A study into access and consumption of Broadband data by South African consumers

A research report submitted by

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ABSTRACT

In South Africa, the unavailability of a universal, high-speed and reliable Broadband network has impacted negatively on the country's development and global competitiveness. Whilst the South African telecommunication sector has grown almost 20-fold over since 1992, the growth masks a range of unintended policy outcomes and a series of costly licensing and regulatory disputes which have set South Africa back.

The South African government gazetted "SA Connect" in 2013 which outlines some ambitious national Broadband targets linked to availability, cost and speed. This research report investigates the barriers that exist for the desired use of Broadband by South Africans who access the Internet for personal purposes.

A review of the literature highlighted cost and speed as a limitation to the take up and usage of Broadband in both developed and developing economies. An online survey questionnaire was distributed where 1,404 respondents were asked to rank the importance of these drivers across home and mobile Broadband categories. T-Test and 1-Way ANOVA statistical tests were then used to analyse what associations existed within each of the respondent categories to better understand the South African Broadband dynamic.

Both cost and speed were found to be significant limitations to Broadband take-up and usage in South Africa with this being even more apparent with users of mobile Broadband. Cost ranked as the highest limitation across both fixed and mobile Broadband users. Income had a direct bearing on access to fixed line Broadband as well as speed. Mobile Broadband was the most used access technology with only 40% of respondents having access to fixed line Broadband.

Recommendations were made to government to review and effectively implement Broadband policy (including licensing of spectrum) that will address cost and speed as barriers whilst private sector is encouraged to continue with investment in mobile Broadband infrastructure which is the future for South Africa.

DECLARATION

I, Dylan Koen, declare that this research report is my own work except as indicated in the references and acknowledgements. It is submitted in partial fulfilment of the requirements for the degree of Master of Business Administration in the University of the Witwatersrand, Johannesburg. It has not been submitted before for any degree or examination in this or any other university.

_____

DYLAN KOEN

Signed at ……

On this 31st day of March 2017.

DEDICATION

To my wife Kim and our two beautiful children, Callym and Alivia. I could not have completed this project without your ongoing sacrifices and unwavering support.

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This has been a truly amazing journey that I could not have achieved without the ongoing support and encouragement of those close to me.

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CHAPTER 1. INTRODUCTION

1.1 Purpose of the study

The purpose of this research is to investigate the barriers that exist for the desired use of Broadband by South Africans who access the Internet for personal purposes.

1.2 Context of the study

In South Africa, the unavailability of a universal, high-speed and reliable Broadband service has impacted negatively on the country's development and global competitiveness (Department of Communications, 2013).

In purely economic terms, gains have clearly been made in the South Africa's telecommunications sector over the last 25 years with total sector revenue growing from R 7 billion in 1992 to R 147 billion in 2015 (Alison Gillwald & Kane, 2003; ICASA, 2015). However, this growth masks a range of unintended policy outcomes and a series of costly licensing and regulatory disputes which have seriously hampered South Africa in global competitiveness terms. The most significant of these being the national objectives of accelerated sector development and affordable access to communication services not being met (Alison Gillwald, 2005).

South Africa Connect, the national Broadband policy gazetted by the department of Communications in November 2013 sets out some ambitious national Broadband targets, namely 50% of the population to have access to 5 Megabits per second (Mbps) average Broadband speed by 2016 with this rising to 90% of the population by 2020. By 2030, the average speed target is set for 100Mbps (Department of Communications, 2013).

The 2015 Global Competitiveness Report released by the World Economic Forum (WEF) revealed that South Africa has improved its competitiveness ranking by seven spots to break into the top fifty after a four-year decline, this was primarily driven by an increased uptake in information and communications

technology (ICT), especially higher Internet bandwidth (World Economic Forum, 2015).

A key metric in the seven place jump for South Africa was the growth of mobile Broadband subscriptions from 25.2 to 40.7 per 100 people. Although mobile Broadband is only one subset of how one can access the Internet, it does give a measure against other countries. Broadband access and usage has become a key enabler and differentiator to the development of people. Based on research by the International Telecommunications Union (ITU), the number of mobile Broadband subscriptions for Africa in 2015 was 17.4 per 100 people and the average for all economies outside of Africa is 57.7 (ITU, 2015a).

Although South Africa has experienced growth of mobile Broadband subscriptions its Broadband services are still ten times more costly and five times slower than that of United Kingdom (The Institute of Race Relations, 2016). South Africa cannot be as competitive and grow like developed countries if costs and access to Broadband remain limited.

Whilst there are numerous focal areas required for South Africa to curtail its economic slide (SAPA, 2014), getting more people to use the Internet is one way to advance growth (Kvochko, 2013). There is overwhelming evidence corroborating the notion that high Broadband penetration is linked directly to positive economic growth. This is discussed in chapter three of the 2009 World Bank book, “Extending reach and increasing impact” (Khalil, Dongier, & Zhen-Wei Qiang, 2009) where a specific study was completed around how Broadband penetration has been linked to raising rural income in developing economies.

In a research study by Koutroumpis (2009), using the Roller and Waverman (2001) model on the link between telecommunications infrastructure and economic development, found that the impact of Broadband for a sample of ‘Organisation for Economic Cooperation and Development’ (OECD) countries was on average around 10% of total growth with some countries showing an impact of greater than 20% (Koutroumpis, 2009).

Whilst these studies are more than five years old, recently there has been renewed interest in this area focussed more on what is commonly known in South Africa as the "Digital Divide". This is a term that refers to the gap between demographics and regions that have access to modern information and communications technology and those that don't have or where it is extremely limited (J. A. G. M. van Dijk, 2006; Rouse, 2014). The Digital Divide is directly linked to Broadband penetration, and other drivers like socio and geographical factors as well as educational, attitudinal and generational status which all directly impact Broadband uptake and usage (Cullen, 2001).

The focus of this study is on how Broadband cost, speed and availability directly impact users. This study therefore looked at a broad demographic of South African consumers with the intention of understanding the barriers to Broadband access and consumption.

1.3 Problem statement

1.3.1 *Main problem*

The unavailability of a national, high-speed and reliable Broadband service has impacted negatively on South Africa's development and global competitiveness (Department of Communications, 2013). Whilst strides are being made and South Africa has improved its mobile growth resulting in improved ranking in terms of competitiveness, Broadband access and consumption are still too low to make a meaningful impact on the required economic growth and development. The questions being addressed in this study are the barriers to Broadband access and consumption in South Africa. This study investigated the Broadband access and consumption limitations that exist for South African consumers connecting to the Internet for personal use.

1.4 Significance of the study

Although Broadband access and usage has become the cornerstone for economic growth and development, South Africa is lagging behind developed economies in terms of penetration and usage. There seems to be limited published research available which investigated the usage and consumption

barriers that exist related to fixed and mobile Broadband diffusion in South Africa and this study aims to fill this gap.

The results of the study are useful to academia and practitioners. For academia, the study builds a foundation for the body of knowledge on Broadband access and consumption in developing countries. For practitioners the results will inform the policy review required to address unintended policy outcomes.

This information can be used to further galvanise policy movement around the allocation of mobile spectrum which will allow for increased capacity and speed within mobile Broadband networks (Department of Communications, 2016; Paul Vecchiatto, 2016). The results will also provide guidance to telecommunication companies (both fixed and mobile) to guide future capital investment decisions around infrastructure.

1.5 Delimitations of the study

- The research is limited to consumers who use either a mobile or fixed Broadband connection to access the Internet for personal use.
- This research will not focus on what actual devices are being used to access the Internet, but rather focus on the usage and consumption barriers that exist within the technologies being used.

1.6 Definition of terms

Broadband – The term Broadband commonly refers to high-speed Internet access that is always on, allowing people to access the Internet through a variety of devices (Federal Communications Commission, 2016). This includes smartphones, routers, tablets, computers, televisions (TV's) and will soon even include fridges (Marrison, 2013). The key requirement for this access is that each device has its own connection point or is connected to another connection point via Wi-Fi. Routers use WiFi to allow multiple devices to access their connection point or Broadband connection.

Router – A router is an electronic device that joins multiple computer networks together. A router can use either fixed Broadband, which can be either of a Digital

Subscriber Line (DSL) or Fibre to the Home (FTTH) connection, or the router is using mobile Broadband like third-generation wireless technology (3G), High Speed Download Packet Access (HSDPA) or Long Term Evolution (LTE) to connect. Devices with an independent wireless connection can access the Internet independently of a router. In order to do this, they would need their own SIM card which enables such a wireless connection.

Connection point – For the purposes of this study, a connection point infers an active Broadband connection which is either through a fixed or mobile technology.

GSM – Global System for Mobile Communications, an international standard for digital cellular communications started in 1992 (Dahlman, Parkvall, Skold, & Beming, 2010, p. 573).

Mobile (wireless) Broadband – Wireless Broadband connects a home or business to the Internet using a radio link between the customer's location and the service provider's facility (Federal Communications Commission, 2016). A number of wireless technologies exist today:

> **EDGE** – Enhanced Data GSM Environment is an enhancement of GSM (Dahlman et al., 2010, p. 573).
>
> **3G** – Third generation mobile data transmission technology (Dahlman et al., 2010, p. 3).
>
> **HSDPA** – High-Speed Download Packet Access is an enhanced 3G (third-generation) mobile data transmission technology (Dahlman et al., 2010, p. 139).
>
> **LTE** – Long Term Evolution is the globally embraced standard behind 4th generation wireless data transmission technology (Bleicher, 2014).
>
> **LTE-A** – Long Term Evolution Advanced, commonly known as 'true 4G' because, unlike 4G LTE, it actually meets the International

Telecommunication Unions specifications for fourth generation wireless systems (Bleicher, 2014).

Fixed line Broadband – A connection to the Internet through the use of a fixed line. The following are common types of fixed line Broadband:

DSL – DSL is a wired transmission technology that transmits data over traditional copper telephone lines. DSL-based Broadband provides transmission speeds ranging from several hundred Kbps to tens of Mbps. The availability and speed of a DSL service may depend on the distance from the connection point to the closest telephone company exchange (the further away, the slower the speed due to the resistance in the copper wires) (Federal Communications Commission, 2016).

ADSL (**Asymmetrical Digital Subscriber Line)** – Used primarily by residential customers. ADSL typically provides faster speed in the downstream direction (download) than the upstream direction (upload) (Federal Communications Commission, 2016).

VDSL (Very High data rate Digital Subscriber Line) – A faster form of DSL (Federal Communications Commission, 2016).

FTTH (Fibre to the Home) – Fibre optic technology converts electrical signals carrying data to light and sends the light through transparent glass fibres as thin as a strand of human hair. Fibre transmits data at speeds far exceeding copper or wireless technologies, typically by tens or even hundreds of Mbps (Federal Communications Commission, 2016).

WiFi – WiFi is the name of a popular wireless networking technology that uses radio waves to provide wireless high-speed Internet and network connections (Morlat, 2004).

MiFi – MiFi is a name used to describe a wireless router that acts as a mobile Wi-Fi hotspot (Novatel Wireless, 2010).

1.7 Assumptions

The following assumptions support the research to be conducted:

- It is assumed that the number of respondents will be an adequate sample for the data analysis of this study.
- It is assumed that all respondents to this study understand what the Internet is.
- It is assumed that all respondents will be honest with their feedback on the research questions. Inaccurate feedback will degrade the research information.
- It is assumed that all respondents will answer truthfully when it comes to the question of using their work Internet access for personal Internet use.
    - This behaviour is commonly known as cyber slacking (Vitak, Crouse, & LaRose, 2011).
    - Using work time for personal use of the Internet is a growing concern for organisations due to the potential in lost revenue and inaccurate feedback on this question will skew the research results as it would question the true nature of the access and use having a positive economic impact (Vitak et al., 2011).

CHAPTER 2. LITERATURE REVIEW

2.1 Introduction

This chapter provides a review that will focus on the economic impact of Broadband penetration, South Africa's Broadband standing on a global stage as well as how the political and regulatory environment is impacting Broadband rollout. A concluding section will use the established 'frame' of Broadband and link it into the specifics how Broadband is consumed, where possible limitations and known challenges exist.

2.2 What is Broadband

According to the International Telecommunication Union (ITU), the term 'Broadband' typically describes a modern Internet connection that can range between 5 and 2000 times the speed of earlier dial-up technologies. However, what is important is that the term 'Broadband' does not refer to either a certain speed or a specific service but rather the connection capacity (bandwidth) and speed (ITU, 2003). In an increasingly integrated global economy, information technology enables people to access and share knowledge and services around the world (Khalil et al., 2009; Department, 2009).

Broadband can change the quality of life for people around the world. Worldwide access to high-speed Broadband services is also linked into advancing the United Nations' Millennium Development Goals, particularly in helping to advance the goal of achieving universal primary education (United Nations, 2015). There is also an opportunity for Broadband to reduce energy use as electronic communications reduce the demand for paper. Online media content is reducing the number of newspaper and magazine subscriptions which in turn reduces the need for paper thus saving both trees and water. Video and online conferencing is saving Billions in fuel which would have been wasted on travel. In short, high-speed Broadband services are having a marked impact on our daily lives (Fuhr & Pociask, 2007).

2.3 Economic impact of Broadband penetration

“Technological change is one of the primary drivers of economic growth” (Koutroumpis, 2009; Barrell & Pain, 1997).

In recent years, Broadband has increasingly been recognised as a service of growing economic interest and there is a significant body of research available that focusses on what kind of economic benefits are derived through Broadband penetration. In the 2009 Book “Extending Reach and Increasing Impact”, (C. Z.-W. R. Qiang, Carlo M Kimura, Kaoro, 2009; C. Z.-W. Qiang, Rossotto, & Kimura, 2009) comparisons of Broadband penetration are drawn with other infrastructure like road, rail and electricity where each of these services eventually had a transformational effect on citizens, companies and governments (C. Z.-W. R. Qiang, Carlo M Kimura, Kaoro, 2009). Much like Broadband, the initial impact of these services was not known but they soon became an essential part of economic activities (C. Z.-W. R. Qiang, Carlo M Kimura, Kaoro, 2009).

Pantelis Koutroumpis in his research on telecoms policy titled “The economic impact of Broadband on growth” (Koutroumpis, 2009) outlined more than one way in which Broadband infrastructure investment can increase economic growth. Whilst most authors focus on the usage benefit of Broadband penetration, Koutroumpis noted that there is also a first level benefit related to the actual infrastructure investment as the drilling and the ductwork required for service provision lead to increases in the demand of goods and services which also has a positive economic impact (Koutroumpis, 2009). This positive economic impact related to infrastructure investment was also highlighted by Raul Katz in his 2010 research paper for the ITU (R. Katz, 2012). In the same piece, Katz highlighted the direct benefits of Broadband deployment looking initially at how both residential and business penetration resulted in a contribution to GDP, growth and employment.

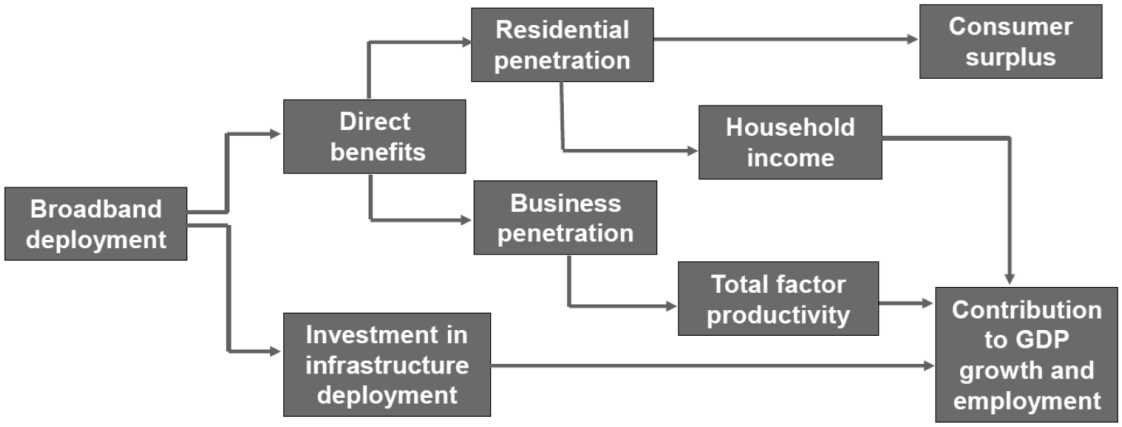

Figure 1 – Positive impact of Broadband deployment (R. Katz, 2012)

Further work by Katz (R. L. Katz & Avila, 2010) on how Broadband penetration impacted economic growth highlighted three areas. First, which was also supported by Fornefeld, Delaunay, and Elixmann (2008), the deployment of Broadband technology across business contributes to an improvement in productivity as a result of the adoption of faster and more efficient business processes. Second, the deployment of Broadband across a population group contributes to an increase and improvement in innovation resulting from the introduction of new applications and services and thirdly, Broadband has a developmental impact on an economy (R. L. Katz & Avila, 2010).

Whilst agreeing on the significant growth associated with Broadband penetration Thompson and Garbacz (2011) in their work on the differences between mobile and fixed Broadband noted that Broadband's ultimate economic benefit would vary greatly by region. Both Chen and Guillén agree on this issue (W. Chen & Wellman, 2004; Guillén & Suárez, 2005) with both exploring what these regional differences are. They conclude that the economic, regulatory and socio-political characteristics of countries and their evolution over time all play a significant role in how Broadband penetration impacts economic growth (Guillén & Suárez, 2005; W. Chen & Wellman, 2004). This variation is more recently being referred to as the global digital divide which is not just the traditional divide within countries but a new global divide between nations due to inequalities in Broadband Internet access (Gulati & Yates, 2012; W. Chen & Wellman, 2004).

The fourth industrial revolution, a deep digital transformation is upon us (Schwab, 2016). The ability to remain competitive and adapt to this rapidly changing environment is fundamental for economies to remain competitive (World Economic Forum, 2015). Broadband is the centre point of this transformation. In a hyper-connected and competitive global economy, cost and access barriers to Broadband penetration are significant disablers to a countries' ability to compete.

Broadband Internet and the underlying infrastructure fulfils many characteristics of a general purpose technology (GPT) "as it has the potential for use in a wide range of market sectors in ways that drastically alter their mode of operation" (Helpman, 1998; Bresnahan & Trajtenberg, 1995). As a GPT, Broadband Internet plays the role of an enabling technology that opens up new opportunities (Helpman, 1998). A clear example of this is the boom of Billion Dollar Internet companies. Carol Tice from Forbes has a list of 12 Tech start-ups worth more than $1 Billion today that did not even exist 5-years ago (Tice, 2016). She also demonstrates how the Internet is having a drastic impact on some industries mode of operation, a prime example is the emergence of Uber, essentially a technology company that does not own any vehicles, Uber has disrupted the entire global taxi industry and fundamentally changed the way that they need to operate to survive (Moira McGregor & Mareike, 2016; Forbes, 2016).

There has been seismic shift in the global economy over the last 50-years with specific reference to how this has largely been driven by the advancement of technology. In their piece titled "A world of change", Ayhan Kose and Ezgi Ozturk (Kose & Ozturk, 2014) explained how technology reduced turn-around times and the effort to produce. Technological advancement allows instant access to an incredible array of information, the ability to engage with and share this information in mere seconds with nothing more than a mouse click (Kose & Ozturk, 2014; Leiner et al., 2009).

The Internet has been in existence since 1991 (Leiner et al., 2009) and in this time it's uptake and use has been staggering. According to a report by the International Telecommunications Union (ITU) more than 3 billion people are now using the Internet (ITU, 2015b). The same report details that the number of Internet users has increased from 738 million in 2000 to 3.2 billion in 2015, which

is an increase of more than 7 times over just 15-years, resulting in global Internet penetration of 43%. Of all connected individuals, the ITU says most of them, some 2 billion, live in developing countries (ITU, 2015b).

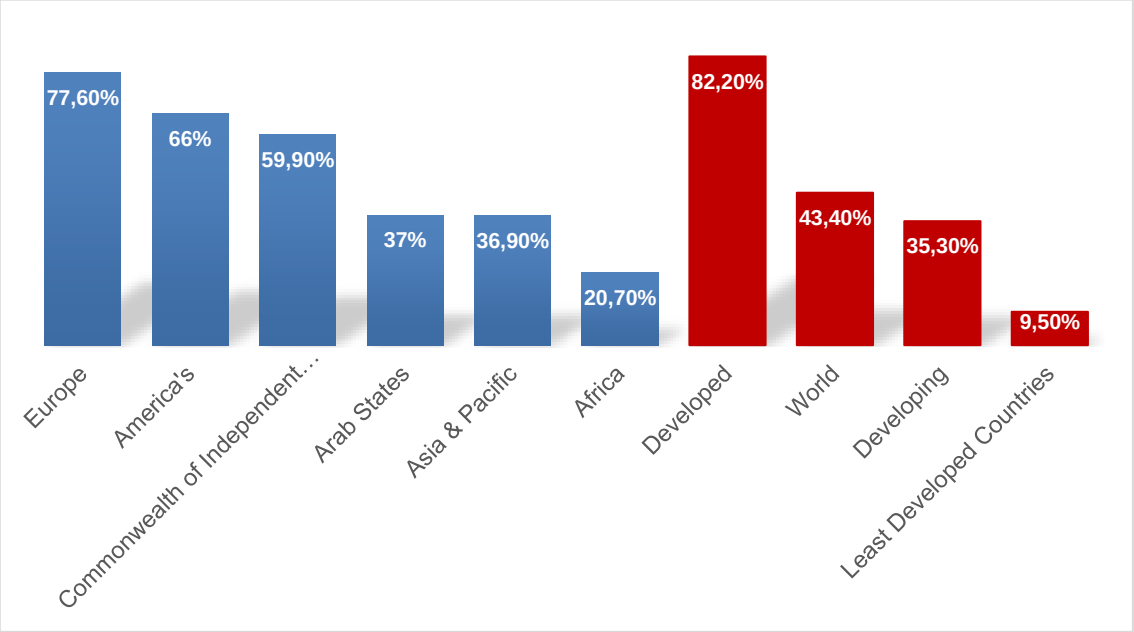

Table 1 – Percentage of individuals using the Internet (ITU, 2015b)

The pace of Broadband uptake has resulted in unprecedented change and it also highlights the challenge in being able to accurately predict the long-term impact that this change has on economic development. Broadband had not fully emerged until the mid-1990's and has undergone significant change over the period up until 2011, specifically due to the arrival of mobile Broadband (Czernich, Falck, Kretschmer, & Woessmann, 2011b). The emergence of mobile Broadband calls for the medium-term projections instead of long-term projections due to a lack of information related to the role that mobile Broadband penetration is having on economic growth (Czernich et al., 2011b; Lehr, Osorio, Gillett, & Sirbu, 2006).

The study by Czernich et al. (2011b) proved that the introduction and utilisation of Broadband has had a tangible positive impact on growth in Gross Domestic Product (GDP). After the introduction of Broadband, GDP was, on average, 2.7 to 3.9% higher than before its introduction (Czernich et al., 2011b).

Further proof validating the positive impact of Broadband penetration comes from a study by Raul Katz, Stephan Vaterlaus, Patrick Zenhäusern and Stephan Suter

for the 45th edition of Intereconomics which calculates the impact of investment in Broadband technology on German employment and economic output (R. L. Katz, Vaterlaus, Zenhäusern, & Suter, 2010). The authors conclude that there is justification of the German Governments' ultra-Broadband evolution strategy (which runs from 2015 through to 2020 and carries an investment requirement of some $50 Billion), that is due to the substantial benefits that would be generated in terms of both additional jobs and GDP growth for the German Economy (R. L. Katz et al., 2010).

2.4 Cost and speed

In their 2016 annual report "Digital in 2016", Social Media agency 'We Are Social' provides an opportunity to compare South Africa's Broadband penetration with that of Germany's. According to their report, South Africa has a total population of 54.73 million with Internet users totalling 26.84 million for an overall penetration of 49% (We Are Social, 2016). This is roughly half of the penetration in comparison to that of Germany.

Looking at a speed comparison, according to research firm Akamai's annual State of the Internet report for 2015, South Africa ranks 90th in the world on average Broadband access speed at 4.1 Mbps which is below the global average of 5.1 Mbps (Akamai, 2016). This statistic underlines the magnitude of advancement in Broadband technology over the past 5-years as the German Broadband statistics from 2010 show that 92% of households had access to lines speed rates of at least 1 Mbps. South Africa (for 2015) shows an average Broadband connection speed of 4.1 Mbps which is more than 4 times higher than that of Germany in 2010. Looking in isolation, this looks to be a great result and comparison for South Africa, but all it actually does it highlight how fast the technology is advancing because the comparison is using Germany in 2010 and South Africa in 2015.

Using the 2015 Akamai 'State of the Internet' Report allows for a more accurate comparison. The report details the average Broadband connection access speed for Germany in 2015 as 12.9 Mbps (Akamai, 2016). This is more than 3 times that of South Africa and an increase of 13-fold over a 5-year period.

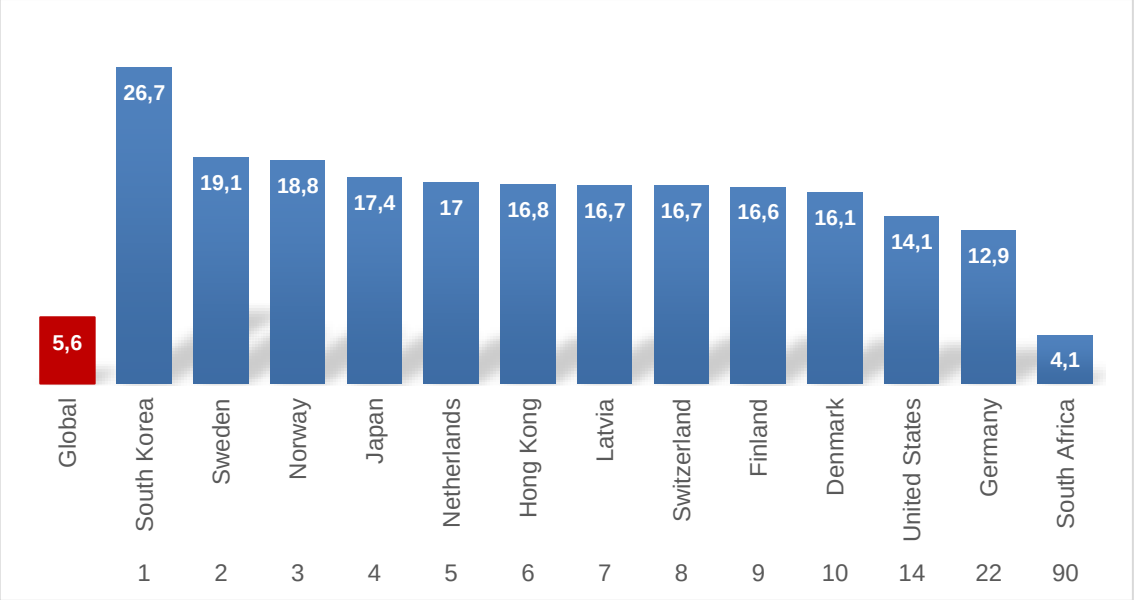

Table 2 – Q4 2015 Average Broadband speed & global ranking (Akamai, 2016)

“High-speed Internet access via Broadband infrastructure has developed rapidly worldwide since the late 1990s” (Czernich et al., 2011b). The same level of growth has not been seen in sub-Saharan Africa. Taken from his 2005 study for the World Bank titled ‘Broadband in Africa’, Mark Williams, a senior economist for GICT found that “the average retail price for basic Broadband in Sub-Saharan Africa in 2006 was US$366 per month, compared with US$6 to US$44 per month in India, typical prices for entry level Broadband services in Europe average around US$40 per month, falling as low as US$12 per month in some European countries” (Williams, 2005). Whilst a study into Broadband costs from 11-years ago is no longer relevant today, this does outline why South Africa in particular has lagged behind as cost of access and available speed has been the primary reason for the slow rate of uptake of Broadband (J. Chen, Amershi, Dhananjay, & Subramanian, 2010; Wyche, Smyth, Chetty, Aoki, & Grinter, 2010; Lehr et al., 2006).

A recently released report by StatsSA which contained an analysis of household expenditure and income data in South Africa over period 2014/2015 calculated that telecommunications made up an average of 3.4% of a South African’s monthly expenditure (StatsSA, 2015). This information was officially released by StatsSA on the 17th of January 2017.

	Average (Rands) per month	Proportion of total expenditure
South Africa	R 292	3.40%
Gender of household head		
Male	R 342	3.38%
Female	R 222	3.43%
Population group of household head		
Black	R 201	3.56%
Coloured	R 357	3.44%
Indian	R 574	3.53%
White	R 913	3.12%
Province		
Western Cape	R 463	3.40%
Eastern Cape	R 188	3.12%
Northern Cape	R 241	3.56%
Free State	R 239	3.36%
Kwazulu-Natal	R 219	3.58%
North West	R 216	3.74%
Gauteng	R 391	3.34%
Mpumalanga	R 259	3.72%
Limpopo	R 159	3.13%

Table 3 – Annual household expenditure on communication by sex, population group and province (StatsSA, 2015)

The OECD telecommunications basket is the Big Mac index equivalent for measuring the cost of mobile telecommunications prices across territories (OECD, 2016). From this report, the ITU provides a guideline of what percentage of income should be for mobile services. The international figure is 5% whereas in South Africa it was measured at 24.7% in 2011 by (Moyo & Christoph Stork, 2012). According to the co-author of the same research paper, Dr Alison Gillwald "Certainly South Africa is not on track to meet the affordability targets set in SA Connect which used the then Department of Communications, Vision 2030, and which refers to 2.5% of income as a target by 2020".

Data from the ITU in their 2012 report titled "Measuring the Information Society" ranked South Africa 73rd most expensive out of 161 measured countries when it came to the cost of Broadband in relation to household income (ITU, 2012).

#	Country	Price as % of GNI	Price in ZAR
1	Gambia	747.4%	R 2 144
2	Eritrea	720.0%	R 1 561
3	Tajikistan	543.7%	R 2 773
4	Togo	405.5%	R 1 267
5	Swaziland	399.1%	R 6 691
6	Cuba	379.0%	R 13 408
7	Rwanda	257.8%	R 855
8	Kiribati	228.7%	R 2 931
9	S. Tomé & Principe	221.3%	R 1 693
10	Niger	193.4%	R 456
70	El Salvador	5.6%	R 121
71	India	5.5%	R 47
72	Saint Lucia	5.4%	R 224
73	***South Africa***	***5.4%***	***R 210***
74	Botswana	5.2%	R 227
75	Colombia	5.2%	R 181
76	Grenada	5.1%	R 225
152	Sweden	0.8%	R 253
153	Belgium	0.7%	R 193
154	Japan	0.7%	R 185
155	Norway	0.7%	R 376
156	Luxembourg	0.6%	R 291
157	United Kingdom	0.6%	R 153
158	Switzerland	0.5%	R 250
159	United States	0.5%	R 153
160	Israel	0.4%	R 67
161	Macao, China	0.3%	R 65

Table 4 – Broadband cost in comparison to average national income per capita (GNI)

Full table attached as Appendix 4 (ITU, 2012). Rand value converted from US$ at 2012 exchange rate of R 7.69 to one US Dollar (Exchange-Rates.org, 2012).

These numbers represent averages and, particularly in the South African context, possibly only tell half of the story when it comes to true Broadband access. The reason for this is due to the significant income inequality in South Africa. According to the Gini coefficient, which is a global measure of income inequality, South Africa ranks number 4 in the world for income inequality with a score of 0.660 (World Bank, 2009). The index ranges from 0 to 1 with 0 representing a perfectly equal society and 1 representing a perfectly unequal society.

The inequality results in a broader distribution of wealth creating a larger access gap, this is important to understand and will be a discussion point later in this research report.

Ookla is the global leader in Broadband testing with performance data from over 4 billion global fixed and mobile broadband network tests. Their 'Household Value Index' statistics from February 2015 show that South Africans pay considerably more than other countries for a Broadband connection (Ookla, 2015).

Despite recent improvements in Broadband speeds and decreasing costs, the relative value South African Broadband users get compared to the rest of the world remains poor. In terms of cost per Megabit per second, South Africa was ranked 62 out of a total of 62 countries measured with the median monthly cost of Broadband at US$19.88 per Mbps compared to the global average of US$5.36 (Ookla, 2015). Even though South Africa's rank and price is alarming, it has improved markedly since September 2014 when the local median monthly cost was $23.08 per Mbps (Ookla, 2015), this is a 14% improvement in only 6-months.

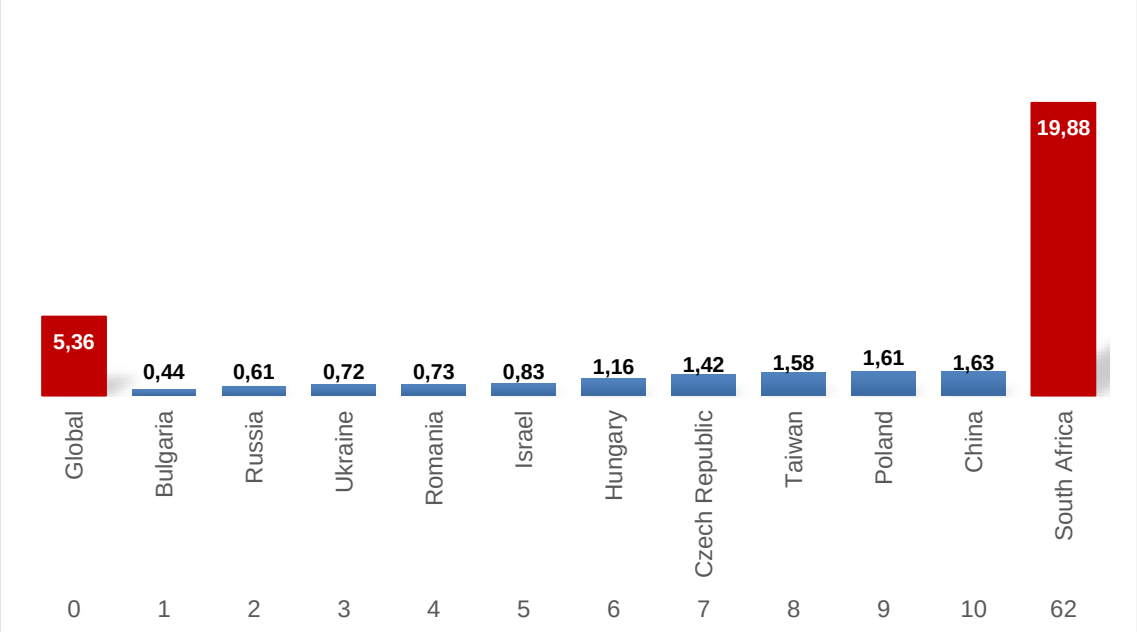

Table 5 – Cost per megabit per second comparison in US$ (Ookla, 2015)

Many countries in Sub-Saharan Africa see Broadband access and penetration as a foundation for long-term economic development (Williams, 2005). It is clear to see why. Research firm GMSA in their annual report 'The Mobile Economy – Sub-

Saharan Africa 2015' (GSMA, 2016a) noted that in 2014 the mobile telecommunications ecosystem was responsible for the direct employment of around 2 million people in Sub-Saharan Africa with the majority working in distribution and around another 325,000 employed directly by mobile network operators (GSMA, 2016a). A further 2.4 million jobs were indirectly supported by the mobile industry, bringing the total to 4.4 million (GSMA, 2016a). The mobile ecosystem in Sub-Saharan Africa also made tax contribution of approximately US$15 billion in 2014 and it is forecast that the industry will grow to support more than 6 million jobs by 2020 (GSMA, 2016).

Most of the studies on the impact of improved Broadband penetration on income, growth and efficiency have suggested a strong positive link to economic growth. The aim of this study is to look at the barriers to Broadband usage in South Africa, but from a personal use perspective. As highlighted by J. Chen et al. (2010), Wyche et al. (2010) & Lehr et al. (2006) both cost and speed of Broadband are limiting factors into how much economic impact can be realised and will be a key focus this research.

2.5 Political and regulatory environment

"Increasing access to Broadband connectivity is a high priority for policymakers across the African continent" (Williams, 2005).

Policy-makers play a key role in the ongoing rollout of Broadband infrastructure. Not only do they need to set goals for Broadband availability but they also are required to seek ways in which investment in Broadband can be stimulated.

A key requirement is the creation of a regulatory environment that encourages market players to invest in Broadband infrastructure as well as offering financial support to encourage market players to provide Broadband, particularly in rural areas where the population density may not be great enough to justify deployment costs (EPRS, 2016).

2.5.1 Broadband penetration in South Africa

Sub-Saharan Africa has some of the lowest levels of infrastructure investment in the world. Two metrics often used to measure the level of infrastructure development include access to power and the percentage of paved roads (IMF, 2014). Today some 25 countries in sub-Saharan Africa out of a total of 48 face an energy crisis which is evidenced by rolling blackouts (World Bank, 2016a). The development of transport infrastructure has also been extremely limited with sub-standard road conditions still being a key issue with less than one-fourth of the total sub-Saharan Africa road network being paved which results in high freight and passenger transportation costs (IMF, 2014).

Alvin Toffler in his 1990 book 'Future Shock' (Toffler, 1990) says that world economies are separated by the fast and the slow with negative implications for the slow. Power shifts to those that are fast, the speed of decision making (both policy and investment), the speed of how new ideas are hatched and brought to market and the speed of how data and information flows through the economy enable fast economies to generate wealth and power that slow economies simply cannot compete with (Toffler, 1990). As a 1990 futurist, Toffler made some predictions that are becoming reality by the day. He stated that information in the modern economy will operate at real-time speeds. The new system for making wealth will therefore consist of an expanding, global network of markets and banks in instant communication with one another; constantly exchanging significant volumes of data, information and knowledge, Toffler called this the fast economy of tomorrow (Toffler, 1990).

Overlaid on this futurist theory is South Africa and their pace with Broadband infrastructure development and penetration. Whilst low levels of infrastructure development continue to persist across the African continent, the growth of the ICT sector in comparison to the world has been remarkable and it has been largely fuelled by the high adoption rate of mobile phones, particularly in South Africa (Alison Gillwald, Moyo, & Stork, 2012).

From the first available mobile phone in 1994 and only 20-years later, South Africa had reached a market penetration of 133%. Market penetration is

measured by the number of active SIM cards in circulation which in 2013 stood globally at 1.85 per subscriber (GSMA, 2016a). The number varies per region and is largely driven by price-sensitivity and pre-paid plans (GSMA, 2016a). Looking at global active SIM circulation, at the end of 2014 there was almost 1 SIM card for every person with the global penetration rate standing at 97% (GSMA, 2016a).

Using the more realistic and accurate measure of 'unique subscribers', South Africa's mobile penetration stood at almost 70% at the end of 2014, which is significantly higher than the 39% average for Sub-Saharan Africa (GSMA, 2016a; ITU, 2015a). In fact, South Africa's 'unique subscriber' mobile penetration rate is the same as North America and, in global competitiveness terms, only lagging behind that of Europe (GSMA, 2016a). Using a numerical measure, at the end of 2014, 3.6 billion people (which is roughly 50% of the global population) had a mobile subscription, which is up from just 20% only ten years ago (ITU, 2015a; GSMA, 2016a).

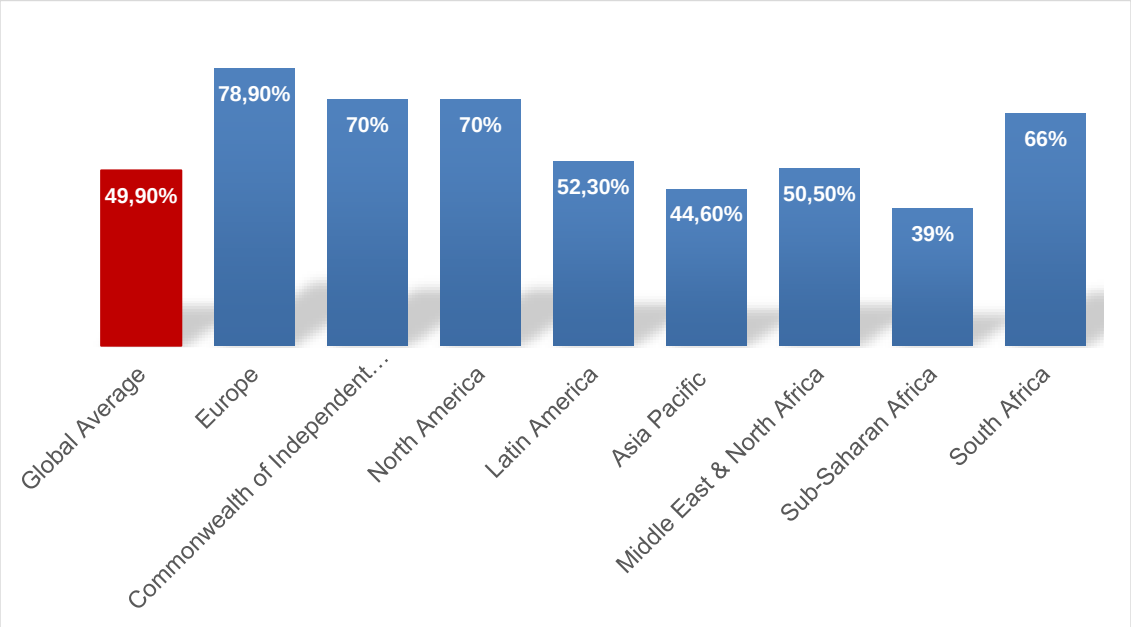

Table 6 – Unique mobile subscriber penetration by region (GSMA, 2016a)

It is then quite obvious to note that in global terms, South Africa has been extremely successful in providing broad access to basic mobile voice services since this technology became freely available. What some people may see as

quite damning is that comparable growth and improvement in Broadband access and connectivity has simply not kept pace. In fact not only has Broadband access not grown but it has actually narrowed (in global terms) over the same period (Williams, 2005), even in comparison to other lower-income countries in Africa. The prices of all communication services in South Africa remain stubbornly high (Moyo & Christoph Stork, 2012).

As highlighted by Dr Alison Gillwald, initially in her 2006 work with Steve Esselar & Christoph Stork on a sector review of South Africa's telecommunications industry and then in 2007 when she wrote a commentary piece on the state of Broadband policy in South Africa (Esselaar, Gillwald, & Stork, 2006; Gillwald, 2007), South Africa lags behind many of its traditional competitors on key indicators of Broadband access and affordability and is rapidly being caught up to and overtaken in a number of areas by African states which historically it has dominated (Esselaar et al., 2006; Gillwald, 2007).

A key statistic quoted in her 2007 piece was that in 2006, Morocco had more fixed line subscriptions (325,000) that South Africa which, at the time, only had 200,000 subscriptions (Esselaar, Gillwald, & Stork, 2006). Overlaying this with population data from 2006, a clearer picture can be drawn on the penetration variance. In 2006 South Africa's population was 48.27 million (World Bank, 2016b) giving a fixed line Broadband penetration rate of 0.4%, whilst Morocco's population in 2006 was 30.4 million (World Bank, 2016b) giving a fixed line Broadband penetration of 1.1%. Both are still incredibly low in global terms but an indication of how South Africa lags behind, both on a global and continental stage.

Using data from the ITU, a more up to date comparison can be drawn to analyse how South Africa has progressed against Morocco since 2006. As can be seen from the comparison table below, South Africa has increased their fixed Broadband penetration to 3.16% at the end of 2014 which was ahead of Morocco's 2.93% (ITU, 2015a; World Bank, 2016).

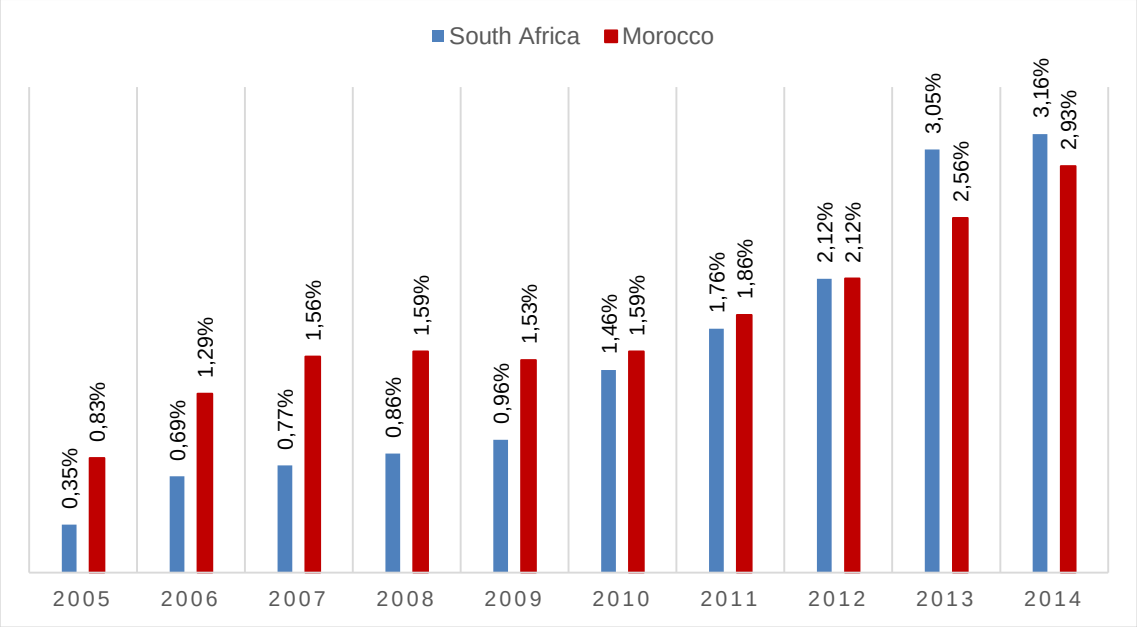

Table 7 – Fixed line Broadband penetration comparison between South Africa and Morocco (World Bank, 2016; ITU, 2015a)

How does this positive trajectory compare in global terms? The ITU is the United Nations' specialised agency for ICTs and official source for global ICT statistics. Their annual "State of Broadband' report illustrates how South Africa rank globally on both fixed line and mobile Broadband penetration. These statistics highlight that whilst South Africa has grown their pace of Broadband penetration, having only 31% of the global average in 2014 highlights the gap and significant work still required to compete.

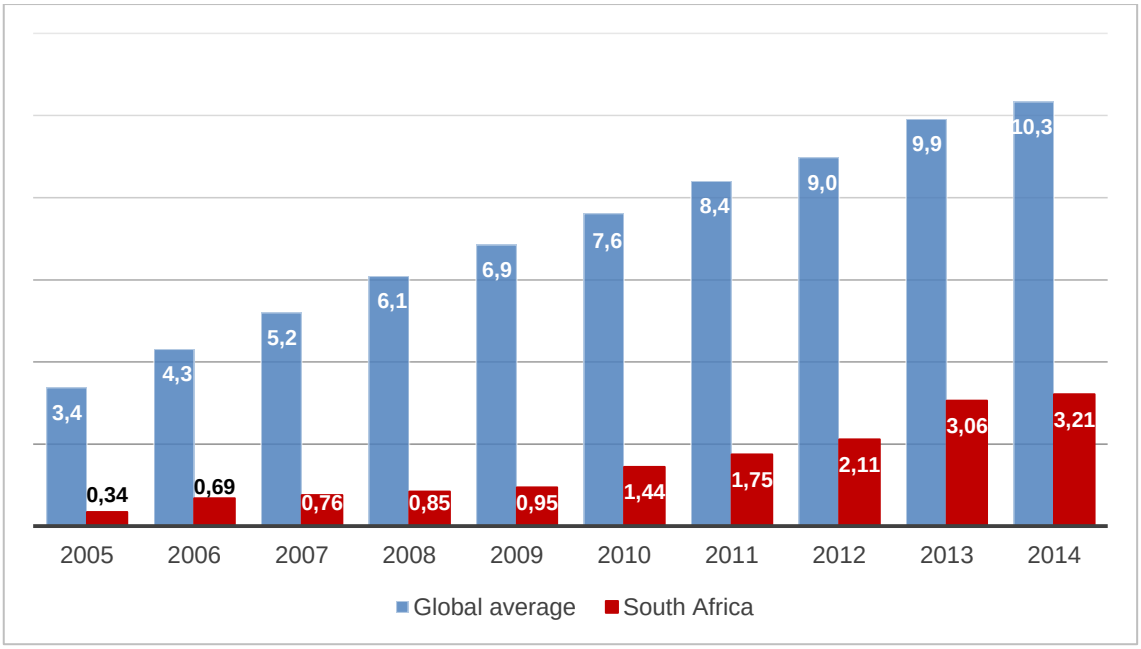

Table 8 – Fixed Broadband penetration (per 100 inhabitants) (ITU, 2015a)

In percentage terms, South Africa has grown their fixed line Broadband penetration from 7% of the world average to 25% over an 8-year period.

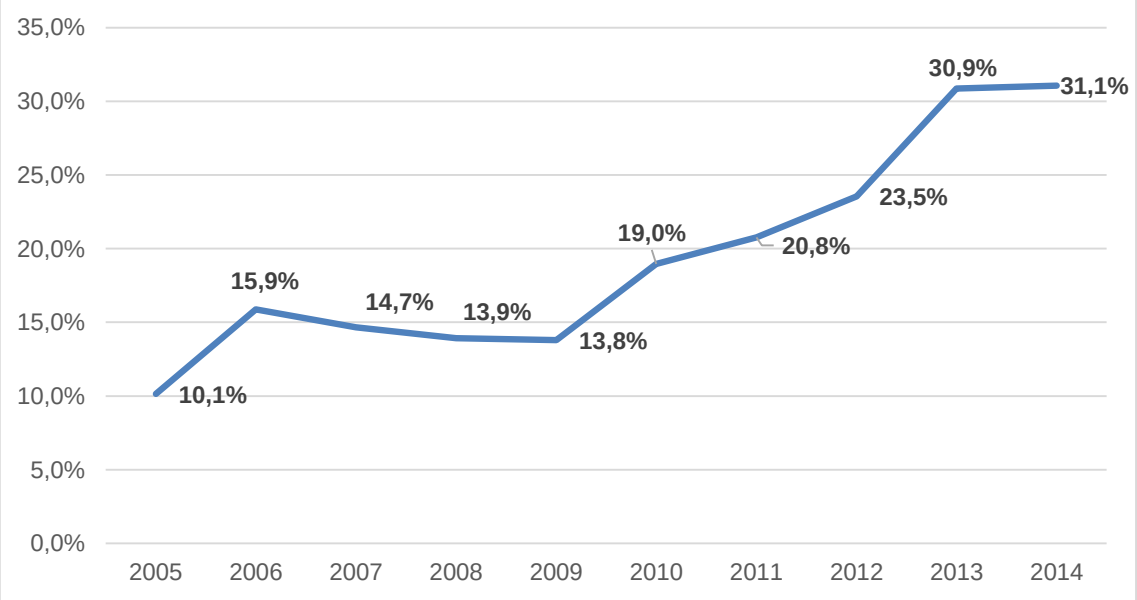

Table 9 – Fixed Broadband comparison, South Africa's percentage of fixed Broadband penetration as a percentage against the world average (ITU, 2015a)

	2010	2011	2012	2013	2014
Africa	1.8	4.6	8.5	10.3	12.9
South Africa	**3.2**	**4.1**	**5.8**	**19.8**	**25.2**
Arab States	5.1	13.1	16.1	27.3	36.1
Asia & Pacific	7.4	11.0	15.3	18.5	29.7
CIS	22.0	31.3	35.3	42.3	46.9
Europe	30.5	39.4	49.1	56.1	69.3
The Americas	24.6	34.1	41.9	55.7	67.3
World	**15.2**	**22.2**	**27.7**	**35.0**	**43.7**

Table 10 – Active Mobile Broadband subscriptions (per 100 inhabitants) (ITU, 2015a)

	2010	2011	2012	2013	2014
Africa	0.2	0.2	0.2	0.3	0.4
South Africa	**1.44**	**1.75**	**2.11**	**3.06**	**3.21**
Arab States	1.9	2.2	2.6	3.2	3.4
Asia & Pacific	5.5	6.4	7.0	7.8	8.3
CIS	8.0	9.2	11.0	12.7	13.1
Europe	23.6	24.8	25.7	27.7	28.6
The Americas	14.0	15.0	15.8	17.0	17.4
World	**7.8**	**8.5**	**9.2**	**10.3**	**10.6**

Table 11 – Active Fixed Line Broadband subscriptions (per 100 inhabitants) (ITU, 2015a)

2.5.2 Barriers to Broadband penetration

There are a number of empirical studies which highlight how low income and population density negatively impact fixed Broadband investment and penetration. (Garcia-Murillo, 2005; Lee, Marcu, & Lee, 2011; Thompson & Garbacz, 2011) All highlight that the primary investment barrier of fixed line infrastructure is the high upfront establishment cost which is difficult to offset in sparsely populated areas. This highlights the challenges facing South Africa with fixed Broadband penetration as (according to statistics compiled by the United Nations in 2015) South Africa has 64.8% of its total population being located in rural areas (GeoHive, 2015).

Further challenges exist in South Africa where the theft of copper wire infrastructure has become commonplace. Whilst modern fixed line infrastructure has moved to Fibre Optic Cables, the dominant technology for fixed line

Broadband infrastructure over the last 20 years has been via copper wire infrastructure. Copper is considered a high-value asset due to its high market value and this has made copper a hot commodity for thieves as it can be sold quickly for cash to scrap yards (Investing News, 2013). The extent of this theft in South Africa is highlighted in South Africa's incumbent fixed line Broadband provider Telkom's annual report for their 2015 Financial year which reported more than 6,000 incidents of theft costing more than R200m (Telkom, 2016). Fifty percent of the theft cost was spent on security services (Telkom, 2016). This is a further complication to the rollout of fixed line infrastructure in South Africa as it makes it more difficult to police due to the expanse of rural areas resulting in an even higher likelihood of theft.

Mobile Broadband however does not have the same infrastructure limitations as fixed line Broadband because it is wireless. This Broadband technology has experienced extreme growth over the last 5-years surpassing fixed line Broadband in terms of the number of active global subscribers (ITU, 2015a).

2.5.3 Broadband policy

Limitations with the body of academic research covering the regulatory and political implications to Broadband investment is their age. Most studies cover a period more than 10-years ago. These previous studies, therefore, cannot cover the implications of policy and regulation of mobile Broadband in each country, mainly because the rapid deployment and uptake of mobile Broadband services is a relatively new phenomenon.

However, as briefly discussed in the previous section and highlighted by (EPRS, 2016) in their 2016 report on the benefits of Broadband infrastructure, policy-makers play a key role in the ongoing rollout of Broadband infrastructure as they need to create a regulatory environment that promotes investment in the necessary infrastructure (EPRS, 2016).

Research data from 2005 on Broadband performance shows that South Korea is by far the global front-runner in terms of Broadband penetration (OECD, 2005) and whilst the pace of change has been significant over the last 12-years, South Korea's leading global position was further entrenched when Akamai completed

their 2015 “State of the Internet” report where South Korea led on both adoption (94%) and average speed (23.6 Mbs) (Akamai, 2016).

A key success factor for South Korea has been how they have regulated Broadband as an industry. The significance of this strength playing such a dominant role is covered by (Fransman, 2006; H. Lee, O'Keefe, & Yun, 2003; Jin, 2005). Both Fransman (2006) and Jin (2005) found a positive link between Neoliberalism in Korea and how the rapid growth of Broadband services was closely related its rise as a central government policy. Jin submitted that, due in large part to Neoliberal policy reform in the 1990’s, the Broadband service industry in Korea became one of their fastest-growing sectors (Jin, 2005), neoliberalism being a complete withdrawal of state intervention in economic affairs (Jin, 2005).

This has not been the case with South Africa, as highlighted again by Dr Alison Gillwald (Alison Gillwald, 2005). South Africa implemented a telecommunications reform policy in the mid 1990’s which was designed around managed liberalisation. The policy was focussed on accelerated sector growth along with modernisation to create universal Broadband access for all South Africans (Alison Gillwald, 2005). In practice it tended to emphasise privatisation at the expense of other reform mechanisms creating a situation of ongoing political interference which led to a lack of stability and predictability within the sector (Alison Gillwald, 2005).

Makhaya and Roberts (2003) also spoke of South Africa’s liberalisation reform policy concluding that under such reform programmes, regulation by the state is needed for meaningful competition to develop. Going one step further, Makhaya and Roberts (2003) highlighted the skills gap that exists within developing countries and how this can lead to an inability to govern effectively given the negotiating games that arise between the regulator and the various firms.

This lack of industry and experience in developing countries can lead to regulatory failure (Jones, 1993; Samarajiva, 2000). This provides an interesting case for South Africa where the necessary capabilities and skills required by the regulator are scarce, as highlighted by Nicola Mawson writing for ITWeb in 2014

who wrote that ICASA (South Africa's communications regulator) is being hampered in carrying out its mandate by a pervasive lack of skills, especially in its technical unit. ICASA's CEO at the time, Pakamile Pongwana was quoted as saying that their engineering and technology department had 76 vacancies, when seen in context of the total department only having 53 employees, it highlights the significant skills gap (Mawson, 2014).

2.5.4 Education

H. Lee et al. (2003) conclude that the lessons other Broadband policy makers should take from Korea is not just about focussing on the supply or provision side of Broadband but also to understand how to stimulate supply by creating demand for the service. Korea's success was not only about creating a free market for competition through their neoliberalistic policy but also about creating concurrent demand for Broadband services. One such action was the creation of the "Ten Million People Internet Education" project. Launched in 2000, this project targeted having 10 million people attending a variety of Internet education programmes by the end of 2002 and it was hugely successful with 3.4 million Koreans learning basic Internet skills in 2000 alone (Lee et al., 2003).

Oh, Ahn, and Kim (2003), A Gillwald (2007) and H. Lee et al. (2003) went further by concluding that the success of Broadband in Korea was not simply around policy but largely due to the education of Korean consumers on Broadband. They proved that there was a clear link between Broadband adoption and customers who had knowledge of what benefits Broadband could bring and made it clear that, over policy reform and infrastructure development, efforts should be made to expand the base of knowledgeable customers which will enable a far higher pace of Broadband Internet adoption (Oh et al., 2003).

Further studies agree on the importance of consumer education as a Broadband enabler. Dwivedi and Lal (2007) found that consumer education is one of the most important drivers of Broadband adoption. In a different study focussed on Broadband adoption in Saudi Arabia, Kolsaker, Lee-Kelley, Dwivedi, and Weerakkody (2007) noted 'usefulness' to consumers as a key determinant of Broadband diffusion.

Sawyer, Allen, and Lee (2003) argue against the point of Broadband being demand driven. They highlight the social concerns driven by the lack of understanding on the long-term impact of Broadband diffusion on the technological and social processes in society (Sawyer et al., 2003). Research covering the importance of consumer education on Broadband diffusion in developing countries has primarily been focussed on the digital divide, J. Van Dijk and Hacker (2003) covered education as one of 4 pillars of the digital divide in Africa, alluding to a “skills access” divide caused by insufficient user friendliness, inadequate education and lack of social support skills. Another pillar linked into education by J. Van Dijk and Hacker (2003) was “mental access”, this linked the divide to a lack of interest or possible computer ‘anxiety’ both of which could be bridged with greater education.

Wilson (2004) in his book “The information revolution and developing countries” supported the same skills access argument, instead calling this “cognitive access”. A more interesting aspect that he covered was “Political access” which is how governmental institutions control the Broadband access landscape (Wilson, 2004).

2.5.5 Politics

Ngwainmbi (2000) notes that some African governments view the Internet as a threat to African culture, their ongoing governance or even national security thus resulting in the possibility of it being restricted from the public. Although Czernich, Falck, Kretschmer, and Woessmann (2011a) highlight that evidence on the effect of the Internet on voting behaviour is still scarce.

This is an interesting proposition for South Africa where the state owned Broadcaster SABC has recently introduced a controversial policy which blocks coverage of all violent protests from their various TV news channels (Quintal, 2016; Mkhize, 2016). This is quite obviously a political strategy to create a more positive perception of government. The unknown question is whether there are broader industries being indirectly hamstrung by political interference.

Warf (2011) framed the context by noting that whilst the Internet is widely celebrated for its inclusionary, education and economic potential, many

governments view it with alarm and have attempted to limit access or to control its contents.

The purpose of this research is not to get into a political discussion, but it is important to highlight that political influence is not simply about creating a stable regulatory platform, but extends to customer facing education activities which have been a proven part of South Korea's long-term Broadband success.

2.6 South Africa's Broadband Policy and Regulatory Environment

The purpose of this research is to understand and decipher the take-up and usage barriers inherent to Broadband in South Africa. As we have noted, speed, access and cost play important roles in how Broadband is used and consumed.

A large amount of academic research has been covered which highlight how policy and regulation play pivotal shaping roles in facilitating Broadband investment and penetration. We also know how important Broadband is as an enabler for economic growth playing a key role in the global *'fast-economy'*. This information has been around a while and has played a vital part in enabling many countries to position themselves ahead of the curve, looking to capitalise and strengthen themselves as economic heavyweights.

Whilst many policy papers exist in South Africa, there is limited academically reviewed research available that covers the nuances of the modern South African regulatory environment and how this continues to impact South African consumers from a Broadband perspective. Understanding this context is important as it remains the perennial question in South Africa when it comes to analysing our current Broadband barriers.

2.6.1 South Africa's Broadband Policy

'South Africa Connect' is South Africa's national Broadband policy that expresses the countries' 2030 National Development Plan (NDP) goals into operational outcomes (Department of Communications, 2013). This Broadband policy is a

document that outlines a clear understanding of not only what needs to happen, but why it is important for South Africa to achieve greater Broadband penetration.

Target	Penetration measure	Baseline (2013)	By 2016	By 2020	By 2030
Broadband access in Mbps user experience	% of population	33.7% Internet access	50% at 5 Mbps	90% at 5 Mbps 50% at 100 Mbps	100% at 10 Mbps 80% at 100 Mbps
Schools	% of schools	25% connected	50% at 10 Mbps	100% at 10 Mbps 80% at 100 Mbps	100% at 1 Gbps
Health facilities	% of health facilities	13% connected	50% at 10 Mbps	100% at 10 Mbps 80% at 100 Mbps	100% at 1 Gbps
Government facilities			50% at 5 Mbps	100% at 10 Mbps	100% at 100 Mbps

Table 12 – 'South Africa Connect' Broadband access and speed targets (Department of Communications, 2013)

Some of the key Broadband measurement metrics which will be focused on in this research are speed, access and cost. The speed measurement can be used to compare with the first time based target outlined in the South Africa Connect document which is 2016. Challenges facing the policy implementation is high turnover of political leadership.

This backdrop is important as it touches on how the lack of progress against clear policy goals has set South Africa back (Institute of Race Relations, 2015). Levy and Spiller (1996) highlight that the absence of stable political and legal institutions in developing economies can limit the ability of telecommunications regulators to avoid outside influence.

2.6.2 Spectrum

One of the most significant discussion points related to the achievement of national Broadband targets in South Africa surrounds spectrum.

Spectrum is a form of electromagnetic radiation and is a vital catalyst for the advancement of next-generation mobile networks (GSMA, 2016b). In the case of

mobile data being used to access the Internet – the information being accessed is converted into digital data, this is then transmitted via radio to the network operator's nearest tower or base station which is transferred to another base station serving the recipient's location and then transmitted again to the recipient's device which converts the signal into data which is then presented on the device screen (GSMA, 2016b). The radio spectrum is divided into frequency bands which are reserved for a single use or a range of compatible uses.

Due to the high-cost of fixed line Broadband infrastructure, wireless Broadband is seen as the key driver of broad-based Broadband penetration in South Africa. In order for this to take place, it requires the release of essential spectrum in the 700Mhz and 800Mhz frequency bands. These bands are currently occupied by analogue TV and will only be unlocked once the long-delayed migration to the digital transmission of TV has been completed. This migration has been a hotly debated issue with significant industry pressure (Alison Gillwald et al., 2012). These frequencies are ideally suited to the rollout of advanced wireless Broadband services using 4th generation or Long Term Evolution (LTE) which are crucial to South Africans as they provide next-generation wireless technology which can carry more data more quickly. This technology is seen as an essential tool to overcoming the digital divide between high connected urban and inferior connected rural citizens in South Africa (Alison Gillwald et al., 2012).

Without much progress over the last few years, local mobile operators Vodacom and MTN have urged government to move on the allocation of mobile spectrum to deal with the increased data demand in South Africa. They say that South Africa faces a data crunch unless spectrum in the key 700 and 800 MHz frequency bands is allocated soon (Alfreds, 2016).

According to Phuthuma Nhleko, chief executive officer of MTN, when speaking at their 2015 annual results presentation, "We have this mobile data explosion in South Africa but this is under threat due to 98% of mobile network subscribers currently only being served by 40% of the allocated spectrum. We need action." (MTN, 2016). The issue of spectrum was also highlighted in Vodacom's 2015 financial year end presentation where CEO Shameel Joosub highlighted that a lack of readily available radio frequency spectrum was hurting South Africa's

national Broadband ambitions (Vodacom, 2016). In an interview, Cell C CEO Jose Dos Santos also bemoaned the fact that new spectrum bands have not yet been allocated to operators. “Access to additional spectrum is imperative for economic and social growth. Already operators abroad are rolling out next-generation technologies and South Africa will be left behind if additional spectrum is not released. Operators cannot effectively roll out next generation technologies like 4G and 5G without this spectrum” (McLeod, 2016).

There is an argument that the spectrum conundrum is being used as a convenient excuse by the incumbent operators to maintain high mobile Broadband data costs. Here are two examples – First MTN South Africa CEO (at the time) Mteto Nyati spoke of MTN having to densify its network due to the lack of spectrum. This densifying resulted in more base stations having to be built to deal with the incoming data volume. This all comes at a price that they cannot recoup by lowering prices (McLeod, 2016). Secondly, at their 2015 Annual Results presentation Vodacom CEO Shameel Joosub outlined how Vodacom had been forced to raise their data prices so that they could drop them in the future and are limited in being able to rollout 4th Generation mobile Broadband data technology due to a lack of Spectrum (Nielsen, 2015).

According to a recent study by Research ICT Africa’s on mobile Broadband in South Africa, Vodacom and MTN collectively have 80% market share in South Africa but charge very high rates. Using the OCED telecommunications basket as a measure, the study found that Vodacom charges R 122, MTN R 76, and Telkom Mobile R 53 for an equivalent product (Moyo & Christoph Stork, 2012; Morganti, Karen Donders, Stork, Calandro, & Gamage, 2014).

With 80% market share and a mandate to return value to their shareholders, one cannot see either of MTN or Vodacom slashing their data prices while government cannot get this crucial spectrum licensed. This is a double edged sword as cost is one of the primary issues. Whilst the rollout of next generation wireless technologies will bring speed and accessibility, without a commensurate cost reduction, how can the SA Connect targets of increasing access and consumption be met?

2.7 Broadband technologies

Residential solutions for a low cost high-speed Internet connection include fixed and mobile technologies and can be summarised into the following main categories which will be used to group respondents in this study.

2.7.1 Fixed Broadband connections:

ADSL – Among fixed Broadband Internet connections, ADSL is the most readily available to residential users. ADSL uses twisted-copper-wire phone lines to provide Broadband access. However, ADSL is hampered by a distance problem as speed of access drops substantially as the distance from the local exchange provisioning the infrastructure increases beyond 4 km (Sawyer et al., 2003).

FTTH – The holy grail of Broadband technologies allowing access speeds of up to 1 Gigabit per second (Gbs). Although fibre technology was around 20 years ago, initial progress in the development of Fibre-optical networks was slowed to a halt by economic and technological factors. Back then, the Internet was not as widespread as it is now and customers did not require the speed and were also not yet ready to pay extra for the access (Nowak & Murphy, 2005). From the technology side, over this time period, significant progress has been made in the electronics as well as in the optical signal processing domain, the availability of these components makes the laying down of a FTTH network far cheaper than it used to be in comparison to other fixed Broadband infrastructure (Verbrugge et al., 2008).

2.7.2 Mobile Broadband connections

The term Mobile for Broadband is self-explanatory as it covers the technology that uses radio spectrum as a medium of communication between networks and devices and is therefore ‘mobile’ as it requires no wires. Mobile services have become particularly popular in many rural areas where fixed Broadband services are not available (ITU, 2003). What differentiates mobile Broadband technology is the speed that it offers the end user as the costs are related to the data consumed and not the speed at which it is accessed. This is different to that of fixed Broadband whose cost is based on both data volume and speed.

2.8 Summary of literature review

How important is Broadband penetration? There is agreement between scholars and policy makers from around the world that the wide-spread availability of Broadband is critical to a healthy and functioning global economy. This is also noted in SA Connect, South Africa's National Broadband policy which has clear targets defined for Broadband penetration and speed in South Africa. It is also proven by Czernich et al. (2011b) and Koutroumpis (2009) of their being a direct relationship between the level of Broadband access and a countries' GDP which was further was proven by Lam and Shiu (2010) to be even more apparent in developing countries.

Investment in Broadband has also led to communities experiencing more rapid growth in employment, having more new businesses as well as a higher concentration of businesses involved with information technology industries (Lehr, Osorio, Gillett, & Sirbu, 2006).

The growth of Broadband, fuelled predominantly by mobile technology has reached a growth inflection point. This phenomenon was predicted by Gordon Moore in 1965 in a piece so highly regarded that it became commonly known as 'Moores Law'. He proposed quite simply that the advancement of technology would enable the number of transistors that could fit on a silicon chip to double every two years, effectively halving in size every 2-years.

Whilst not a true physical law, Moore's law was entirely prophetic in how it not only explained the exponential growth we see today, but also it having been adopted as the bedrock to modern computing theory (Gurgia, 2016). This inflection point comparison is noted by both Czernich et al. (2011b) and Lehr et al. (2006) as they both highlight that the sheer pace of growth in Broadband adoption makes it impossible to understand or predict the long-term economic impact that it may have.

It is fair to say that worldwide Broadband adoption has exploded, but this is not the case for South Africa which has lagged behind. Per ITU statistics from 2015, South Africa had 25.2 active *mobile* Broadband subscriptions per 100 inhabitants

in comparison to a global average of 43.7 (only 57%) and 3.21 to a global average of 10.6 on *fixed* line Broadband penetration per 100 inhabitants (ITU, 2015a). High establishment barriers for *fixed* line Broadband coupled with a predominantly rural weighted population (66.7%) limits this infrastructure as a broad-based connectivity solution for South Africa, but what explains the low *mobile* Broadband take-up rate especially with a mobile SIM card penetration of 133% which is significantly ahead of the global average of 97% (GSMA, 2016a).

There are studies available that examine speed and cost as a variable in Broadband adoption and usage.

- Chaudhuri, Flamm, and Horrigan (2005) making use of a survey of Internet use among American households found that both price and education had a significant influence on Broadband take-up.
- Garcia-Murillo (2005) using a statistical analysis of 100 countries found price of Broadband positively impacted the number of active subscribers.
- S. Lee and Brown (2008), using a statistical analysis of 110 observations found that the impact of faster speeds on the increase of Broadband adoption were significant.

Whilst all of these studies used Broadband take-up as the primary measure, the analysis was related to fixed line Broadband as the global mobile Broadband phenomenon had yet to materialise at the time that these studies were completed.

In spite of the rapid diffusion of mobile Broadband technology over the last 5-years, there are no empirical studies available which have focused on the same factors that impact the usage of mobile Broadband, particularly the impact of access, speed and cost.

This study will look to explore and test some of the concepts and theories covered in the literature. Particular focus will be on usage barriers and how these differ across income and population groups in South Africa.

According to South Africa's 2011 Census by Statistics SA, nearly 80% of the almost 52 million strong population is Black (StatsSA, 2011), these groups are an

integral part of the research to best understand whether any responses have statistically significant variances which would be enough to question some of the ultimate conclusions in this paper.

SA's POPULATION: CENSUS 2011		
Population group	**Number**	**% of total**
Black	41 000 938	79.20%
White	4 586 838	8.90%
Coloured	4 615 401	8.90%
Indian/Asian	1 286 930	2.50%
Other	280 454	0.50%
TOTAL	**51 770 560**	**100%**

Table 13 – South Africa population groups (StatsSA, 2011)

The research will test the following hypotheses:

2.8.1 Research Hypothesis 1

Cost is a significant limitation for the desired use of the Internet (for personal use) at home in South Africa.

The literature confirms that Broadband access in South Africa is more expensive (per MB) when compared to the global average. Also confirmed is that cost is a proven determinant of Broadband adoption and use. The research will aim to understand whether cost is a limitation to the desired use of the Internet (for personal use) in South Africa.

2.8.2 Research Hypothesis 2

Speed is a significant limitation for the desired use of the Internet (for personal use) at home in South Africa.

The literature confirms that Broadband in South Africa is slower (using the measure of megabits per second) when compared to the global average. Also confirmed is that speed is a proven determinant of Broadband adoption and use. The research will aim to understand whether speed is a limitation to the desired use of the Internet (for personal use) in South Africa.

2.8.3 Research Hypothesis 3

Cost is a significant limitation for the desired use of the Internet (for personal use) via Mobile in South Africa.

Whilst the literature confirms that Broadband access South Africa is more expensive (per MB) when compared to the global average as well as cost being a proven determinant of Broadband adoption and use, this is related to fixed line Broadband. No such research exists that touches on take-up and usage barriers related to Mobile Broadband. The research will aim to understand whether cost is a limitation to the desired use of the Internet (for personal use) via Mobile in South Africa.

2.8.4 Research Hypothesis 4

Speed is a significant limitation for the desired use of the Internet (for personal use) via Mobile in South Africa.

Whilst the literature confirms that Broadband in South Africa is slower (using the measure of megabits per second) when compared to the global average as well as confirming that speed is a proven determinant of Broadband adoption and use, much like with the previous research hypothesis, no such literature exists in relation to speed being a determinant in relation to mobile Broadband take-up and usage. The research will aim to understand whether speed is a limitation to the desired use of the Internet (for personal use) via Mobile in South Africa.

2.8.5 Research Hypothesis 5

Is there an association between income levels and access to fixed line Broadband in South Africa?

The literature highlights the lack of investment in fixed line Broadband infrastructure that is due to South Africa's largely rural landscape, high crime levels (related to copper wire Broadband infrastructure theft) and low levels of commercial return on investment due to disparate income levels. The research will test this theory by looking at the percentage of respondents with access to fixed line Broadband overlaid with their income levels.

2.8.6 Research Hypothesis 6

Is there an association between the monthly costs of Broadband in South Africa access relative to income levels?

The literature highlights a monthly cost target of 2.5% of income yet StatsSA releases research from 2014/2015 which calculates an average monthly cost of 3.4% across all population groups. This research will focus on what association exists between the cost of Broadband and income levels in South Africa.

2.8.7 Research Hypothesis 7

Is there an association between income levels and Broadband speed in South Africa?

We know from the literature that South Africa lags the world average when it comes to the speed of Broadband access. The research will look into more detail as whether there is a link between speed of access and income levels.

2.8.8 Final comment

Apart from the seven hypotheses, the research will also focus on any meaningful variances between respondent responses based on their gender, income or population group. Whilst the overall research responses may be reliable and statistically strong enough to support or reject the hypotheses, it will be important to look for any signs or trends within the research that can be used as part of the overall analysis and recommendations.

CHAPTER 3. RESEARCH METHODOLOGY

3.1 Introduction

This study used quantitative research methodology to test seven research hypotheses:

1. Cost is a significant limitation for the desired use of the Internet (for personal use) at home in South Africa.
2. Speed is a significant limitation for the desired use of the Internet (for personal use) at home in South Africa.
3. Cost is a significant limitation for the desired use of the Internet (for personal use) via mobile in South Africa.
4. Speed is a significant limitation for the desired use of the Internet (for personal use) via mobile in South Africa.
5. Is there an association between income levels and access to fixed line Broadband in South Africa?
6. Is there an association between the monthly costs of Broadband in South Africa access relative to income levels?
7. Is there an association between income levels and Broadband speed in South Africa?

The data was derived from an online survey using a structured questionnaire. The objective was to secure information that allowed for the seven research hypotheses to be tested and either supported or rejected.

3.2 Research methodology

"Scientific research is systematic, controlled, empirical, and critical investigation of natural phenomena guided by theory and hypotheses about the presumed relations among such phenomena" (Kerlinger, 1986, p. 10)

Chapter 1 of this report highlighted the main aim of this research which was to study the Broadband access and consumption limitations that exist for South African consumers connecting to the Internet for personal use. The Literature

review in Chapter 2 created a framework of Broadband in South Africa. Chapter 3 will focus on the research methodology.

Researchers tend to favour one of two primary methods of gathering data (Larsson, 1993). This is either the nomothetic survey method, where the emphasis is on quantitative analysis of a few variables across large samples of data or the idiographic case study method, which is focused primarily on the qualitative, in-depth study of one or a few cases (Larsson, 1993). A better explanation for a nomothetic survey method is that it seeks to produce general statements that account for larger patterns which form the context of single events, individual behaviours and experience (Crossman, 2016). In this sense, quantitative research takes a nomothetic or generalising perspective of science through the statistical analysis of data (Morey & Luthans, 1984).

The most appropriate method for this research was quantitative. The research focussed on the collection of data across a large cross-section of a South African population sample and then used statistical analysis to test the research hypotheses.

This quantitative method was fit for this study based on the large sample size required and general nature of the information being collected. A quantitative study can use a standard survey process of collecting data involving the practice of manipulating numerical and independent variables to generate statistically analysable data. The results generated can then be used to test various hypotheses, with statistics being able to give a clear view on the overall picture (Shuttleworth, 2016). In this study the results generated were used to test the seven hypotheses.

3.3 Research Design

Research design can be defined as the general plan of how the researcher will go about answering their research questions (Saunders, 2011). The methodological approach used in this research was through the use of an online questionnaire. It was appropriate for this study as it allowed access to a large and

diverse population with the potential for the collection of significant amounts of data which would have been an important foundation to this study.

With the research questionnaire being online, the respondents require Internet connectivity to access and complete the survey. This provided additional legitimacy and reliability to the research responses based on the respondents having an existing understanding on the concept of Internet access and Broadband.

Advantages to this approach which are all relevant to this study:

- Efficient and convenient for respondents.
- Protects data accuracy as it is captured directly into a database versus having any manual capturing error risk.
- Guarantees a better response rate to a paper based approach (Matz, 1999).
- Lower financial resource implication (Ilieva, Baron, & Healey, 2002).

Disadvantages:

- Inability to pinpoint response location which potentially skews demographic split.
- Inaccuracy of data due to fraudulent responses – respondents do not answer questions truthfully thus skewing the data.
- Proliferation of marketing / educational studies resulting in lack of interest and thus response in target audience.

3.4 Population and sample

3.4.1 Population

Quantitative research *projects* results at a wider audience on the basis of primary data collected from a large group of individuals (Martins, Loubser, & Van Wyk, 1996). In order for the projected results to have credibility, the initial collection sample needs to be broad enough to represent the total population. This is also highlighted by (Henn, Weinstein, & Foard, 2005, p. 27; As cited in Delice, 2010),

“quantitative research emphasises the importance of generalisability and reliability”. The aim is to apply the relationship obtained among variables to the population. This explains why the selection of a sample that is representative of the population is so essential to this research methodology (Delice, 2010; As cited in Karasar, 2012).

The research population of this study comprises all South African’s who are currently active on the Internet and consuming Broadband data in some form which, according to statistics by the ITU, currently sits at 28,580,290 people at July 2016 (ITU, 2016).

3.4.2 Sample and sampling method

The sampling method used for this research was non-probability sampling. Saunders (2011) outlines non-probability sampling in the context of market surveys and case study research where it is not possible to specify the probability that any case will be included in the sample. This is because of the difficulty of having a sampling frame. “Non-probability sampling provides a range of alternative techniques to select samples based on your subjective judgement” (Saunders, 2011, p. 233). Non-probability samples occur when the probability that every respondent included in the sample cannot be determined, or it is left up to each individual to choose to participate in the survey (Fricker, 2008).

The non-probability sampling method used in this research is self-selection. The use of self-selection is expedient as it allows each individual the option to choose to participate in the research. A common issue with the use of surveys is that they are prone to self-selection bias, this occurs when the respondent sample differs from the population group based on a predisposition to respond based on a variety of factors, being interested in the topic as one example (Braver & Bay, 1992). As highlighted by Bethlehem (2010) and M. H. Lee (2011) two key methods to reduce potential self-selection bias from survey based research sampling is propensity weighting and high sample size.

The aim with this research was to get 1,000 respondents to an online questionnaire that was published via four channels. The high number of targeted respondents has two objectives:

1. To reduce the potential for self-selection bias in the results.
2. To improve the research validity due to the inferential statistical analysis method that will be used in chapter four. According to Fedor-Freybergh and Mikulecký (2005), when using inferential statistical methods, a sample of less than 200 respondents can impact the validity of the results.

Distribution channels

Distribution 1

- Posted the survey link and summary into the Facebook page of Mondo Mobile, a direct reseller of Vodacom, MTN and Telkom products in South Africa with over 125,000 Facebook fans.
  - The researcher has secured approval for the use of this channel on the basis that the research results will be shared with the Executive Management team of Mondo Sales (Pty) Ltd.

Distribution 2

- E-mailed the survey link and summary to a database of 10,000 South African consumers.
- This database was extracted against a demographic profile published by research group Effective Measure of Internet demographics in SA which is based on surveying 111,149 SA Internet users in March 2014 (Effective Measure, 2014).
- The data was selected based on the availability of an e-mail address for each customer which indicated that they has some form of Internet access.
- The data was supplied by the Expert Decision System (XDS) which is South Africa's largest wholly owned and registered credit bureau.

Distribution 3

- SMS the link to the same database of 10,000 South African consumers.

Distribution 4

- Distribution to the internal e-mail network of Rewardsco Sales (Pty) Ltd.
- Rewardsco Sales (Pty) Ltd is a Durban based company with 700 staff members.
- The researcher is employed by this company.

3.5 The research instrument

The quality of research is as dependent on asking the right questions as it is on the collection, interpretation and presentation of the data (Black, 1999).

In his book 'Data Collection in Context', Ackroyd (1992) identifies three types of surveys:

1. Factual surveys – these are used to collect descriptive information.
2. Attitudinal surveys – an attitudinal survey will attempt to collect and measure people's attitudes and opinions.
3. Explanatory survey – this type of survey goes beyond the collection of data and rather aims to test theories and hypotheses.

The research instrument that was used in this study was a self-administered, Internet-mediated questionnaire. This falls into the factual survey description as it was used to collect descriptive information (Ackroyd, 1992).

The questionnaire was structured and consisted of closed questions where respondents were asked to select their answers from a range of predetermined options. The survey questionnaire was easy to understand and complete so as to minimise non-response error and improve the quality of the results. As highlighted by Couper (2000), non-response error can be mitigated by using a survey instrument that is easy to understand as well as reassuring respondents regarding the confidentiality of their responses. The covering note on the survey highlighted the confidentiality of the exercise as well as explaining the importance of answering all questions as objectively and accurately as possible.

The instrument has not been adapted from any previous Broadband specific survey as no related survey could be found that addressed the specific nature of

questions required in this study. The initial demographic category questions have been adapted from the 2014 Effective Measure survey of Internet users in South Africa (Effective Measure, 2014) as these were used to profile the respondent data for improved validity.

Documents can be located in the following appendices:

- Appendix 1 – The research instrument / questionnaire.
- Appendix 2 – The covering note.

3.6 Procedure for data collection

Data collection took place via the completion of an online questionnaire.

The questionnaire as afore-mentioned was distributed via 4 channels:

- Mondo Mobile Facebook page.
- E-mail to 10,000 profiled customers.
- SMS to same 10,000 profiled customers.
- Internal corporate e-mail to Durban based company with 700 staff members.

The questionnaire was tested and validated on an initial sample of 10 respondents who were made up of colleagues, friends and family. This allowed for the questionnaire to be refined should there be any possible areas of weakness when analysing the initial response results. For further details on data collection procedure refer to section 4.2.

3.7 Data analysis and interpretation

The process of data analysis involves making sense out of the data obtained from respondents (Creswell, 2013). There are two existing primary types of statistical data analysis techniques (Sapsford & Jupp, 2006):

- Descriptive statistics that is focussed on the description of the data being presented.

- Inferential statistics that is used in order to draw conclusions about a wider population from sample data which is then used to examine differences, similarities and relationships between the different variables.

More simplistically, descriptive statistics summarises the current dataset and inferential statistics aims to draw conclusions about an additional population outside of the dataset.

This study used inferential statistics as it attempted to address the relation between the sample of measurements and the corresponding population which the sample has been drawn from. The sample was a small set of the total population but the research questions cover the total population of Internet users in South Africa. The study make inferences to broader population based on the statistical trends drawn from the results about their Internet use and access.

Sapsford and Jupp (2006) define two options available to researchers within inferential statistics:

- They can generalise from the sample to the population.
- They can test hypotheses about relationships or differences in the population using the data from the sample.

No matter which option is used, the results are based on samples and therefore they will be subject to sampling error (Sapsford & Jupp, 2006). In this study because its sample is unrepresentative of the broader population the inferential statistics method was used to test hypotheses.

3.8 Limitations of the study

- The study was specifically an investigative look at the Broadband market in South Africa.
    - The focus of the study was on how speed and cost may inhibit take-up and usage of Broadband in South Africa and focussed more on the access medium versus any hardware specific issue.
    - Based on this, any weaknesses in supplier service or product offerings are not covered.

- Sampling error – With Inferential statistics, all results are based on samples and therefore subject to sampling error (Sapsford & Jupp, 2006), the validity of the study will therefore hinge on the accuracy of the sample data.
    - The database used to provide a demographic sample which will be used to profile respondent data is extracted against a demographic profile of Internet demographics in South Africa published by research group Effective Measure (Effective Measure, 2014), the research will thus hinge on the accuracy of this data as a sample.
- Number of respondents – According to Fedor-Freybergh and Mikulecký (2005) when using inferential statistical methods, under 200 respondents, particularly under 30 measurements, the difference between sample and population becomes more and more critical to the validity of results.
    - Whilst the aim of this research is to secure more than 1,000 respondents, this is not guaranteed which highlights a potential risk should the number of respondents fail to exceed 200.
- Non-probability sampling means that the study cannot generalise results to broader population but can test the hypotheses from the sample.

3.9 Validity and reliability

Validity is best described as the degree to which a research study measures what it intends to measure (Gravetter, 2009). There are two main types of validity, internal and external. Both are very important in analysing the appropriateness, meaningfulness and usefulness of a research study. All variables that threaten validity should be controlled as much as possible (Gravetter, 2009).

3.9.1 External validity

External validity refers to the ability to generalise research findings to the target population. It is increased by having a large sample size as well as by ensuring that the sample is a close representation of the population. Research that is weak in external validity is not considered to provide an adequate test of theory (Calder, Phillips, & Tybout, 1982).

This study samples South African consumers who currently access the Internet making it sufficiently representative to cover all variances in the population. The sample is profiled according to South African Internet user demographics which were defined in a 2014 study across over 111,149 users. The results can therefore be applied with confidence across the whole population of Internet users in South Africa.

3.9.2 Internal validity

According to Trochim and Donnelly (2001), internal validity is the approximate truth about inferences regarding causal relationships. Therefore, internal validity is only relevant in studies that try to establish a causal relationship and thus, it is not relevant in most observational or descriptive studies. What this essentially means is that the researcher has evidence that what they did in their study caused what was observed to happen (Trochim & Donnelly, 2001).

How this study aimed to increase the internal validity was by testing the questionnaire with friends and family first to ensure that the outcomes are in line with the requirements. The questionnaire was refined or altered to ensure the outcomes were in line with the design requirements. For further details on how internal and external validity in this study were achieved please refer to section 4.18.

3.9.3 Reliability

Reliability in the context of research is defined as the consistency of results when an experiment is repeated under the same conditions (Hammond, Malec, Nick, & Buschbacher, 2014).

Coefficient alpha (Cronbach, 1951; As cited in Green, 2003) is known as the most popular reliability test in social-science research for measures with multiple components (Green, 2003). The reason for the popularity of the model is that it is an internal consistency estimate and, as opposed to other forms of reliability tests, only requires only a single administration measure rather than multiple administrations (Green, 2003).

This study used Cronbach Alpha as a test for reliability. It is an internal reliability test (meaning that it tests within the data versus using external sources) and provided a coefficient output which gauged whether the response pattern within the data is consistent. For further details on how Cronbach Alpha in this study was applied please refer to section 4.19.

3.10 Demographic profile of respondents

All that is currently available is the demographic profile of the Effective Measure survey results which was used to appropriately weight the research sample to accurately reflect the broader Internet user population in South Africa.

Gender	
Male	49%
Female	51%

Table 14 – Gender split of South African Internet users (Effective Measure, 2014)

Monthly household income	
Under R9000	21%
R9000 to R20000	20%
R20000 to R50000	26%
Over R50000	13%
Unknown	20%

Table 15 – Income split of South African Internet users (Effective Measure, 2014)

Age	
Under 20	9%
20-29	30%
30-39	25%
40-49	18%
50-59	13%
60+	5%

Table 16 – Gender split of South African Internet users (Effective Measure, 2014)

Where they are based	
Gauteng	47%
Western Cape	21%
Eastern Cape	6.5%
Northern Cape	1%

Where they are based	
Kwazulu-Natal	12%
Free State	3%
Mpumalanga	3.5%
North West	2.5%
Limpopo	3.5%

Table 17 – Location split of South African Internet users (Effective Measure, 2014)

Population Group	
Black	43%
Coloured	8%
White	40%
Indian	5%
Other	1%
Prefer not to say	3%

Table 18 – Population group split of South African Internet users (Effective Measure, 2014)

CHAPTER 4. PRESENTATION OF RESULTS

4.1 Introduction

The results of the data collection and analysis are presented in this chapter. The results are presented according to quantitative data analysis methods in line with the research methodology followed.

4.2 Survey response results

The survey was distributed via the following channels as indicated in section 3.6:

- E-mail and cell-number database of 10,000 South African residents provided by Xpert Decision Systems (XDS), a South African credit bureau.
    - 10,000 SMS's were sent on 19 December 2016.
        - 8,912 SMS's were delivered.
    - 10,000 e-mails were sent over the course of January 11, 12 and 13.
        - Of the 10,000 e-mails that were sent.
        - 412 were personalised.
        - The balance were generic.
        - 3,346 e-mails were undelivered due to incorrect addresses.
- Distribution to friends, colleagues and family.
- Social media campaigns:
    - Two Facebook campaigns via Mondo Mobile a local direct to consumer Telecommunications Company.
    - One Twitter post via Mondo Mobile's Twitter account.
    - One personal Facebook post.

The final data collection results:

- Total responses – 1,404.
- Total partial responses – 354.
- Total complete responses – 1,050.

4.3 Data interpretation

The response data has been modified according to the correspondence analysis rescaling approach as covered by (Stacey, 2005). This approach was shown to provide a good balance between data accuracy and precision whilst generating respondent level data which enables more effective numerical analysis (Stacey, 2005).

The rescaling has removed the nonlinearity from the data, moving the Likert table survey responses to a score on a standardised scale.

The method involved taking all twenty-two (22) survey questions and analysing them as a batch. The result of this analysis was an ‘average’ agreement across all questions equalling zero.

The below table and graph is a relative measure to the average response of zero. The higher the number, the more agreement there is with that item and conversely the lower the number then the more disagreement there is with that item.

Mean response	**Category**
Less than -0.98	Strongly disagree
Between -0.98 and -0.68	Somewhat disagree
Between -0.68 and -0.32	Neither agree or disagree
Between -0.32 and 0.24	Somewhat agree
More than 0.24	Strongly agree

Table 19 – Mean to category table based on data rescaling

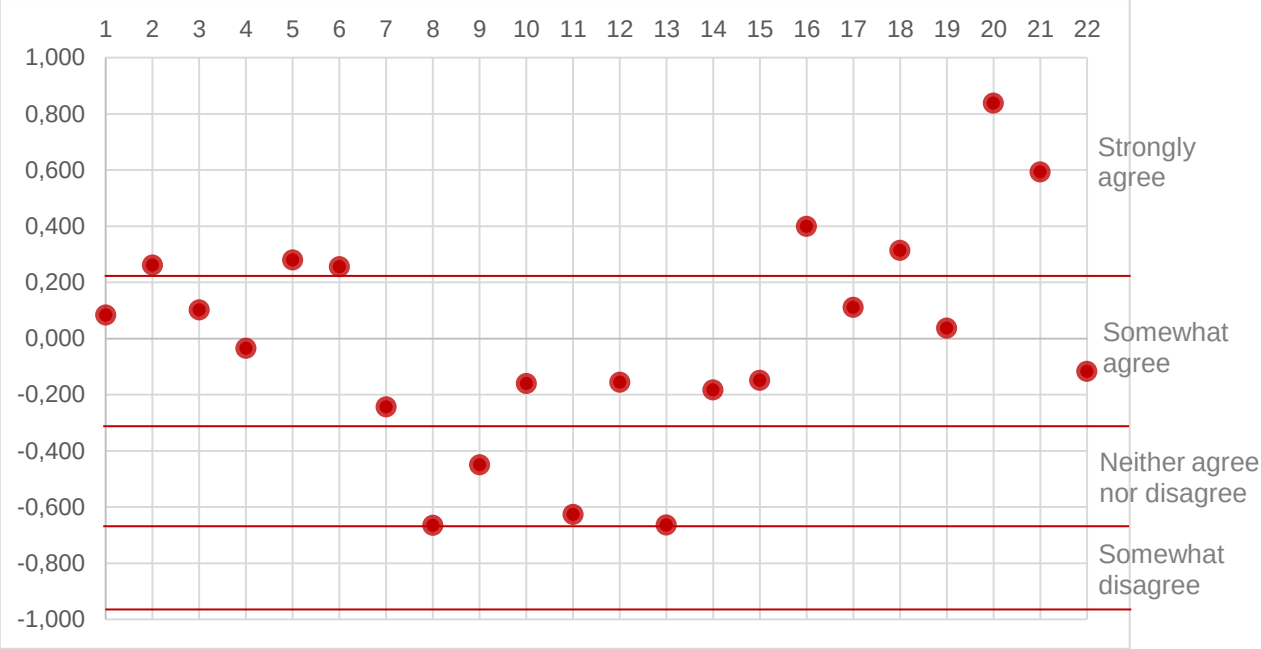

Figure 2 – Graph plot of mean response to 22 Likert scale questions from research questionnaire with average agreement across all questions equalling zero.

Q	Label	Mean	Std Dev	N
1	Cost is an influence in your decision to access and use Broadband / the Internet from home?	0.084	0.762	572
2	Download speed is an influence in your decision to access and use Broadband / the Internet from home?	0.262	1.017	572
3	Cost limits your 'desired usage' of Broadband / the Internet at home?	0.101	1.061	560
4	Download speed limits your 'desired usage' of Broadband / the Internet at home?	-0.035	0.681	560
5	Cheaper Broadband access at home would materially change my Internet usage habits	0.280	0.848	547
6	Faster Broadband access at home would materially change my Internet usage habits	0.255	0.731	547
7	My current home Broadband / Internet access solution disadvantages me	-0.243	0.821	547
8	I use the Internet at work because I do not have access to the Internet elsewhere	-0.665	0.886	234
9	I use the Internet at work because it is too expensive to access it elsewhere	-0.450	0.948	234

Q	Label	Mean	Std Dev	N
10	I use the Internet at work because it is fast	-0.160	0.976	234
11	Using the Internet at work eats into my work productivity	-0.627	0.900	234
12	I have no limitations to Internet usage at work	-0.155	0.933	234
13	The company that I work for limits the amount of Internet that can be used	-0.664	1.105	234
14	If I had access to cheaper home or mobile Internet, I would spend less time on the Internet at work	-0.183	0.951	234
15	If I had access to faster home or mobile Internet, I would spend less time on the Internet at work	-0.149	1.022	234
16	Cost is a factor in your decision to access the Internet using your mobile device?	0.399	1.035	861
17	Download speed is a factor in your decision to access the Internet from your mobile device?	0.111	0.861	861
18	Cost limits your 'desired usage' of mobile Broadband to access the Internet?	0.314	0.935	844
19	Download speed limits your 'desired usage' of mobile Broadband to access the Internet?	0.037	0.745	844
20	Cheaper mobile Broadband would materially change my Internet usage habits	0.838	1.229	830
21	Faster mobile Broadband access would materially change my Internet usage habits	0.593	1.007	830
22	My current mobile Broadband solution disadvantages me	-0.118	0.735	830

Table 20 – Summary statistics – Survey questions and corresponding mean results tabulated with response categories along with standard deviations

#	Question	Mean	Category
1	Cost is an influence in your decision to access and use Broadband from home?	0.084	Somewhat agree
2	Download speed is an influence in your decision to access and use Broadband from home?	0.262	Strongly agree
3	Cost limits your 'desired usage' of Broadband at home?	0.101	Somewhat agree

#	Question	Mean	Category
4	Download speed limits your 'desired usage' of Broadband t at home?	-0.035	Somewhat agree
5	Cheaper Broadband access at home would materially change my Internet usage habits	0.280	Strongly agree
6	Faster Broadband access at home would materially change my Internet usage habits	0.255	Strongly agree
7	My current home Broadband access solution disadvantages me	-0.243	Somewhat agree
8	I use the Internet at work because I do not have access to the Internet elsewhere	-0.665	Neither agree or disagree
9	I use the Internet at work because it is too expensive to access it elsewhere	-0.450	Neither agree or disagree
10	I use the Internet at work because it is fast	-0.160	Somewhat agree
11	Using the Internet at work eats into my work productivity	-0.627	Neither agree or disagree
12	I have no limitations to Internet usage at work	-0.155	Somewhat agree
13	The company that I work for limits the amount of Internet that can be used	-0.664	Neither agree or disagree
14	If I had access to cheaper home or mobile Internet, I would spend less time on the Internet at work	-0.183	Somewhat agree
15	If I had access to faster home or mobile Internet, I would spend less time on the Internet at work	-0.149	Somewhat agree
16	Cost is a factor in your decision to access the Internet using your mobile device?	0.399	Strongly agree
17	Download speed is a factor in your decision to access the Internet from your mobile device?	0.111	Somewhat agree
18	Cost limits your 'desired usage' of mobile Broadband to access the Internet?	0.314	Strongly agree
19	Download speed limits your 'desired usage' of mobile Broadband to access the Internet?	0.037	Somewhat agree
20	Cheaper mobile Broadband would materially change my Internet usage habits	0.838	Strongly agree
21	Faster mobile Broadband access would materially change my Internet usage habits	0.593	Strongly agree
22	My current mobile Broadband solution disadvantages me	-0.118	Somewhat agree

Table 21 – Survey questions and corresponding mean results tabulated with response categories

4.4 Demographics

The sampling took into account the demographics of the South African Internet using population across age, gender, income and race. This sampling was a vital part of interrogating the research findings so that the ultimate conclusions and recommendations were fit for purpose.

4.4.1 Gender distribution

Majority of respondents (64%) are female. This result is different to the broader sample which has a 49/51 Male/Female split.

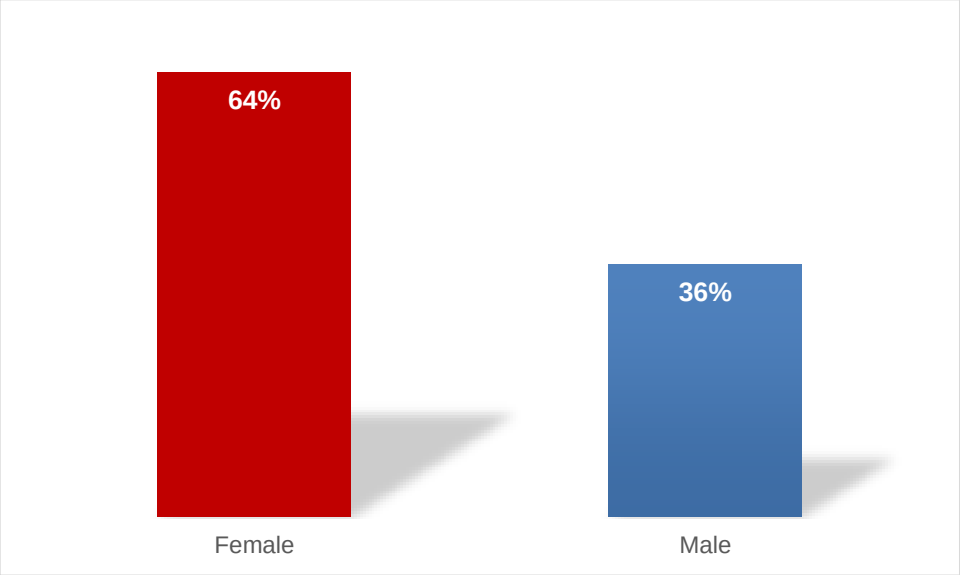

Table 22 – Gender distribution of respondents

4.4.2 Age distribution

The majority of respondents (70%) fall into the 20 to 39 age group category.

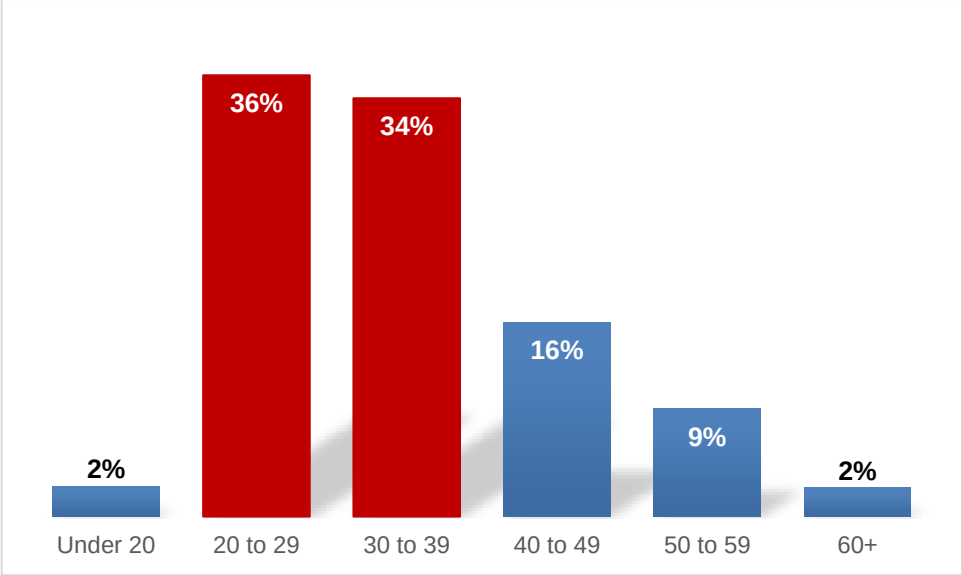

Table 23 – Age distribution of respondents

4.4.3 Income distribution

The majority of respondents (50%) fall into the income bracket earning below R 9,000 per month.

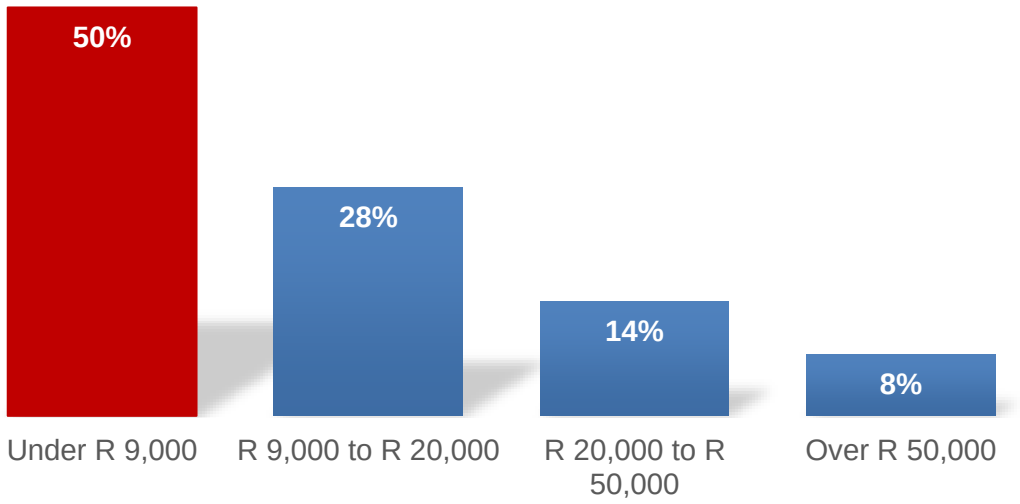

Table 24 – Income distribution of respondents

4.4.4 Population group distribution

Majority of respondents (40%) are Black with Whites making up a further 30%, giving these two population groups 70% of the total response data.

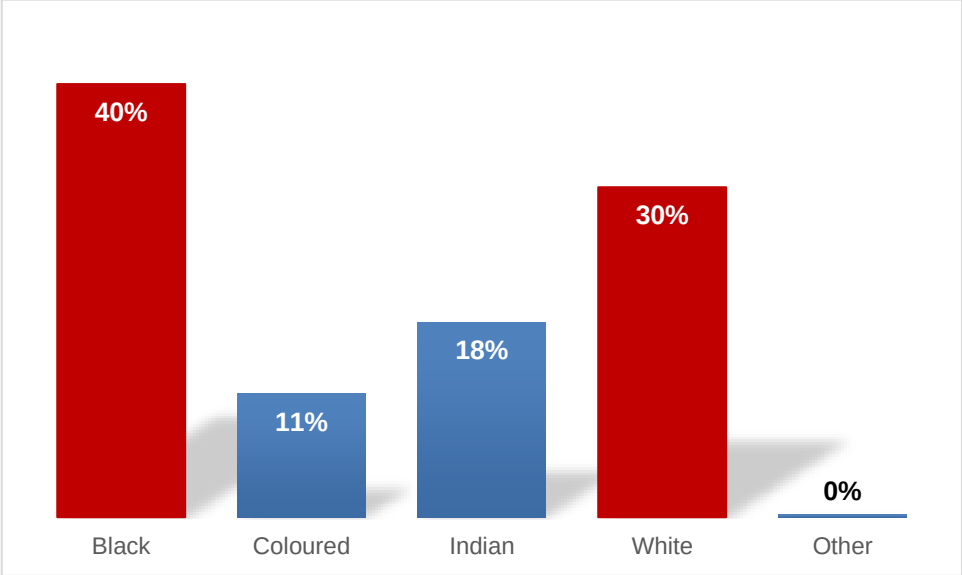

Table 25 – Population group distribution of respondents

4.4.5 Location distribution

29% of the respondents live in Gauteng whilst 24% of the respondents live in Kwazulu-Natal.

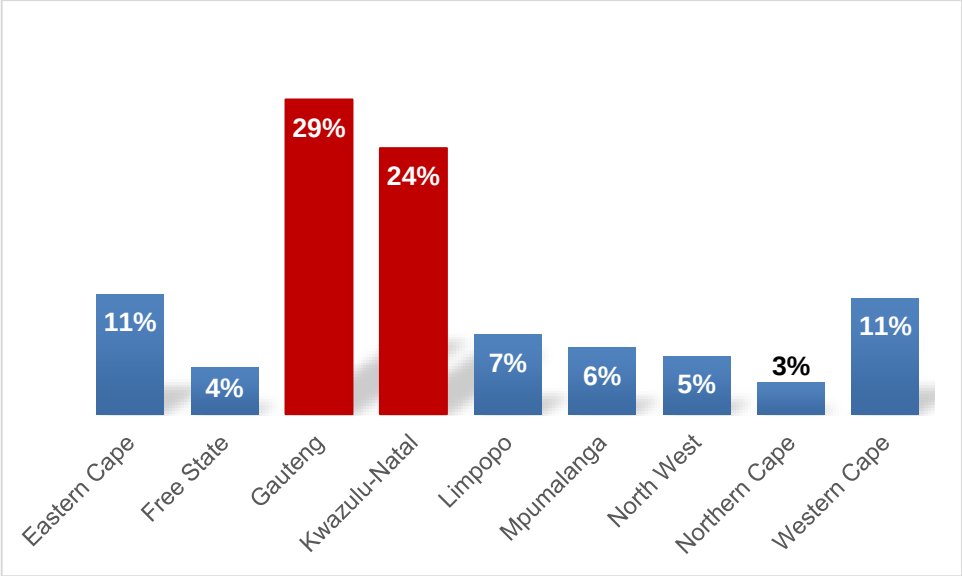

Table 26 – Population group distribution of respondents

4.5 Broadband specific survey responses

Apart from the demographic categories, there were also specific Broadband questions related to how much the services cost a household per month, the average speed of their connection and whether or not the respondent had access to fixed line Broadband where they lived.

The average cost per month, speed and fixed line access were key points from the literature and were used to test the various hypotheses as well as any other learnings that could be taken out of this research report.

4.5.1 How much does Broadband cost you per month

This question was framed around a respondents' personal expense per month for using Broadband to access the Internet for personal purposes.

30% of the respondents are spending between R 250 and R 500 per month for Broadband services.

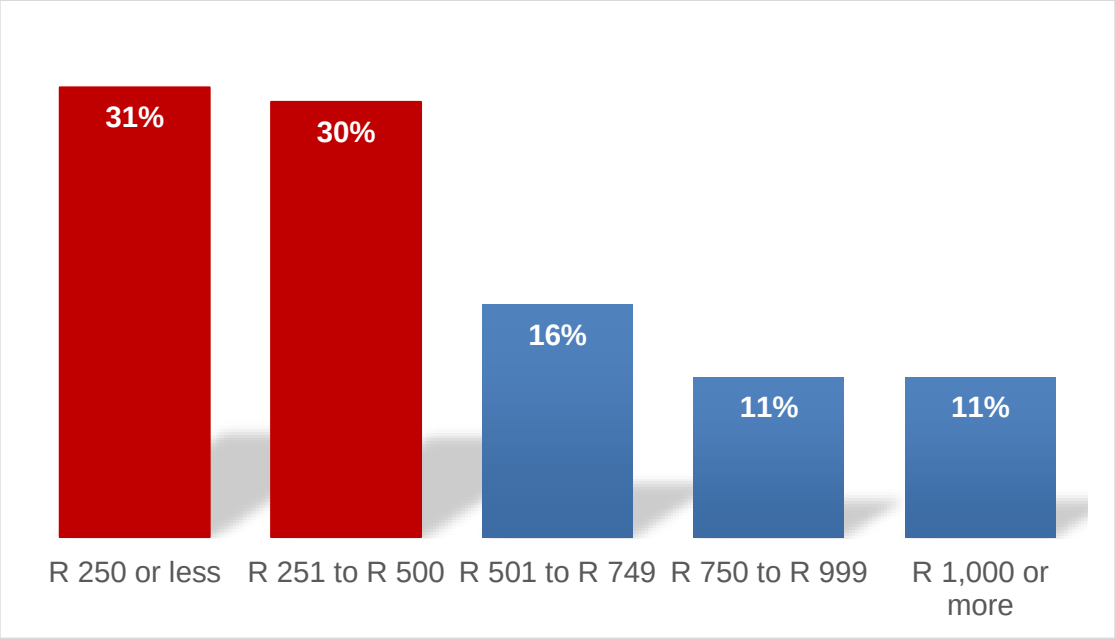

Table 27 – Cost of Broadband per month for personal purposes

4.5.2 Average speed of Broadband connection

The question was framed around the average speed of a respondents' Broadband connection that is being used the most.

A more technical question that resulted in the majority of respondents (44%) not being sure of what speed their Broadband connection was. This result is discussed further in section 5.9.

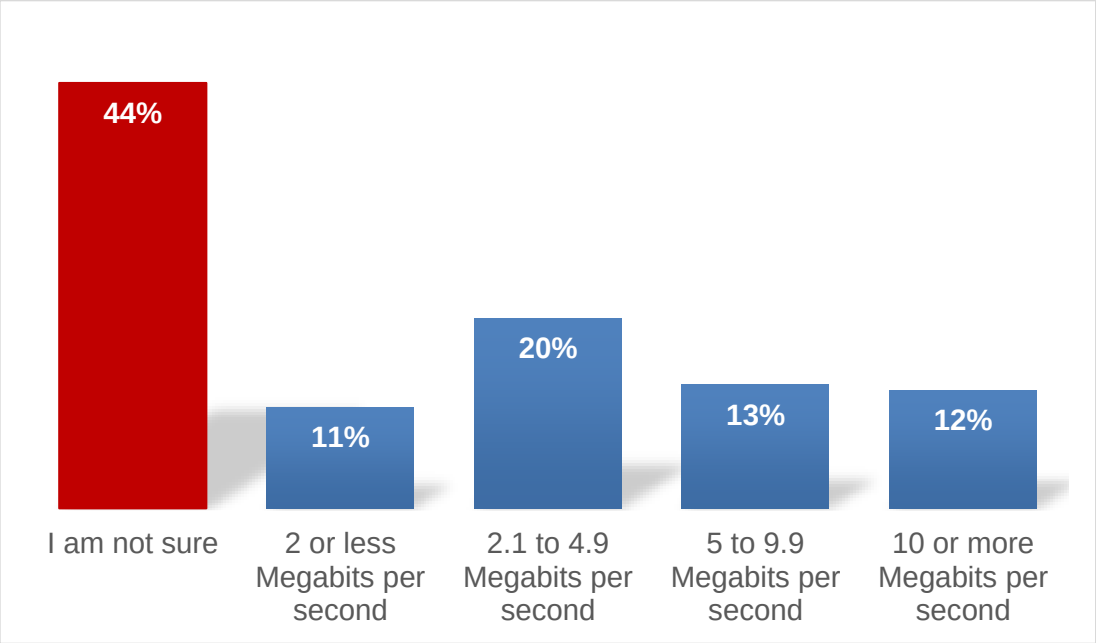

Table 28 – Average speed of Broadband connection that is used the most

4.5.3 Do you have access to fixed line Broadband (ADSL or Fibre to the Home) where you live?

The question was designed to secure a response on whether a respondent had access to any fixed line Broadband connection where they lived. The question specifically mentioned *access* as the objective was to secure a response on whether fixed line Broadband was available or not in the area where the respondent lived irrespective of whether the respondent was using it.

More than half of the respondents did not answer this question, but of the 589 who did answer, 56% do have access to fixed line Broadband services. Particular attention was given to how this question was structured so that a respondent

would be clear on what was being asked. It is not clear why more than half of the respondents did not complete the question, this opens an opportunity for further research which is discussed in section 6.4.

This measure will be used to analyse response variances in the survey data due to the cost and speed differences relative to fixed and mobile Broadband.

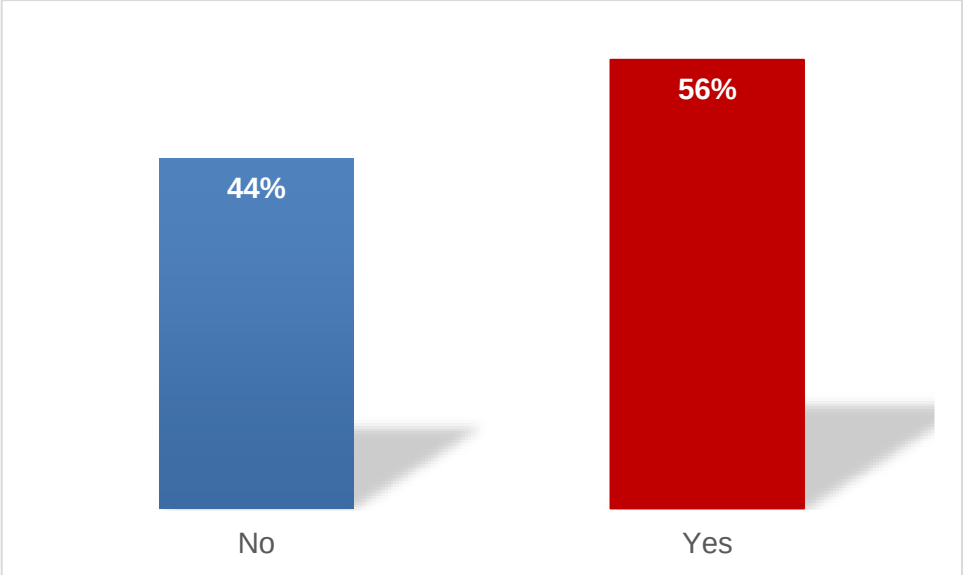

Table 29 – Do you have access to fixed line Broadband services where you live?

4.6 Broadband access mediums

Outside of demographics and Broadband specific questions regarding cost and speed, the research survey centred on Likert scale questions related to the access medium used by a respondent when using Broadband to connect to the Internet for personal purposes.

This is the heart of the research questionnaire which was segmented into the three sections of Home, Work and Mobile. The purpose of this section was simply for a respondent to select the access medium that they used (or had access to) and answer the questions accordingly.

A respondent could respond via all 3 mediums or via only 1. Each section of questions that followed was specific to whether the respondent had selected one or all of the options. There were 22 questions in all split along the following lines:

- 7 questions – Access from Home.
- 8 questions – Access from Work.
- 7 questions – Access from Mobile.

4.6.1 Where do you access Broadband (home/work/mobile)?

The highest band of respondents (35%) only use mobile Broadband to connect to the Internet for personal purposes.

Home	Work	Mobile	Observations	Percentage
0	0	0	228	16%
		1	493	35%
	1	0	39	3%
		1	47	3%
1	0	0	218	16%
		1	218	16%
	1	0	12	1%
		1	149	11%
			1404	**100%**

Table 30 – From where do you access Broadband / the Internet the most

4.7 Home respondents

Results takes from all respondents who responded that they accessed Broadband and the Internet from home.

A total of 597 out of the 1,404 total respondents completed the Home based survey section. This is 42.5% of the sample.

Q	Question	Mean	Std Dev	N
1	Cost is an influence in your decision to access and use Broadband / the Internet from home?	0.084	0.762	572
2	Download speed is an influence in your decision to access and use Broadband / the Internet from home?	0.262	1.017	572
3	Cost limits your 'desired usage' of Broadband / the Internet at home?	0.101	1.061	560
4	Download speed limits your 'desired usage' of Broadband / the Internet at home?	-0.035	0.681	560

Q	Question	Mean	Std Dev	N
5	Cheaper Broadband access at home would materially change my Internet usage habits	0.280	0.848	547
6	Faster Broadband access at home would materially change my Internet usage habits	0.255	0.731	547
7	My current home Broadband / Internet access solution disadvantages me	-0.243	0.821	547

Table 31 – Home survey questions and corresponding mean results

Q	Question	Mean	Category
1	Cost is an influence in your decision to access and use Broadband from home?	0.084	Somewhat agree
2	Download speed is an influence in your decision to access & use Broadband from home?	0.262	Strongly agree
3	Cost limits your 'desired usage' of Broadband at home?	0.101	Somewhat agree
4	Download speed limits your 'desired usage' of Broadband at home?	-0.035	Somewhat agree
5	Cheaper Broadband access at home would materially change my Internet usage habits	0.280	Strongly agree
6	Faster Broadband access at home would materially change my Internet usage habits	0.255	Strongly agree
7	My current home Broadband access solution disadvantages me	-0.243	Somewhat agree

Table 32 – Home survey questions and corresponding mean results tabulated with response categories

The graph below illustrates the mean score on each of the Likert scale survey questions related to Broadband access from home. The same ‘relative’ scale of zero exists with the overall mean response equalling zero, any response higher than zero represents more agreement than the average and vice versa.

The relative agreement was strongest on question five (5) which had a mean of 0.28. Both questions two (2) and six (6) scored at 0.26. Question two and five

were both related to the impact of faster Broadband whilst question five (5) was related to the impact of cheaper Broadband. Question seven (7) had the lowest relative agreement with a mean score of -0.24. This question related to the respondents current home Broadband solution disadvantaging them.

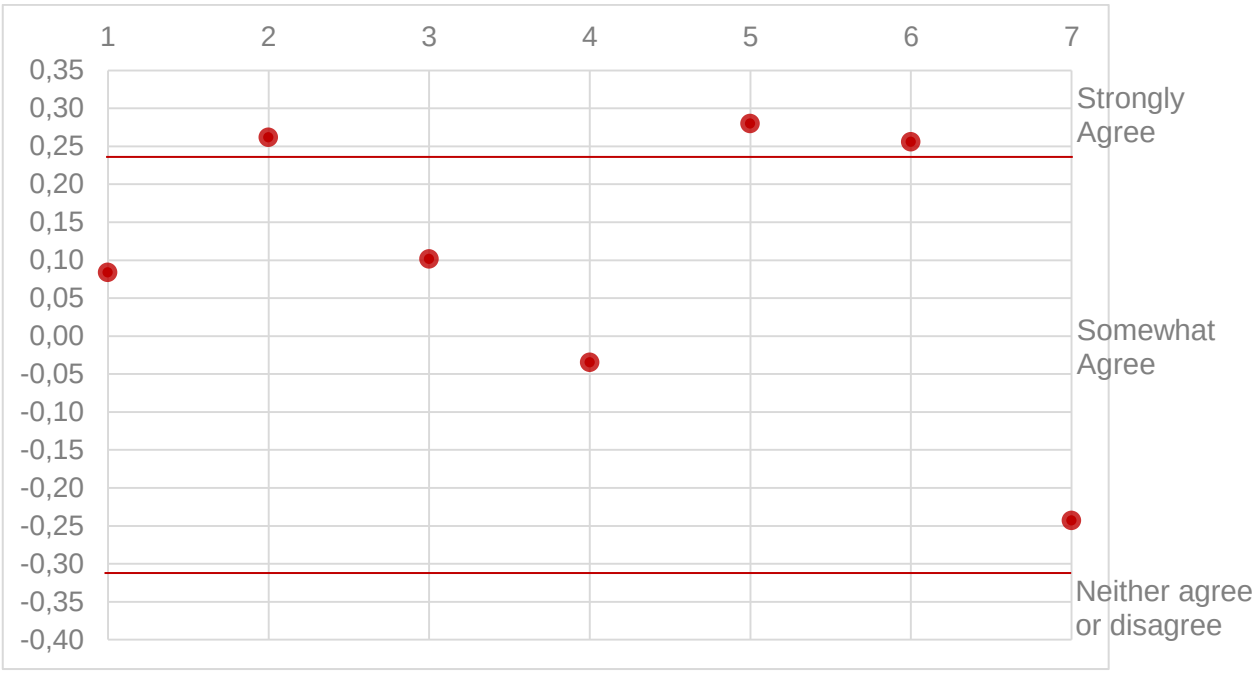

Figure 3 – Graphical interpretation of mean result against each of the seven (7) home based research survey questions (x-axis = home based research questions, y-axis = mean)

4.7.1 Further home based question analysis

Of the seven (7) research questions related to respondents who access Broadband from home, the highest mean result and the lowest mean result will be analysed against the following factors:

1. Gender.
2. Population group.
3. Income.

The gender and fixed line Broadband access categories will be analysed using a T-Test. This is a way of comparing the mean of a continuous dependent variable across two categories (G. Lee, 2015, p. 269). Whilst one can analyse the variance between the means using descriptive statistics, the T-Test goes a little further by

validating whether the difference in means is statistically significant (G. Lee, 2015, p. 270). Seeing that both gender and fixed line access categories have two variables, the T-test is the perfect way to analyse the significance of any variability between the respondent results.

The key metric used in the T-Test is the p-value. If the p-value (Pr>|t|) is less than 0.05 then this suggests a significant difference between the two response categories at a 5% confidence level (G. Lee, 2015, p. 271).

The population group and income categories require a different analysis approach due to them having more than two variable categories. The best statistical analysis method for comparing one dependent variable with more than two categories is called a 1-way Analysis of Variance (ANOVA) which is the most common statistical method used when comparing means across multiple independent groups (G. Lee, 2015, p. 278).

The 1-way ANOVA method is ideal for the population group and income categories based on each category having multiple groups, five (5) for population group and six (6) for income.

The key metric used in the ANOVA test is the F value. This is the ratio that tests how well a model as a whole (adjusted for the mean) accounts for the dependent variable's behaviour. The significance probability associated with the statistic is labelled (Pr > F). If this significance probability is less than 0.05 then this suggests that there is high variance within each of the response categories.

4.7.2 T-test analysis on research responses related to access and usage from home

Q	Description	Research question	Mean
5	Highest dependent variable	Cheaper Broadband access at home would materially change my Internet usage habits	0.280
7	Lowest dependent variable	My current home Broadband access solution disadvantages me	-0.243

4.7.3 T-Test results – Gender

1. **Question 5** – Cheaper Broadband access at home would materially change my Internet usage habits

The difference between the Female and Male means on question 5 is 0.1059

What is your gender	Method	Mean
Female		0.32
Male		0.2141
Diff (1-2)	Pooled	0.1059
Diff (1-2)	Satterthwaite	0.1059

The p-value (Pr>|t|) of 0.16 is in excess of 0.05 means that there is no significant statistical difference between the means of Male and Female respondents to question 5.

Method	Variances	DF	t Value	Pr > |t|
Pooled	Equal	527	1.4	0.1629
Satterthwaite	Unequal	427.14	1.38	0.1698

2. **Question 7** – My current home Broadband access solution disadvantages me

The difference between the Female and Male means on question 7 is 0.0304.

What is your gender	Method	Mean
Female		-0.2247
Male		-0.2551
Diff (1-2)	Pooled	0.0304
Diff (1-2)	Satterthwaite	0.0304

The p-value (Pr>|t|) of 0.68 is in excess of 0.05 means that there is no significant statistical difference between the means of Male and Female respondents to question 7.

Method	Variances	DF	t Value	Pr > |t|
Pooled	Equal	527	0.42	0.6759
Satterthwaite	Unequal	416.69	0.41	0.6827

4.7.4 1-Way ANOVA results – Income group

1. **Question 5** – Cheaper Broadband access at home would materially change my Internet usage habits

What is your monthly household income	Obs	Mean	Std Dev
Over R 50,000	73	0.04	0.89
R 20,000 to R 50,000	105	0.35	0.74
R 9,000 to R 20,000	155	0.37	0.82
Under R 9,000	196	0.25	0.91

Pr>F is the overall ANOVA test for differences between groups. If significant (<0.05) then one can conclude that then at least some groups are different (G. Lee, 2015, p. 285). The ANOVA result for this test is 0.2042 which indicates that most of the responses to question 5 grouped by income are not significantly different from one another on the basis of strongly agreeing that cheaper Broadband access at home would materially change their Internet usage habits.

ANOVA of Squared Deviations from Group Means					
Source	**DF**	**Sum of Squares**	**Mean Square**	**F Value**	**Pr > F**
What is your monthly household income	3	5.597	1.8657	1.54	0.2042
Error	525	637.6	1.2146		

2. **Question 7** – My current home Broadband access solution disadvantages me

What is your monthly household income	Obs	Mean	Std Dev
Over R 50,000	73	-0.34	0.83
R 20,000 to R 50,000	105	-0.33	0.75
R 9,000 to R 20,000	155	-0.24	0.84
Under R 9,000	196	-0.15	0.83

The ANOVA result for this test is 0.3593 which indicates that most of the responses to question 7 grouped by income are not significantly different from one another on the basis of strongly agreeing that cheaper Broadband access at home would materially change their Internet usage habits.

ANOVA of Squared Deviations from Group Means					
Source	**DF**	**Sum of Squares**	**Mean Square**	**F Value**	**Pr > F**
What is your monthly household income	3	1.593	0.531	1.07	0.3593
Error	525	259.4	0.494		

4.7.5 1-Way ANOVA results – Population group

1. **Question 5** – Cheaper Broadband access at home would materially change my Internet usage habits

What is your population group	Obs	Mean	Std Dev
Black	135	0.22	0.95
Coloured	57	0.26	0.87
Indian	106	0.43	0.78
Other	1	0.00	0.00
White	230	0.25	0.82

The ANOVA result for this test is a p-value of 0.1945 which indicates that most of the population group responses to question 5 are not significantly different from one another on the basis of strongly agreeing that cheaper Broadband access at home would materially change their Internet usage habits.

ANOVA of Squared Deviations from Group Means					
Source	**DF**	**Sum of Squares**	**Mean Square**	**F Value**	**Pr > F**
What is your population group	3	5.7334	1.9111	1.57	0.1945
Error	524	635.9	1.2136		

2. **Question 7** – My current home Broadband access solution disadvantages me

What is your population group	Obs	Mean	Std Dev
Black	135	-0.16	0.87
Coloured	57	-0.23	0.84
Indian	106	-0.29	0.80
Other	1	-0.52	0.00
White	230	-0.26	0.80

The ANOVA result for this test is a p-value of 0.4702. This is high which indicates that most of the population group responses to question 7 are not significantly different from one another on the basis of strongly agreeing that their current home Broadband solution disadvantages them.

ANOVA of Squared Deviations from Group Means					
Source	**DF**	**Sum of Squares**	**Mean Square**	**F Value**	**Pr > F**
What is your population group	3	1.2536	0.4179	0.84	0.4702
Error	524	259.4	0.4951		

4.8 Work respondents

Results takes from all respondents who responded that they accessed Broadband and the Internet from work.

A total of 247 out of 1,404 respondents completed the work based survey section, this is 17.6% of the sample.

Q	Question	Mean	Std Dev	N
8	I use the Internet at work because I do not have access to the Internet elsewhere	-0.665	0.886	234
9	I use the Internet at work because it is too expensive to access it elsewhere	-0.450	0.948	234
10	I use the Internet at work because it is fast	-0.160	0.976	234
11	Using the Internet at work eats into my work productivity	-0.627	0.900	234
12	I have no limitations to Internet usage at work	-0.155	0.933	234
13	The company that I work for limits the amount of Internet that can be used	-0.664	1.105	234
14	If I had access to cheaper home or mobile Internet, I would spend less time on the Internet at work	-0.183	0.951	234
15	If I had access to faster home or mobile Internet, I would spend less time on the Internet at work	-0.149	1.022	234

Table 33 – Summary statistics for Work respondents – Survey questions and corresponding mean results tabulated with response categories along with standard deviations

#	Question	Mean	Category
8	I use the Internet at work because I do not have access to the Internet elsewhere	-0.665	Neither agree or disagree
9	I use the Internet at work because it is too expensive to access it elsewhere	-0.450	Neither agree or disagree
10	I use the Internet at work because it is fast	-0.160	Somewhat agree
11	Using the Internet at work eats into my work productivity	-0.627	Neither agree or disagree
12	I have no limitations to Internet usage at work	-0.155	Somewhat agree
13	The company that I work for limits the amount of Internet that can be used	-0.664	Neither agree or disagree
14	If I had access to cheaper home or mobile Internet, I would spend less time on the Internet at work	-0.183	Somewhat agree
15	If I had access to faster home or mobile Internet, I would spend less time on the Internet at work	-0.149	Somewhat agree

Table 34 – Survey questions and corresponding mean results tabulated with response categories for work responses

The graph below illustrates the mean score on each of the Likert scale survey questions related to Broadband access from home. As with the previous ‘home’ model, the scale is aligned to an overall mean and relative response of zero.

The relative agreement was strongest on question seven 14 which had a relative mean of -0.18. Both questions one 8 and six 13 scored at -0.66 which is the lowest mean score relative to zero although seeing that the lowest and highest scores (relative to zero) were being further analysed, the results had one more decimal added to separate the two questions. With this third decimal added, question 8 became the question with the lowest mean score relative to zero with -0.665.

Question 14 was related to the cost of Broadband access at home as the respondents ‘somewhat agree’ that if they had access to cheaper home or mobile Internet, they would spend less time on the Internet at work

Question 8 relates to a respondent only using the Internet at work because they do not have access to the Internet anywhere else whilst question 13 centred on their being limits to Internet usage at work.

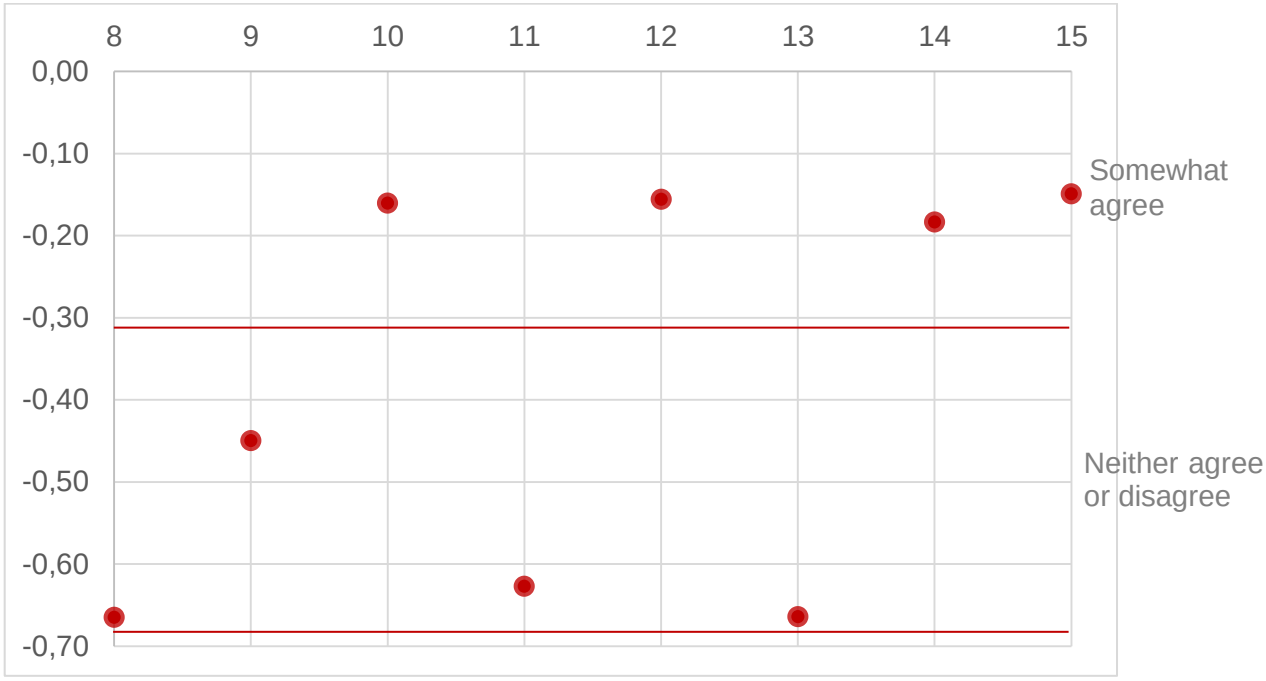

Figure 4 – Graphical interpretation of mean result against each of the eight (8) work based research survey questions (x-axis = work based research questions, y-axis = mean score against each question)

4.8.1 Further work based question analysis

The ‘work’ section will not be further analysed as work Broadband access was not a focus are in this research report.

4.9 Mobile respondents

Results takes from all respondents who responded that they accessed Broadband via a mobile Broadband device.

A total of 907 out of 1,404 respondents completed the mobile based survey section, this is 63.6% of the sample.

Q	Label	Mean	Std Dev	N
16	Cost is a factor in your decision to access the Internet using your mobile device?	0.399	1.035	861
17	Download speed is a factor in your decision to access the Internet from your mobile device?	0.111	0.861	861
18	Cost limits your 'desired usage' of mobile Broadband to access the Internet?	0.314	0.935	844
19	Download speed limits your 'desired usage' of mobile Broadband to access the Internet?	0.037	0.745	844
20	Cheaper mobile Broadband would materially change my Internet usage habits	0.838	1.229	830
21	Faster mobile Broadband access would materially change my Internet usage habits	0.593	1.007	830
22	My current mobile Broadband solution disadvantages me	-0.118	0.735	830

Table 35 – Summary statistics – Survey questions and corresponding mean results tabulated with response categories along with standard deviations

#	Question	Mean	Category
16	Cost is a factor in your decision to access the Internet using your mobile device?	0.399	Strongly agree
17	Download speed is a factor in your decision to access the Internet from your mobile device?	0.111	Somewhat agree
18	Cost limits your 'desired usage' of mobile Broadband to access the Internet?	0.314	Strongly agree
19	Download speed limits your 'desired usage' of mobile Broadband to access the Internet?	0.037	Somewhat agree
20	Cheaper mobile Broadband would materially change my Internet usage habits	0.838	Strongly agree
21	Faster mobile Broadband access would materially change my Internet usage habits	0.593	Strongly agree
22	My current mobile Broadband solution disadvantages me	-0.118	Somewhat agree

Table 36 – Survey questions and corresponding mean results tabulated with response categories

The graph below illustrates the mean score on each of the Likert scale survey questions related to Broadband access from a mobile device.

The relative agreement was strongest on question five (5) which had a relative mean of 0.84. Both questions five and six (6) had very strong agreement relative to zero. Question five and six were related to the impact of cheaper and faster mobile Broadband on their Internet usage habits.

The lowest relative agreement was still above zero and this was for question four (4) which relates to download speed limiting the respondents' desired usage of mobile Broadband to access the Internet.

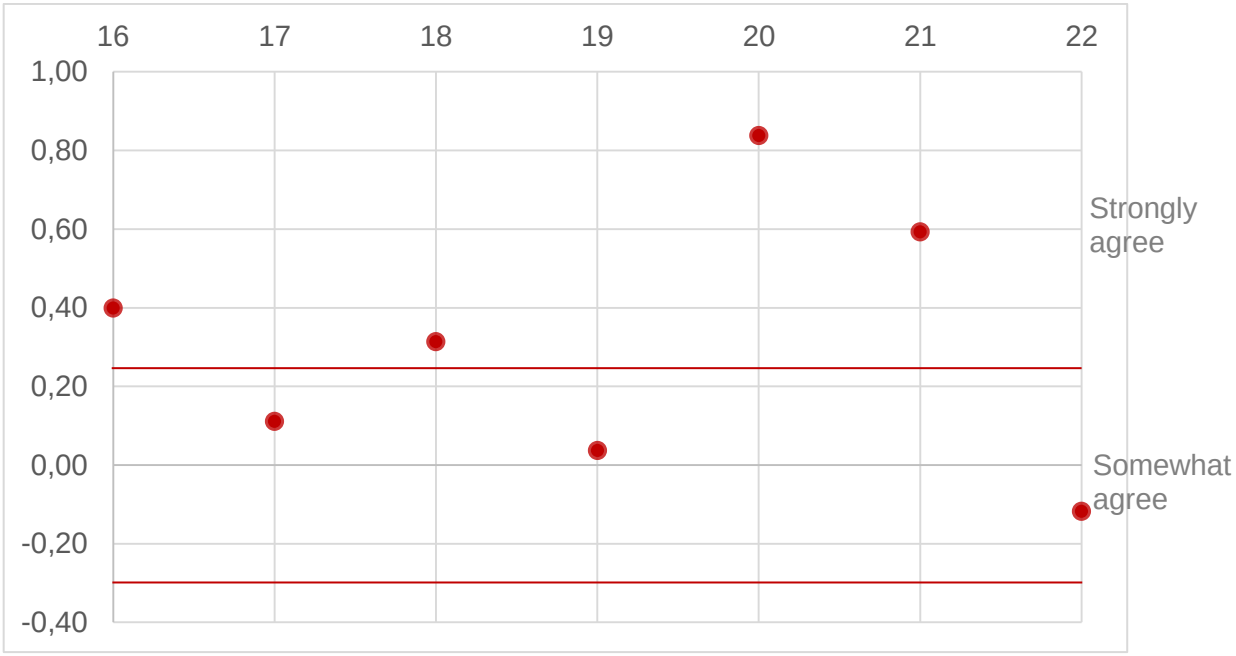

Figure 5 – Graphical interpretation of mean result against each of the seven (7) research survey questions based on usage of a mobile device to access the internet (x-axis = mobile based research questions, y-axis = mean score against each question)

4.9.1 Further mobile based question analysis

Of the seven (7) research questions related to respondents who accessed Broadband from a mobile device, much like the previous two sections on home and work, the highest relative means result and the lowest relative mean result will be analysed against the following factors:

1. Gender.
2. Population group.
3. Income.
4. Access to fixed line Broadband.

The same statistics analysis tests will be used. Questions with the highest and lowest relative means score are analysed using both a T-Test (for Gender and access to fixed line Broadband) and 1-way ANOVA (for Population group and income).

The T-Test uses a p-value to ascertain whether there is any statistical significance between respondent category responses whilst the 1-way ANOVA also used a p-value to ascertain if there is any statistical significance between each of the category groups. The key difference between the T-test and 1-way ANOVA is the number of categories that an analysis variable is being classified in. a T-test is limited to two whilst the 1-way ANOVA caters for multiple.

4.9.2 T-test analysis on research responses related to access and usage from a mobile device

Q	Description	Research question	Mean
20	Highest dependent variable	Cheaper mobile Broadband would materially change my Internet usage habits	0.838
19	Lowest dependent variable	Download speed limits your 'desired usage' of mobile Broadband to access the Internet?	0.037

4.9.3 T-Test results – Gender

1. **Question 20** – Cheaper mobile Broadband would materially change my Internet usage habits

The difference between the Female and Male means on question 5 is -0.0745.

What is your gender	Method	Mean
Female		0.8178
Male		0.8924

What is your gender	Method	Mean
Diff (1-2)	Pooled	-0.0745
Diff (1-2)	Satterthwaite	-0.0745

The p-value (Pr>|t|) of 0.4 is in excess of 0.05 means that there is no significant statistical difference between the means of Male and Female respondents to question 20.

Method	Variances	DF	t Value	Pr > |t|
Pooled	Equal	820	-0.84	0.3994
Satterthwaite	Unequal	657.12	-0.85	0.3962

2. **Question 19** – Download speed limits your 'desired usage' of mobile Broadband to access the Internet?

The difference between the Female and Male means on question 4 is 0.0536.

What is your gender	Method	Mean
Female		0.0563
Male		0.00273
Diff (1-2)	Pooled	0.0536
Diff (1-2)	Satterthwaite	0.0536

The p-value (Pr>|t|) of 0.32 is in excess of 0.05 means that there is no significant statistical difference between the means of Male and Female respondents to question 19.

Method	Variances	DF	t Value	Pr > |t|
Pooled	Equal	820	1.00	0.3184
Satterthwaite	Unequal	637.36	1.00	0.3200

4.9.4 T-Test results – Access to fixed line Broadband at home

1. **Question 20** – Cheaper mobile Broadband would materially change my Internet usage habits

The difference between the means on question 20 is 0.2476. The category response relates to those that have access to fixed line Broadband at home and those that do not.

Access to fixed line Broadband at home	Method	Mean
No		0.9739
Yes		0.7263
Diff (1-2)	Pooled	0.2476
Diff (1-2)	Satterthwaite	0.2476

The p-value (Pr>|t|) of 0.06 is in excess of 0.05. Being so close means that there is a difference but it is not significant enough to be statistically relevant.

Method	Variances	DF	t Value	Pr > |t|
Pooled	Equal	327	1.86	0.0638
Satterthwaite	Unequal	326.86	1.89	0.0594

2. **Question 19** – Download speed limits your 'desired usage' of mobile Broadband to access the Internet?

The difference between the means on question 19 is 0.1056. The category response relates to those that have access to fixed line Broadband at home and those that do not.

Access to fixed line Broadband at home	Method	Mean
No		0.0846
Yes		-0.0209
Diff (1-2)	Pooled	0.1056
Diff (1-2)	Satterthwaite	0.1056

The p-value (Pr>|t|) of 0.19 is in excess of 0.05 means that there is no significant statistical difference between the means those who have access to fixed line Broadband and those that do not in relation to question 4.

Method	Variances	DF	t Value	Pr > |t|
Pooled	Equal	330	1.31	0.1901
Satterthwaite	Unequal	328.38	1.32	0.1864

4.9.5 1-Way ANOVA results – Income group

1. **Question 20** – Cheaper mobile Broadband would materially change my Internet usage habits

What is your monthly household income	Obs	Mean	Std Dev
Over R 50,000	62	0.586	1.326
R 20,000 to R 50,000	102	0.865	1.109
R 9,000 to R 20,000	218	0.982	1.136
Under R 9,000	440	0.810	1.274

The ANOVA result for this test is that the p-value for Pr>F = 0.0951, this p-value is higher than 0.05 which indicates that responses to question 20 grouped by income are not significantly different from one another.

ANOVA of Squared Deviations from Group Means					
Source	**DF**	**Sum of Squares**	**Mean Square**	**F Value**	**Pr > F**
What is your monthly household income	3	27.7689	9.2563	2.13	0.0951
Error	818	3556.6	4.3479		

2. **Question 19** – Download speed limits your 'desired usage' of mobile Broadband to access the Internet?

What is your monthly household income	Obs	Mean	Std Dev
Over R 50,000	62	-0.102	0.757
R 20,000 to R 50,000	102	0.0429	0.685
R 9,000 to R 20,000	218	0.030	0.757
Under R 9,000	440	0.057	0.750

The ANOVA result for this test is that the p-value for Pr>F = 0.44, this p-value is high which indicates that most of the responses to question four grouped by income are not significantly different from one another on the basis of ‘somewhat agreeing’ that download speed limits their desired usage of mobile Broadband to access the internet.

ANOVA of Squared Deviations from Group Means					
Source	**DF**	**Sum of Squares**	**Mean Square**	**F Value**	**Pr > F**
What is your monthly household income	3	0.9066	0.3022	0.90	0.4413
Error	818	275.0	0.3362		

4.9.6 1-Way ANOVA results – Population group

1. **Question 20** – Cheaper mobile Broadband would materially change my Internet usage habits

What is your population group	Obs	Mean	Std Dev
Black	368	0.822	1.283
Coloured	88	0.713	1.358
Indian	149	1.085	1.017
Other	3	0.200	1.264
White	214	0.783	1.186

The ANOVA result for this test results in a p-value of 0.0158. This low number (<0.05) indicates that most of the population group responses to question 20 are significantly different from one another on the basis of strongly agreeing that cheaper mobile Broadband would materially change their Internet usage habits. This result will be analysed further and discussed in more detail in chapter 5.

ANOVA of Squared Deviations from Group Means					
Source	**DF**	**Sum of Squares**	**Mean Square**	**F Value**	**Pr > F**
What is your population group	4	52.4288	13.1072	3.07	0.0158
Error	817	3485.5	4.2663		

2. **Question 19** – Download speed limits your 'desired usage' of mobile Broadband to access the Internet?

What is your population group	Obs	Mean	Std Dev
Black	368	0.047	0.766
Coloured	88	0.154	0.783
Indian	149	0.0507	0.700
Other	3	-0.204	0.284
White	214	-0.0369	0.722

The ANOVA result for this test results in a p-value of 0.1538. This p-value is high which indicates that most of the responses to question four grouped by population group are not significantly different from one another on the basis of ‘somewhat agreeing’ that download speed limits their desired usage of mobile Broadband to access the internet.

ANOVA of Squared Deviations from Group Means					
Source	**DF**	**Sum of Squares**	**Mean Square**	**F Value**	**Pr > F**
What is your population group	4	2.3032	0.5758	1.67	0.1538
Error	817	280.9	0.3438		

4.10 Research Hypotheses

Research hypothesis – A wise guess that is formulated and temporarily adopted to explain the observed facts covered by the study (Calmorin & Calmorin, 2007).

4.11 Results pertaining to research Hypothesis 1

Cost is a significant limitation for the desired use of the Internet (for personal use) at Home in South Africa.

Alternative Hypothesis (H_n)	Cost is a significant limitation > 0

The hypothesis test used is the one-sample T-Test. This differs from the previous T-Tests which tested the independent variable against one or more categorical variables. The one-sample T-test compares the mean of the independent variable to the overall mean of the population which is zero.

Three questions taken out of the Home Broadband section are linked into cost being a limitation to the desired use of the internet for personal use at home in South Africa.

Question 1	Cost is an influence in your decision to access and use Broadband / the Internet from home?
Question 3	Cost limits your 'desired usage' of Broadband / the Internet at home?
Question 5	Cheaper Broadband access at home would materially change my Internet usage habits

The purpose of the T-test will be to check the p-values of each test to understand if they show any statistical significance. Like with the previous two-sample T-Tests, the key value is Pr>|t|. With the null hypothesis = 0, the Pr>|t| will need to be less than 0.05 which will suggest a significant difference at a 5% confidence.

1. *Question 1*

DF	t Value	Pr > |t|
571	2.620	0.009

2. *Question 3*

DF	t Value	Pr > |t|
559	2.260	0.024

3. *Question 5*

DF	t Value	Pr > |t|
546	7.720	<.0001

The p-values for each T-Test fall below 0.05 which suggests a statistically significant variance between the mean of each question and zero which supports the alternate hypothesis of cost being a limitation to Broadband usage at home.

4.11.1 Conclusion of research hypothesis 1

The null hypothesis of cost not being a significant limitation to the usage of Broadband at home for personal purposes is rejected.

4.12 Results pertaining to research Hypothesis 2

Speed is a significant limitation for the desired use of the Internet (for personal use) at Home in South Africa.

Alternative Hypothesis (H_n)	Speed is a significant limitation > 0

As with the previous hypothesis test, the testing method used is the one-sample T-Test. As with hypothesis one, three questions taken out of the Home

Broadband section are linked into speed being a limitation to the desired use of the internet for personal use at home in South Africa.

Question 2	Download speed is an influence in your decision to access and use Broadband / the Internet from home?
Question 4	Download speed limits your 'desired usage' of Broadband / the Internet at home?
Question 6	Faster Broadband access at home would materially change my Internet usage habits

Like with the previous one-sample T-Test, the key value is Pr>|t|. With the null hypothesis = 0, the Pr>|t| will need to be less than 0.05 which will suggest a significant difference at a 5% confidence.

1. *Question 2*

DF	t Value	Pr > |t|
571	6.150	<.0001

2. *Question 4*

DF	t Value	Pr > |t|
559	-1.22	0.2246

3. *Question 6*

DF	t Value	Pr > |t|
546	8.17	<.0001

The T-test for question 4 suggests no significance to zero. This question is related to download speed limiting use of Broadband at home.

The p-values for question 2 and 6 below 0.0001 which suggests a statistically significant variance between the mean of each question and zero which supports the alternate hypothesis of download speed being a limitation to Broadband usage at home.

4.12.1 Conclusion of research hypothesis 2

The null hypothesis of download speed not being a significant limitation to the usage of Broadband at home for personal purposes is rejected, two out of the three T-tests supported the alternate hypothesis.

4.13 Results pertaining to research Hypothesis 3

Cost is a significant limitation for the desired use of the Internet (for personal use) via Mobile in South Africa.

Alternative Hypothesis (H_n)	Cost is a significant limitation > 0

Three questions taken out of the Mobile Broadband section are linked into cost being a limitation to the desired use of the internet for personal use via Mobile in South Africa.

Question 16	Cost is a factor in your decision to access the Internet using your mobile device?
Question 18	Cost limits your 'desired usage' of mobile Broadband to access the Internet?
Question 20	Cheaper mobile Broadband would materially change my Internet usage habits

As with the previous hypothesis test, the testing method used is the one-sample T-Test. As with hypothesis one, three questions taken out of the mobile Broadband section are linked into cost being a limitation to the desired use of the internet for personal use via mobile in South Africa.

1. *Question 16*

DF	t Value	Pr > |t|
860	11.32	<.0001

2. *Question 18*

DF	t Value	Pr > |t|
843	9.75	<.0001

3. Question 20

DF	t Value	Pr > |t|
829	19.64	<.0001

The p-values for each T-Test fall below 0.0001 which suggests a statistically significant variance between the mean of each question and zero which supports the alternate hypothesis of cost being a limitation to Broadband usage via a mobile device.

4.13.1 Conclusion of research hypothesis 3

The null hypothesis of cost not being a significant limitation to the usage of Broadband via mobile for personal purposes is rejected, all 3 T-tests showed a significant difference to the population mean of zero.

4.14 Results pertaining to research Hypothesis 4

Cost is a significant limitation for the desired use of the Internet (for personal use) via Mobile in South Africa.

Alternative Hypothesis (H_n)	Speed is a significant limitation > 0

As with the previous hypothesis test, the testing method used is the one-sample T-Test. As with hypothesis one, three questions taken out of the Home Broadband section are linked into speed being a limitation to the desired use of the internet for personal use at home in South Africa.

Question 17	Download speed is a factor in your decision to access the Internet from your mobile device?
Question 19	Download speed limits your 'desired usage' of mobile Broadband to access the Internet?
Question 21	Faster mobile Broadband access would materially change my Internet usage habits

As with the previous one-sample T-Test, the key value is Pr>|t|. With the null hypothesis = 0, the Pr>|t| will need to be less than 0.05 which will suggest a significant difference at a 5% confidence.

1. *Question 17*

DF	t Value	Pr > |t|
860	3.80	0.0002

2. *Question 19*

DF	t Value	Pr > |t|
843	1.42	0.1549

3. *Question 21*

DF	t Value	Pr > |t|
829	16.95	<.0001

The p-values for question 17 and 21 are below 0.0001 which suggests a statistically significant variance between the mean of each question and zero. This supports the alternate hypothesis of download speed being a limitation to Broadband usage via mobile.

4.14.1 Conclusion of research hypothesis 4

The null hypothesis of download speed not being a significant limitation to the usage of Broadband via mobile for personal purposes is rejected, two out of the three T-tests supported the alternate hypothesis.

4.15 Results pertaining to research Hypothesis 5

Is there an association between income levels and access to fixed line Broadband in South Africa?

Alternative Hypothesis (H_n)	There is a significant association between income levels and access to fixed line Broadband in South Africa

The purpose of this hypothesis test is to ascertain if there is any association between Broadband speed in South Africa and the income levels.

Frequency	Over R 50 k	R 20 to R 50 k	R 9 to R 20 k	Under R 9 k	Total
No	2.8%	5.1%	13.0%	21.2%	42.2%
Yes	11.0%	14.7%	16.3%	15.9%	57.8%
Total	13.8%	19.8%	29.3%	37.1%	100.0%

Table 25 – Contingency table converted into percentages over total observations

Statistic	DF	Value	Prob
Chi-Square	3	44.0258	<.0001
Likelihood Ratio Chi-Square	3	45.7016	<.0001
Mantel-Haenszel Chi-Square	1	42.6056	<.0001

Table 37 – Table analysis results taken from SAS

This calculation secures the Chi-Square statistic which equals 44.0258. We also have the predetermined alpha level of significance (0.05) and Degrees of Freedom which equals 3.

Entering the Chi-Square distribution table below with 3 Degrees of Freedom and reading along the row we find our value of χ_2 (44.0258) lies above 16.27 on the table. The corresponding probability is below the 0.001 probability level.

This means that the p-value is below 0.001 which is lower than the conventionally accepted significance level of 0.05 (i.e. p > 0.05) thus we reject the null hypothesis.

DF / α	0.01	0.10	0.02	0.05	0.001
1	0.00004	2.71	3.84	5.41	10.83
2	0.01	4.61	5.99	7.82	13.82
3	*0.07*	*6.25*	*7.82*	*9.84*	*16.27*

Table 38 – Chi-Squared distribution table

4.15.1 Conclusion of research hypothesis 5

The null hypothesis of there being no significant association between income levels and access to fixed line Broadband in South Africa is rejected due to their being a statistically significant association between these two variables.

4.16 Results pertaining to research Hypothesis 6

Is there an association between the monthly costs of Broadband in South Africa access relative to income levels?

Alternative Hypothesis (H_n)	There is a significant association between the monthly cost of Broadband in South Africa access relative to income levels

The purpose of this hypothesis test is to ascertain if there is any significant association between the monthly costs of Broadband in South Africa relative to income levels.

Frequency	Over R 50 k	R 20 to R 50 k	R 9 to R 20 k	Under R 9 k	Total
R 1,000 or more	2.8%	2.4%	2.5%	3.7%	11.4%
R 250 or less	0.6%	1.6%	5.2%	22.7%	30.0%
R 251 to R 500	0.9%	3.9%	9.9%	15.4%	30.1%
R 501 to R 749	1.5%	3.9%	5.6%	5.7%	16.8%
R 750 to R 999	1.7%	2.1%	4.4%	3.5%	11.7%
Total	7.5%	13.7%	27.7%	51.0%	100.0%

Table 39 – Contingency table converted into percentages over total observations

Statistic	DF	Value	Prob
Chi-Square	12	202.167	<.0001
Likelihood Ratio Chi-Square	12	193.820	<.0001
Mantel-Haenszel Chi-Square	1	15.772	<.0001

Table 40 – Table analysis results taken from SAS

This calculation secures the Chi-Square statistic which equals 202.167. We also have the predetermined alpha level of significance (0.05) and Degrees of Freedom which equals 12.

Entering the Chi-Square distribution table below with 12 Degrees of Freedom and reading along the row we find our value of χ_2 (202.167) lies above 32.91 on the table. The corresponding probability is below the 0.001 probability level.

This means that the p-value is below 0.001 which is lower than the conventionally accepted significance level of 0.05 (i.e. p > 0.05) thus the null hypothesis is rejected.

DF / α	0.01	0.10	0.02	0.05	0.001
12	*3.07*	*18.55*	*21.03*	*24.05*	*32.91*
13	3.57	19.81	22.36	25.47	34.53
14	4.08	21.06	23.69	26.87	36.12
15	4.60	22.31	25.00	28.26	37.70

Table 41 – Chi-Squared distribution table

4.16.1 Conclusion of research hypothesis 6

The null hypothesis of there being no significant association between the monthly costs of Broadband in South Africa access relative to income levels is rejected due to their being a statistically significant association between the two variables.

4.17 Results pertaining to research Hypothesis 7

Is there an association between income levels and Broadband speed in South Africa?

Alternative Hypothesis (H_n)	There is a significant association between income levels and Broadband speed in South Africa

The purpose of this hypothesis test is to ascertain if there is any association between Broadband speed in South Africa and income levels.

Frequency	Over R 50 k	R 20 to R 50 k	R 9 to R 20 k	Under R 9 k	Total
10 or more Megabits per second	1.9%	2.2%	3.0%	5.6%	12.6%
2 or less Megabits per second	0.9%	1.1%	3.4%	5.6%	11.1%

Frequency	Over R 50 k	R 20 to R 50 k	R 9 to R 20 k	Under R 9 k	Total
2.1 to 4.9 Megabits per second	1.4%	3.6%	7.1%	8.7%	20.7%
5 to 9.9 Megabits per second	1.0%	1.6%	4.5%	5.9%	13.1%
I am not sure	2.3%	5.3%	9.7%	25.2%	42.5%
Total	**7.5%**	**13.7%**	**27.7%**	**51.0%**	**100.0%**

Table 42 – Contingency table converted into percentages over total observations

Statistic	DF	Value	Prob
Chi-Square	12	40.5435	<.0001
Likelihood Ratio Chi-Square	12	38.4979	0.0001
Mantel-Haenszel Chi-Square	1	17.6001	<.0001

Table 43 – Table analysis results taken from SAS

This calculation secures the Chi-Square statistic which equals 40.543. We also have the predetermined alpha level of significance (0.05) and Degrees of Freedom which equals 12.

Entering the Chi-Square distribution table below with 12 Degrees of Freedom and reading along the row we find our value of χ_2 (40.544) lies above 32.91 on the table. The corresponding probability is below the 0.001 probability level.

This means that the p-value is below 0.001 which is lower than the conventionally accepted significance level of 0.05 (i.e. p > 0.05) thus we reject the null hypothesis.

DF / α	0.01	0.10	0.02	0.05	0.001
12	*3.07*	*18.55*	*21.03*	*24.05*	*32.91*
13	3.57	19.81	22.36	25.47	34.53
14	4.08	21.06	23.69	26.87	36.12
15	4.60	22.31	25.00	28.26	37.70

Table 44 – Chi-Squared distribution table

4.17.1 Conclusion of research hypothesis 7

The null hypothesis of there being no significant association between income levels and Broadband speed in South Africa is rejected due to their being a statistically significant association between income levels and Broadband speed in South Africa.

4.18 Research validity

4.18.1 External validity

As discussed in the research methodology chapter section 3.9, external validity refers to the ability to generalise research findings to the target population and is increased by having a large sample size as well as by ensuring that the sample is a close representation of the population.

The external validity in this study is strong based on having a large sample size of 1,404 respondents and general alignment to the external profile of South African Internet user demographics which were defined in a 2014 study across over 111,149 users by research group Effective Measure (Effective Measure, 2014).

4.18.2 Internal validity

The research questionnaire was circulated to a sample group of 10 prior to being distributed via the various channels.

The feedback from this initial sample was used to adjust and refine certain areas of the questionnaire to improve the research result and mitigate any spurious data.

The adjustments made were as follows:

- Aligned the 22 Likert scale questions to use the same scale headings.
- Reversed the Likert scale measure – Started with negative moving to positive.
- Modified the questionnaire structure:

- Included an introduction page emphasizing that importance of answering the questionnaire based on ‘personal’ use of Broadband.

These measures allowed for the questionnaire to be improved prior to distribution which increases the external validity strength.

4.19 Research reliability

As detailed in chapter 3 section 3.9, this study used Cronbach Alpha as a test for reliability. The rule of thumb for interpreting alpha Likert scale type questions is per the table below summarised from (Aaker & Day, 1980).

Cronbach's alpha	**Internal consistency**
α >= 0.9	Excellent
0.9 > α >= 0.8	Good
0.8 > α >= 0.7	Acceptable
0.7 > α >= 0.6	Questionable
0.6 > α >= 0.5	Poor
0.5 > α	Unacceptable

Table 45 – Cronbach Alpha interpretation

The Cronbach Alpha test uses standardised coefficients as this is based upon item correlation. The more strongly the variables are inter-related, the more likely that the test is consistent (Aaker & Day, 1980).

#	**Question**	**Alpha**	**Category**
1	Cost is an influence in your decision to access and use Broadband from home?	0.8092	Good
2	Download speed is an influence in your decision to access and use Broadband from home?	0.8126	Good
3	Cost limits your 'desired usage' of Broadband at home?	0.7866	Acceptable
4	Download speed limits your 'desired usage' of Broadband at home?	0.7881	Acceptable
5	Cheaper Broadband access at home would materially change my Internet usage habits	0.7777	Acceptable
6	Faster Broadband access at home would materially change my Internet usage habits	0.7798	Acceptable
7	My current home Broadband / Internet access solution disadvantages me	0.8198	Good

#	Question	Alpha	Category
8	I use the Internet at work because I do not have access to the Internet elsewhere	0.6526	Questionable
9	I use the Internet at work because it is too expensive to access it elsewhere	0.6471	Questionable
10	I use the Internet at work because it is fast	0.6656	Questionable
11	Using the Internet at work eats into my work productivity	0.7211	Acceptable
12	I have no limitations to Internet usage at work	0.7543	Acceptable
13	The company that I work for limits the amount of Internet that can be used	0.7518	Acceptable
14	If I had access to cheaper home or mobile Internet, I would spend less time on the Internet at work	0.6432	Questionable
15	If I had access to faster home or mobile Internet, I would spend less time on the Internet at work	0.6305	Questionable
16	Cost is a factor in your decision to access the Internet using your mobile device?	0.7970	Acceptable
17	Download speed is a factor in your decision to access the Internet from your mobile device?	0.8028	Good
18	Cost limits your 'desired usage' of mobile Broadband to access the Internet?	0.7889	Acceptable
19	Download speed limits your 'desired usage' of mobile Broadband to access the Internet?	0.7932	Acceptable
20	Cheaper mobile Broadband would materially change my Internet usage habits	0.7900	Acceptable
21	Faster mobile Broadband access would materially change my Internet usage habits	0.7898	Acceptable
22	My current mobile Broadband solution disadvantages me	0.8157	Good

Table 46 – Cronbach Alpha using standardised variables

Out of the 22 questions:

Category	Number	Percentage
Good	5	22.5%
Acceptable	12	55%
Questionable	5	22.5%

All 5 ‘questionable’ Cronbach Alpha coefficients fall under the “Work” question segment which was not a focus in any of the research analysis. This section was included to provide greater context to both Home and Mobile respondents.

With the “work” responses removed the Cronbach’s Alpha for all remaining constructs exceeds 0.7 indicating acceptable reliability.

#	Question	Alpha	Category
1	Cost is an influence in your decision to access and use Broadband from home?	0.8092	Good
2	Download speed is an influence in your decision to access and use Broadband from home?	0.8126	Good
3	Cost limits your 'desired usage' of Broadband at home?	0.7866	Acceptable
4	Download speed limits your 'desired usage' of Broadband at home?	0.7881	Acceptable
5	Cheaper Broadband access at home would materially change my Internet usage habits	0.7777	Acceptable
6	Faster Broadband access at home would materially change my Internet usage habits	0.7798	Acceptable
7	My current home Broadband / Internet access solution disadvantages me	0.8198	Good
16	Cost is a factor in your decision to access the Internet using your mobile device?	0.7970	Acceptable
17	Download speed is a factor in your decision to access the Internet from your mobile device?	0.8028	Good
18	Cost limits your 'desired usage' of mobile Broadband to access the Internet?	0.7889	Acceptable
19	Download speed limits your 'desired usage' of mobile Broadband to access the Internet?	0.7932	Acceptable
20	Cheaper mobile Broadband would materially change my Internet usage habits	0.7900	Acceptable
21	Faster mobile Broadband access would materially change my Internet usage habits	0.7898	Acceptable
22	My current mobile Broadband solution disadvantages me	0.8157	Good

Table 47 – Cronbach Alpha with “work” responses removed

4.20 Summary of the results

The following questions were analysed for statistical differences between certain respondent segments, with results summarised in the table below.

Two questions, those for each section which had the highest and lowest relative score to zero, were analysed for each segment between Home, Work and Mobile usage. The table has been split to reflect each segment along with the results from each respondent segment.

Analysis against gender

#	Question – Broadband at home	Mean	Statistically significant variance
5	Cheaper Broadband access at home would materially change my Internet usage habits	0.43	No
7	My current home Broadband access solution disadvantages me	-0.25	No
#	**Question – Broadband at work**	**Mean**	**Statistically significant variance**
8	I use the Internet at work because I do not have access to the Internet elsewhere	-0.64	No
15	If I had access to faster home or mobile Internet, I would spend less time on the Internet at work	-0.17	No
#	**Question – Mobile Broadband**	**Mean**	**Statistically significant variance**
19	Download speed limits your 'desired usage' of mobile Broadband to access the Internet?	0.03	No
20	Cheaper mobile Broadband would materially change my Internet usage habits	0.77	No

Analysis against having ADSL access at home

#	Question – Broadband at home	Mean	Statistically significant variance
5	Cheaper Broadband access at home would materially change my Internet usage habits	0.43	No
7	My current home Broadband access solution disadvantages me	-0.25	Yes

#	Question – Broadband at work	Mean	Statistically significant variance
8	I use the Internet at work because I do not have access to the Internet elsewhere	-0.64	Yes
15	If I had access to faster home or mobile Internet, I would spend less time on the Internet at work	-0.17	Yes
#	**Question – Mobile Broadband**	**Mean**	**Statistically significant variance**
19	Download speed limits your 'desired usage' of mobile Broadband to access the Internet?	0.03	No
20	Cheaper mobile Broadband would materially change my Internet usage habits	0.77	No

Analysis against household income

#	Question – Broadband at home	Mean	Statistically significant variance
5	Cheaper Broadband access at home would materially change my Internet usage habits	0.43	No
7	My current home Broadband access solution disadvantages me	-0.25	No
#	**Question – Broadband at work**	**Mean**	**Statistically significant variance**
8	I use the Internet at work because I do not have access to the Internet elsewhere	-0.64	Yes
15	If I had access to faster home or mobile Internet, I would spend less time on the Internet at work	-0.17	No
#	**Question – Mobile Broadband**	**Mean**	**Statistically significant variance**
19	Download speed limits your 'desired usage' of mobile Broadband to access the Internet?	0.03	No
20	Cheaper mobile Broadband would materially change my Internet usage habits	0.77	No

Analysis against population group

#	Question – Broadband at home	Mean	Statistically significant variance
5	Cheaper Broadband access at home would materially change my Internet usage habits	0.43	No
7	My current home Broadband access solution disadvantages me	-0.25	No
#	**Question – Broadband at work**	**Mean**	**Statistically significant variance**
8	I use the Internet at work because I do not have access to the Internet elsewhere	-0.64	No
15	If I had access to faster home or mobile Internet, I would spend less time on the Internet at work	-0.17	Yes
#	**Question – Mobile Broadband**	**Mean**	**Statistically significant variance**
19	Download speed limits your 'desired usage' of mobile Broadband to access the Internet?	0.03	No
20	Cheaper mobile Broadband would materially change my Internet usage habits	0.77	Yes

Results pertaining to research Hypothesis 1

The null hypothesis was rejected.

Alternative Hypothesis (H_n)	Home – Cost is a significant limitation > 0

Results pertaining to Hypothesis 2

The null hypothesis was rejected.

Alternative Hypothesis (H_n)	Home – Speed is a significant limitation > 0

Results pertaining to Hypothesis 3

The null hypothesis was rejected.

Alternative Hypothesis (H_n)	Mobile – Cost is a significant limitation > 0

Results pertaining to Hypothesis 4

The null hypothesis was rejected.

Alternative Hypothesis (H_n)	Mobile – Speed is a significant limitation > 0

Results pertaining to Hypothesis 5

The null hypothesis was rejected.

Alternative Hypothesis (H_n)	There is a significant association between income levels and access to fixed line Broadband in South Africa

Results pertaining to Hypothesis 6

The null hypothesis was rejected.

Alternative Hypothesis (H_n)	There is a significant association between the monthly cost of Broadband in South Africa access relative to income levels

Results pertaining to Hypothesis 7

The null hypothesis was rejected.

Alternative Hypothesis (H_n)	There is a significant association between income levels and Broadband speed in South Africa

CHAPTER 5. DISCUSSION OF THE RESULTS

5.1 Introduction

This chapter analyses and discusses the practical implications of the results presented in the previous chapter in the context of the literature discussed in Chapter 2.

5.2 Literature context

The literature provided a frame to the eventual research questions and approach. Much of the literature focused on the broader economic and political context to Broadband penetration which was designed to ultimately shape the research approach and design. Without this background, the basis of the research and its purpose would possibly have been misunderstood. It was important to understand the context, particularly South Africa's position relative to the world. The ultimate purpose of the research was to look at the usage barriers that exist for South African consumers when connecting to the Internet for personal use and then compare those with the figures that were discussed in the literature.

5.3 Discussion pertaining to research Hypothesis 1

Cost is a significant limitation for the desired use of the Internet (for personal use) at home in South Africa.

Hypothesis 1 was really about the cost of Broadband at home and how this was potentially a limitation. The literature confirmed that price was an enabler for the take-up and usage of fixed line Broadband, research by Chaudhuri et al. (2005) highlighted this whilst further research from the ITU also highlighted the cost per Megabit second in South Africa in comparison to the world where they ranked 62 out of 62 at a price per Mbs of US$19.88 in comparison to the global average of US$5.36 (Ookla, 2015).

In saying that, cost is always relative, which is why it was important to test this as a research hypothesis. Of the 7 questions which were asked under the "Home" category, 3 were directly linked to cost and all question responses were above

the ‘average’ and relative mean score of zero which suggests that there was more agreement with each question.

Q	Label	Mean	Mean category
1	Cost is an influence in your decision to access and use Broadband / the Internet from home?	0.084	Somewhat agree
3	Cost limits your 'desired usage' of Broadband / the Internet at home?	0.101	Somewhat agree
5	Cheaper Broadband access at home would materially change my Internet usage habits	0.280	Strongly agree

Table 48 – Cost based questions from home respondent category

The highest score was related to the changing of usage behaviour. Would cheaper access at home have a material change in the respondents’ Internet usage habits?

Question 5 had the highest mean score of the Home based questions and was thus subjected to a T-Test on gender and 1-way ANOVA test across both income and population groups.

- Gender T-test
  No significant variance in the response results
- Income 1-way ANOVA test
  No significant variance in the response results
- Population group 1-way ANOVA test
  No significant variance in the response results

Nothing in the research is in contrast to the literature. There is positive agreement that cost influences usage decisions and that it is a barrier. The interesting aspect to this Home category is that there are currently no ‘cheaper’ alternatives to home or fixed Broadband in South Africa. Customers who have access to fixed line ADSL or Fibre to the Home (FTTH) need to be considered lucky as they are in the minority and have access to the cheapest Broadband in South Africa.

According to their 2016 annual report “Digital in 2016”, Social Media agency ‘We Are Social’ reported that South Africa has a total population of 54.73 million with

Internet users totalling 26.84 million for an overall penetration of 49% (We Are Social, 2016). This can be compared to the penetration of Telkom who, according to their 2016 annual report, have reached 1,027,507 fixed Broadband subscribers (Telkom, 2016).

Internet users and Broadband subscribers are not directly comparable as there could be multiple users per subscription, but the gross comparison is fair for discussion purposes and the point is simply that South African consumers who have access to fixed line Broadband are in the minority at around 4% (ITU, 2015b).

This then better informs the cost situation based on the variance between fixed line and mobile in South Africa. The comparison below is on the basis of a monthly data requirement of 20GB.

Access technology	Data	Cost per month
ADSL	20GB	R 399*
Mobile – Contract	20GB	R 599*
Mobile – Prepaid	20GB	R 999*

Table 49 – Cost comparison – ADSL & mobile Broadband in South Africa

* Cost per month taken as an average across multiple service providers. ADSL cost includes line rental & DSL subscription fee per month and is based on a 4Mbs speed line.

5.4 Discussion pertaining to research Hypothesis 2

Speed is a significant limitation for the desired use of the Internet (for personal use) at home in South Africa.

Looking at it from a user perspective, the primary usage barriers to fixed line Broadband across the globe are both cost and speed. The aspect of cost has already been discussed under hypothesis 1 but the other is speed.

Speed was a common feature in the various literature pieces covered in chapter 2, in their research paper, S. Lee and Brown (2008), found that the impact of faster speeds on the increase of fixed line Broadband adoption were significant.

There was also a lot of comparison and consequent ranking as to how South Africa fared on the global stage when it came to a speed comparison. According to Akamai's Annual State of the Internet Report for 2015, South Africa rank 90th in the world on average Broadband access speed at 4.1 Mbps which is below the global average of 5.1 Mbps (Akamai, 2016). Speed is also a key item in the South Africa Connect Broadband policy outlining a target of all South Africans having access to at least 5 Megabits per second Broadband speeds by 2016 (Department of Communications, 2013).

Much as cost is relative, so is speed. If a user has not had access to 50Mbs plus speed Broadband then they do not have any context to determine what is fast or slow. So whilst South Africa may rank poorly on a global scale when it comes to speed, is it seen as a significant limitation as cost was?

Is there enough user education around Broadband speed and what high speed could result in? All of these questions still remain and they are quite specific to South Africa, so whilst the broader research confirms speed as an enabler, it was important to test this as a research hypothesis. Of the 7 questions which were asked under the "Home" category, much like the cost segment, 3 were directly linked to speed and all question responses were above the 'average' and relative mean score of zero which suggests that there was more agreement with each question.

Q	Label	Mean	Mean category
2	Download speed is an influence in your decision to access and use Broadband / the Internet from home?	0.262	Strongly agree
4	Download speed limits your 'desired usage' of Broadband / the Internet at home?	-0.035	Somewhat agree
6	Faster Broadband access at home would materially change my Internet usage habits	0.255	Strongly agree

Table 50 – Speed based questions from the home respondent category

The highest mean score was related to speed being an influence in the respondents' decision to use Broadband from home. Question 2 had the highest mean score of the Home based questions around speed, but did not form part of the further T-Test and 1-way ANOVA test covered in the results section. The fact

that the highest relative agreement is to question 2 highlights the importance of speed to a home Broadband user as this even outranks question 6 which is how faster home Broadband would materially change usage behaviour. This points to a clear understanding over what the user is looking for in the solution over what alternatives exist.

None of the research findings is in contrast to the literature. There is positive agreement that speed influences usage decisions for Broadband at home.

5.5 Discussion pertaining to research Hypothesis 3

Cost is a significant limitation for the desired use of the Internet (for personal use) via Mobile in South Africa.

This is where the research becomes especially interesting as the next two research hypotheses explore cost and speed aspects in relation to mobile Broadband which was found to have very little supporting literature due to its mass adoption being a relatively new phenomenon.

Both cost and speed were agreed by various scholars to be usage barriers for the take-up of fixed line Broadband and the results of this research confirm this to be accurate. These two aspects were also used to measure mobile Broadband with the two resulting hypotheses being largely similar, except targeted at those respondents using mobile to connect to the Internet.

Mobile Broadband is the key enabler for South Africa to realise their national Broadband targets. Fixed line Broadband is limited due to the high capital costs required to install. With 64.8% of South Africa's population based in rural areas (GeoHive, 2015), which are not aligned to fixed line Broadband return on investment requirements, the only solution is mobile. This is therefore a vital segment in the research.

The "Mobile" question segment contained 7 questions of which 3 were directly linked to cost. All question responses were above the 'average' and mean score of zero which suggests that there was more relative 'agreement' with each question.

Q	Label	Mean	Mean category
16	Cost is a factor in your decision to access the Internet using your mobile device?	0.399	Strongly agree
18	Cost limits your 'desired usage' of mobile Broadband to access the Internet?	0.314	Strongly agree
20	Cheaper mobile Broadband would materially change my Internet usage habits	0.838	Strongly agree

Table 51 – Cost based questions from the mobile respondent category

The highest score was related to the changing of usage behaviour. Would cheaper access via mobile have a material change in the respondents' Internet usage habits?

Question 20 had the highest mean score of the mobile based questions and was thus subjected to a T-Test on gender and access to fixed line Broadband and 1-way ANOVA test across both income and population groups.

- Gender T-test.
  No significant variance in the response results.
- Access to fixed line Broadband T-test.
  No significant variance in the response results.
- Income 1-way ANOVA test.
  No significant variance in the response results.
- Population group 1-way ANOVA test.
  Significant variance in the response results.

The ANOVA result for this population group test resulted in a p-value of 0.0158. This low number (<0.05) indicates that most of the population group responses to question 20 are significantly different from one another.

What is your population group	Obs	Mean	Std Dev
Black	368	0.822	1.283
Coloured	88	0.713	1.358
Indian	149	1.085	1.017
Other	3	0.200	1.264
White	214	0.783	1.186

Table 52 – Summary statistics on Population group responses to question 20

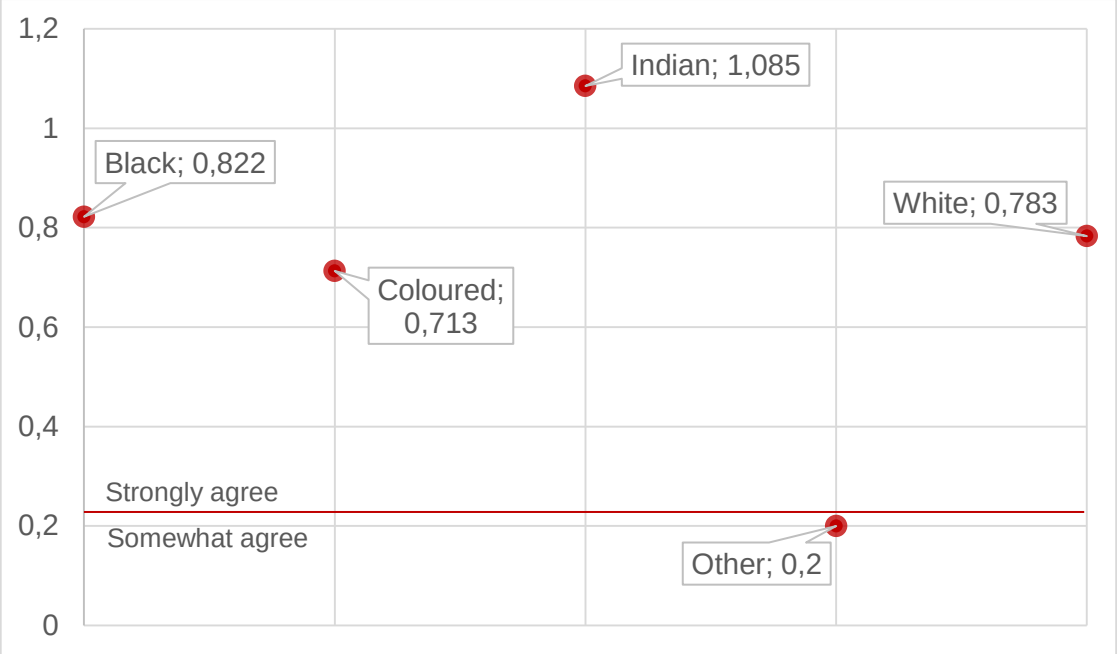

Figure 6 – Population group – Mean responses to question 20. The graph has been modified to include the 0.24 mean category difference between “Somewhat agree” and “Strongly agree”.

Whilst having a large statistical difference between the population group responses, the variance is all within the “Strongly agree” category with only a 3 observation sample for “Other” sitting slightly outside in the “Somewhat agree” category.

Since the statistical variance between the various population groups answers to question 20 sits within one response category, there is no further analysis required. The mean response of this group was the highest over all other questions in this research questionnaire at 0.838. This question was also answered by 822 respondents representing 59% of the total sample.

The question is related to how cheaper mobile Broadband would materially change a respondents internet usage habits. On this evidence, it can safely be assumed that cost is a significant usage barrier for Broadband when being used by a mobile device.

5.6 Discussion pertaining to research Hypothesis 4

Speed is a significant limitation for the desired use of the Internet (for personal use) via Mobile in South Africa.

Hypothesis 4 is directly linked to 3 much as 2 was to 1. Much like hypothesis 3, limited academic literature exists that covers take-up and usage barriers for mobile Broadband. The “Mobile” question segment contained 7 questions of which 3 were directly linked to speed. All question responses were above the ‘average’ and mean score of zero which suggests that there was more relative ‘agreement’ with each question.

Q	Label	Mean	Mean category
17	Download speed is a factor in your decision to access the Internet from your mobile device?	0.111	Somewhat agree
19	Download speed limits your 'desired usage' of mobile Broadband to access the Internet?	0.037	Somewhat agree
21	Faster mobile Broadband access would materially change my Internet usage habits	0.593	Strongly agree

Table 53 – Speed based questions from the mobile respondent category

The highest relative to zero mean score was for question 21, that faster mobile Broadband access would materially change a user’s internet usage habits.

All questions related to speed had responses above the relative mean of zero. These results provide strong support for speed being a significant factor in the take-up and usage of both fixed and mobile Broadband.

5.7 Discussion pertaining to research Hypothesis 5

Is there an association between access to fixed line Broadband in South Africa relative to income levels?

The literature not only spoke of South Africa’s poor fixed line Broadband penetration but also covered the reasons why it is so poor. Studies from Garcia-Murillo (2005), S. Lee, Marcu, and Lee (2011) & Thompson and Garbacz (2011)

all highlight that the primary investment barrier to the rollout of fixed line Broadband is the high establishment cost of the infrastructure. This becomes even more difficult to offset in sparsely populated and low income areas. Consequently, potential for further rollout of fixed line Broadband is limited due to the risk of there being insufficient return on investment.

How relevant is this in South Africa? Of the 1,404 respondents to this research questionnaire, only 560 answered the question related to having access to fixed line Broadband. This was interesting as this question was not a part of any of the home, work or mobile segments but as a stand-alone. Great care was taken to make this question clear to understand, so the overall response rate of 40% was disappointing.

A purpose of this hypothesis test was to understand if there was an association between access to fixed line Broadband and the respondents' income levels. On the basis of the literature, customers with low income levels should be inverse to those who had access to fixed line Broadband.

Another purpose of this hypothesis test was to ascertain if there is any association between Broadband speed in South Africa and income levels. Using the Table test, a statistically significant association was found between income levels and access to fixed line Broadband. This result is in agreement with the research, but it requires more analysis to understand the nature of the association and whether this is aligned to lower income levels having less access to fixed line Broadband.

Income	No	Yes	Total
Over R 50,000	15	58	73
R 20,000 to R 50,000	27	78	105
R 9,000 to R 20,000	69	86	155
Under R 9,000	112	84	196
Total	223	306	529

Table 54 – Income levels compared to access to fixed line Broadband

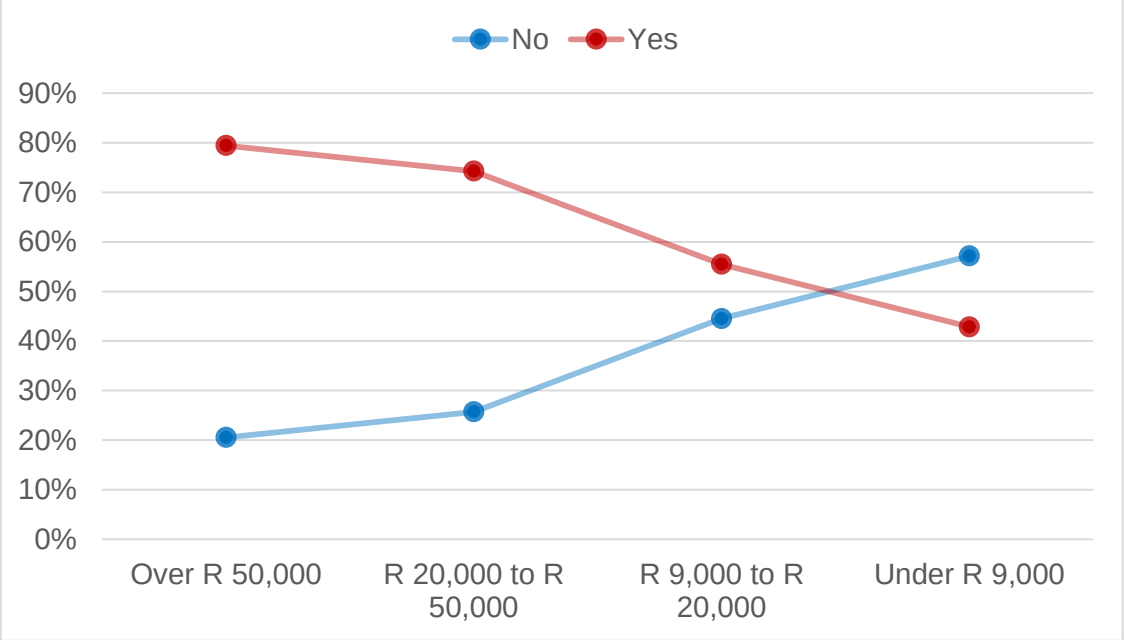

Figure 7 – Income levels compared to access to fixed line Broadband (expressed as percentages)

The graph lines clearly support the argument that lower income levels have less access to fixed line Broadband. As income levels drop, so does access to fixed line Broadband. Even though the sample was only 40% of the population, the table test returned a strong statistical association between income levels and access to fixed line Broadband. The inverse trend is confirmed with this illustration.

There is no evidence to suggest that the South African Broadband context is any different to that researched around the world in relation to fixed line Broadband access being directly linked to income.

5.8 Discussion pertaining to research Hypothesis 6

Is there an association between the monthly costs of Broadband in South Africa access relative to income levels?

Whilst the only valid academic literature covering the monthly cost of Broadband was outdated, it did highlight the chasm between the cost of internet in sub-Saharan Africa and in other developed economies. In a 2005 survey, it was highlighted that the average retail price for Broadband in South Africa was $366

per month which equals R 2,313 when corrected for the exchange rate at the time (Williams, 2005). More recent research from 2012 by the ITU ranked South Africa the 73rd most expensive country when it came to the cost of Broadband in relation to annual household income at 5.4% of income (or R 210 per month which was adjusted to the cost at the time based on the then Rand/Dollar exchange rate) (ITU, 2012).

A more recent release by StatsSA provided a total monthly cost of telecommunications in relation to household income of 3.4% (StatsSA, 2015). This figure is higher than the 2.5% which is a national 2020 target covered in SA Connect, South Africa's gazetted national Broadband policy (Department of Communications, 2013). The cost of Broadband is not split between fixed or mobile but rather what the average cost irrespective of the access technology.

Having both income levels and average cost per month from this research allowed a test to evaluate if there was an association between income and cost of Broadband.

Two tests were done to accept or reject this research hypothesis:

1. Chi-square hypothesis table test to ascertain whether there was any association between the monthly cost of Broadband and income levels.
2. Income and cost weighting calculation to compare against figures covered in the literature review.
    a. This second test carries no statistical weight and thus is not part of the hypothesis test, but it does provide some additional information related to the literature and research data.

As highlighted in the previous section summarising the results, 30% of the research respondents are spending between R 250 and R 500 per month for Broadband access and usage.

Cost of Broadband per month	Observations	Percentage
R 1,000 or more	134	11%
R 750 to R 999	134	11%
R 501 to R 749	192	16%
R 251 to R 500	*354*	*30%*

Cost of Broadband per month	Observations	Percentage
R 250 or less	372	31%
	1186	100%

Table 55 – Cost of Broadband per month for personal purposes

By using the cost figure on the lower end of each segment, a basic cost per month calculation can be completed. No exact figures exist for this calculation as the question was related to bands of income. This means that this comparison can only be an approximation.

By way of example:

- If the cost band was R 251 to R 500 per month, then the figure used will be R 251 (the lowest end of the band).
- For the lowest band which carries R 250 or less as a cost per month, the cost will be halved between the top and zero – In this example, the cost on the lowest tier will be assumed to be R 125 (50%).

Weighted cost of Broadband per month	Weighted cost	Percentage
R 1 000 per month	R 110	11%
R 750 per month	R 83	11%
R 501 per month	R 80	16%
R 251 per month	R 75	30%
R 125 per month	R 39	31%
	R 387	*100%*

Table 56 – Weighted cost of Broadband per month

This suggests an overall weighted cost per month of R 387 for Broadband access and usage. The same calculation can then be used for approximate income using the weighting of each segment to calculate an average income.

	Observations	Percentage
Over R 50,000	80	8%
R 20,000 to R 50,000	146	14%
R 9,000 to R 20,000	294	28%
Under R 9,000	542	51%
	1,062	100%

Table 57 – Average monthly cost of Broadband

Weighted income per month	Weighted income	Percentage
R 50,000	R 4,000	8%
R 20,000	R 2,800	14%
R 9,000	R 2,520	28%
R 4,500	R 2,295	51%
	R 11,615	100%

Table 58 – Weighted average income per month

These two calculations leave two weighted amounts:

Averaged weighted cost of Broadband per month	R 387
Average weighted income per month	R 11,615
	3.33%

Whilst the calculation methods of rounding down to the lowest band of each segment as well as halving the lowest band related to both cost and income could be seen as both rudimentary and flawed, the result is a percentage of 3.33% which is aligned to the 3.4% which was produced by StatsSA as the average monthly cost of telecommunications for South Africans.

This test to decipher the approximate cost of Broadband in relation to income is in support of the Chi-Squared table test which demonstrated a statistically significant association between income levels and Broadband speed in South Africa.

The statistics confirm an expected relationship between the highest income earners and their monthly cost of Broadband. The lowest income earners have the highest percentage of respondents spending on the lowest cost threshold whilst the highest income earners have the exact opposite with each section have an inverse distribution between cost and income.

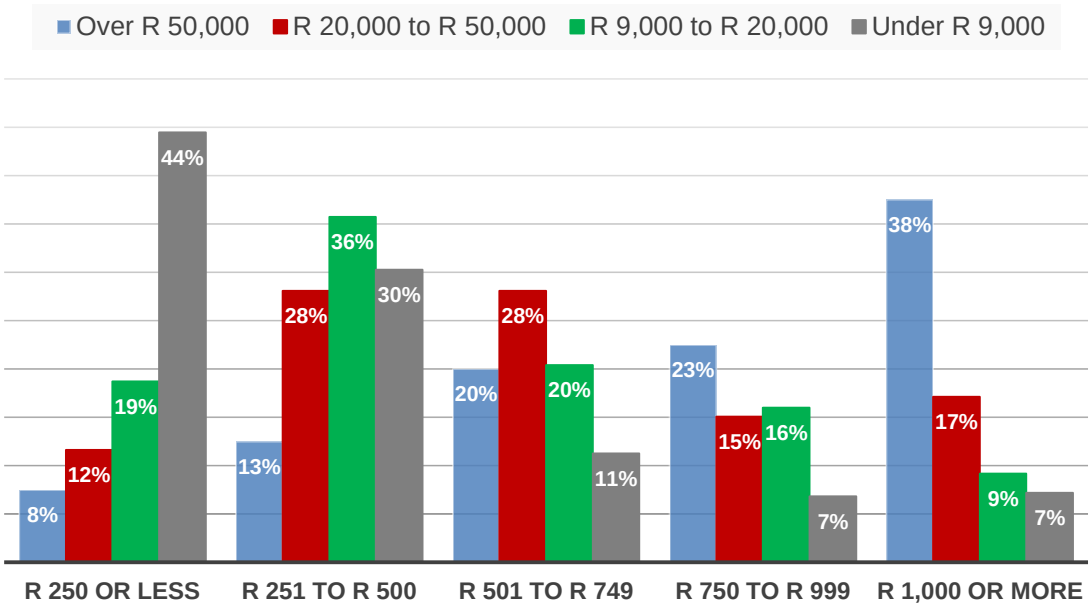

Figure 8 – Cost of Broadband per month compared to income

What is clear from both the literature and this research is that the cost of Broadband in relation to household income in South Africa is trending in the right direction. Whilst the sources of information are disparate, they show a real improvement in the cost of data reducing as a percentage of income in South Africa. The SA Connect target is 2.5% of household income by 2020, this requires a significant change in Broadband pricing to be realised as it represents a 36% reduction in the cost of Broadband on the basis of aggregate per capita household income remaining static over a 3-year period.

5.9 Discussion pertaining to research Hypothesis 7

Is there an association between income levels and Broadband speed in South Africa?

Broadband speed has been a key feature in this research. It is a proven enabler for fixed line Broadband and shows even stronger enablement evidence when analysed against mobile Broadband users specific to this research study.

The purpose of this hypothesis test was to gauge how speed of Broadband correlates with income levels in South Africa, particularly as South African has

one of the greatest income inequality gaps in the world, ranking 4th on the World Bank's Gini coefficient in 2009 (World Bank, 2009).

There is also further learning that can be taken that relates back to the literature and that is in relation to education. The literature identified consumer education as one of the most important drivers of Broadband penetration. This was discussed by Dwivedi and Lal (2007) with further research by Kolsaker et al. (2007) noting 'usefulness' to consumers as another key enabler to Broadband diffusion.

The education measure is far more complex as it brings the topic of the digital divide into the equation which relates to the gap existing between those who have access to Broadband and those that do not. One option that will be used to further analyse the education angle is that one of the options available for customers to choose when it came to the question of their Broadband connection speed was 'I am not sure'. Understanding speed could be considered as a rather basic education measure. It certainly plays a role in understanding what Broadband products and solutions are most appropriate for consumption and is also a key measure of the South Africa Connect target of 5 Mbs by 2016.

The Chi-square hypothesis table test was used to ascertain whether there was any statistically significant association between income levels and Broadband speed in South Africa. The test resulted in statistically significant evidence being found of an association between these two groups.

Whilst the relation of Broadband speed to income inequality was not specifically identified through the literature, the nature of this research report and how it can be used to understand better the South African Broadband situation underlines its importance.

The table below was an output of the Chi-squared table test which compared speed to income levels.

Frequency	**Over R 50,000**	**R 20,000 to R 50,000**	**R 9,000 to R 20,000**	**Under R 9,000**
I am not sure	30%	38%	35%	49%

Frequency	Over R 50,000	R 20,000 to R 50,000	R 9,000 to R 20,000	Under R 9,000
2 or less Megabits per second	13%	8%	12%	11%
2.1 to 4.9 Megabits per second	19%	26%	26%	17%
5 to 9.9 Megabits per second	14%	12%	16%	12%
10 or more Megabits per second	25%	16%	11%	11%

Table 59 – Speed compared to income levels comparison

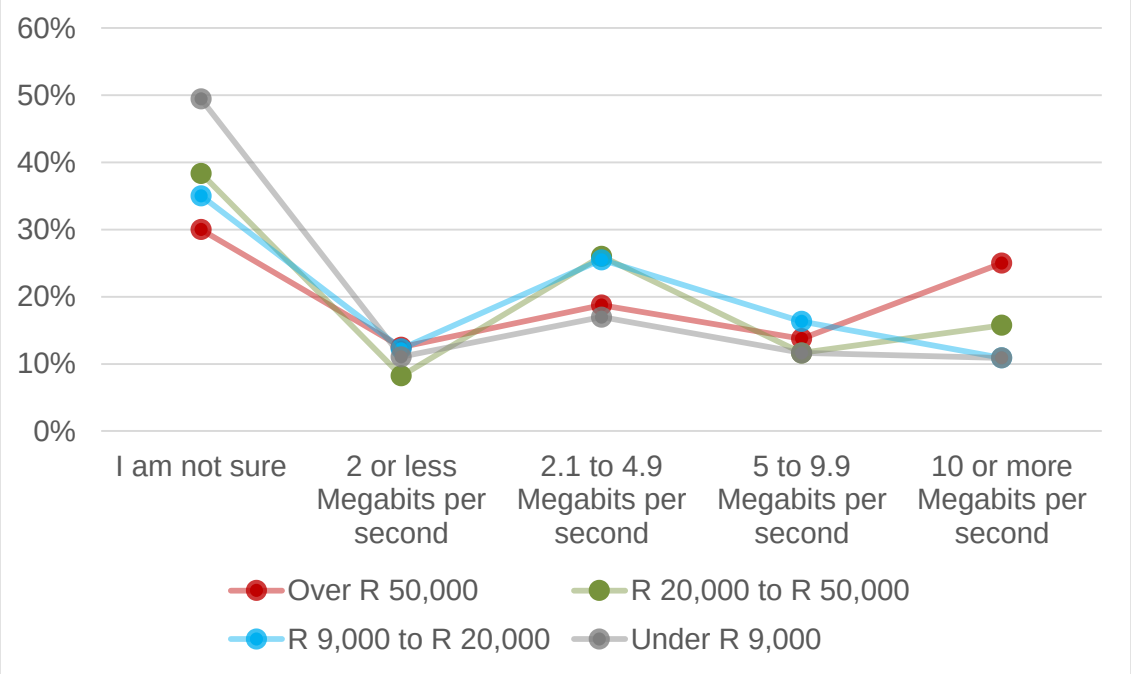

Figure 9 – Graph illustration of speed over income comparison

In Figure 9 above, percentages have been calculated against the total responses related to each segment. By way of example, the 30% of respondents indicated that they were not sure when asked that their Broadband speed was. These were the respondents who earned over R 50,000 per month and the 30% is 24 out of a total of 80 responses. These figures are all detailed overleaf in Table 61.

The graph plot shows a linear association between income and Broadband speed:

- Respondents answering as “not being sure” of their Broadband speed.

- Inverse response to having a Broadband speed in excess of 10 Megabits per second.

Both of these results are expected:

- That the higher the income the more ‘knowledge’ of Broadband speed.
- The higher the income the more access to the highest speed category.

The rest of the results are less clear but point towards less integrity in the data based on what kind of Broadband solution is available / being used and how this impacts the cost of speed for each customer.

Frequency	Over R 50,000	R 20,000 to R 50,000	R 9,000 to R 20,000	Under R 9,000	Total
I am not sure	24	56	103	268	**451**
2 or less Megabits per second	10	12	36	60	**118**
2.1 to 4.9 Megabits per second	15	38	75	92	**220**
5 to 9.9 Megabits per second	11	17	48	63	**139**
10 or more Megabits per second	20	23	32	59	**134**
Total	**80**	**146**	**294**	**542**	**1062**

Table 60 – Speed compared to income levels using table analysis method in SAS

CHAPTER 6. CONCLUSIONS & RECOMMENDATIONS

6.1 Introduction

The relationship between Broadband access and consumption & economic growth and development is long established. There is a long-run significant relationship between Internet usage and economic growth as well as between economic growth, financial development and trade openness in Southern African countries (Salahuddin & Gow, 2015). South Africa has adopted a Broadband policy in order to seize the opportunity to improve its economic growth and quality of life of its citizens. The policy achievements have failed to meet expectations. This study investigated barriers or limitations to access and consumption of Broadband in South Africa that negate policy objectives. In order to respond to the research question the study tested seven hypotheses. In this chapter, the findings from the research hypotheses are summarised, general conclusions are then presented based on the research findings. This is followed by recommendations to policy makers and network operators who have an integral role to play in how South Africa can truly capitalise on the national Broadband opportunity. The chapter is then concluded by presenting the limitations of this research as well as making suggestions for further study.

6.2 Summary of main findings

Barriers of access and consumption of Broadband in South Africa.

6.2.1 Cost

The study found that cost is a significant limitation for the desired use of the Internet (for personal use) at home in South Africa.

Research hypothesis 1 tested that cost is a significant limitation for the usage of Broadband at home in South Africa. This finding is supportive of the existing published research by Chaudhuri et al. (2005), Lehr et al. (2006) and Wyche et al. (2010) who all associate the slow uptake of fixed line Broadband in South

Africa as being primarily due to the cost of access and available speed. Public and private sector should address the issue of Broadband price.

6.2.2 Broadband speed

The second finding is that speed is a significant limitation for the desired use of the Internet (for personal use) at home in South Africa.

Research hypothesis 2 proved Broadband speed is a barrier to the usage of the Internet. This finding is supportive of the existing published research articles which all coupled cost and speed as limitations to the take-up of Broadband in South Africa. This finding is directly and closely related to the cost because the slower the connection the higher the costs incurred. For the poor it is even worse to spend money on data with little to show for it, an example of this is a user who is attempting to download a job application form or trying to apply to a study programme. Lack of speed results in many failed attempts yet the user is expending the data and incurring costs. Public and private sector should address the issue of Broadband speed by implementing expedient decisions in relation to freeing up spectrum for new and existing entrants.

6.2.3 Cost as barrier for mobile users

The third finding is that cost is a significant limitation for the desired use of the Internet (for personal use) via mobile in South Africa.

There is limited literature covering mobile Broadband, in fact Czernich et al. (2011b) noted that the results of their research, which focussed on the economic impact of Broadband, could only be considered over the medium-term due to the unknown long-term impact that Broadband is having on economic growth which was specifically related to the high-speed of mobile Broadband take-up.

The emergence of the mobile technology brought hope that the costs of Broadband will subside. Even though South Africa's mobile growth has been phenomenal it has mainly been concentrated in voice services instead of data which carries the proven direct and indirect economic growth and development returns. The literature focussed predominantly on fixed line Broadband with both

cost and speed being broadly supported as barriers to both entry and use. Without literature to contrast against, the objective was to understand if cost and speed were also seen as barriers to the uptake and usage of mobile Broadband. Public and private sector should plan better because same barrier that affected fixed is impacting mobile and this is limiting South Africa's potential.

6.2.4 Speed as barrier for mobile users

The fourth finding is that speed is a significant limitation for the desired use of the Internet (for personal use) via mobile in South Africa.

Although mobile technology has revolutionised Broadband use in South Africa the speed is still below the world average. Cost and speed are barriers for Broadband access and consumption in South Africa across both fixed and mobile. These barriers are closely related to cost and further condemn the poor or less privileged. Of particular interest was that the responses to the mobile Broadband questions around both cost and speed had the highest 'relative' agreement of the 14 Likert scale questions across home and mobile. This indicates that cost and speed are even greater limitations for the desired usage of mobile data over fixed line Broadband.

6.2.5 Income as barrier for access to fixed line Broadband

The fifth finding is that there is an association between access to fixed line Broadband in South Africa relative to income levels.

Studies by Thompson and Garbacz (2011), Garcia-Murillo (2005) and S. Lee et al. (2011) all discuss high establishment costs as significant limitations to the rollout of fixed line Broadband. This creates an inverse relationship between income and access as the infrastructure is limited to areas where high take-up can justify the establishment expenses.

As can be seen from the results in Figure 10, as income drops, so does access to fixed line Broadband. This result is in support of the literature that fixed line Broadband is limited in its rollout due to high costs which result in it being unavailable in lower-income areas.

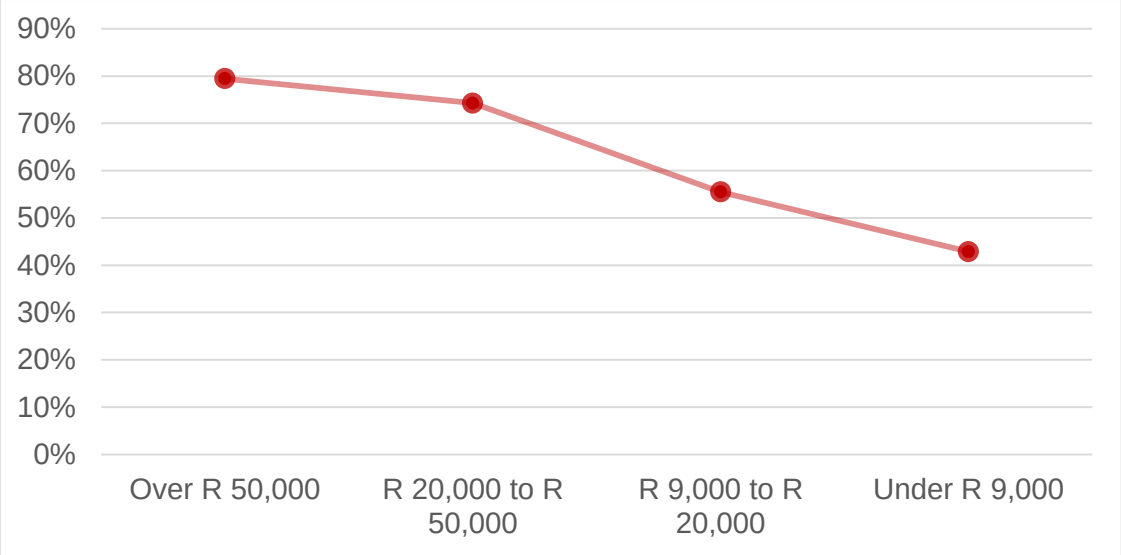

Figure 10 – Income levels compared to access to fixed line Broadband (expressed as percentages)

6.2.6 Cost of Broadband relative to income levels as barrier to Broadband access and consumption

The sixth finding is that there is an association between the monthly costs of Broadband access relative to income levels in South Africa.

Both the literature and research highlight cost as a limitation for the uptake and usage of both fixed line and mobile Broadband. Recently StatsSA provided a report which detailed the total monthly cost of telecommunications in South Africa over household income was 3.4% (StatsSA, 2015). This number is directly linked to the national 2020 target of 2.5% for SA Connect (South Africa's National Broadband policy) which was also discussed in the literature. This means that unless there is strong government intervention though policy instruments the digital divide and/or digital inclusivity will remain elusive.

The lowest income earners have the highest percentage of respondents spending on the lowest cost threshold whilst the highest income earners have the exact opposite with the highest percentage on the largest cost threshold. Income therefore becomes an enabler of Broadband access and consumption.

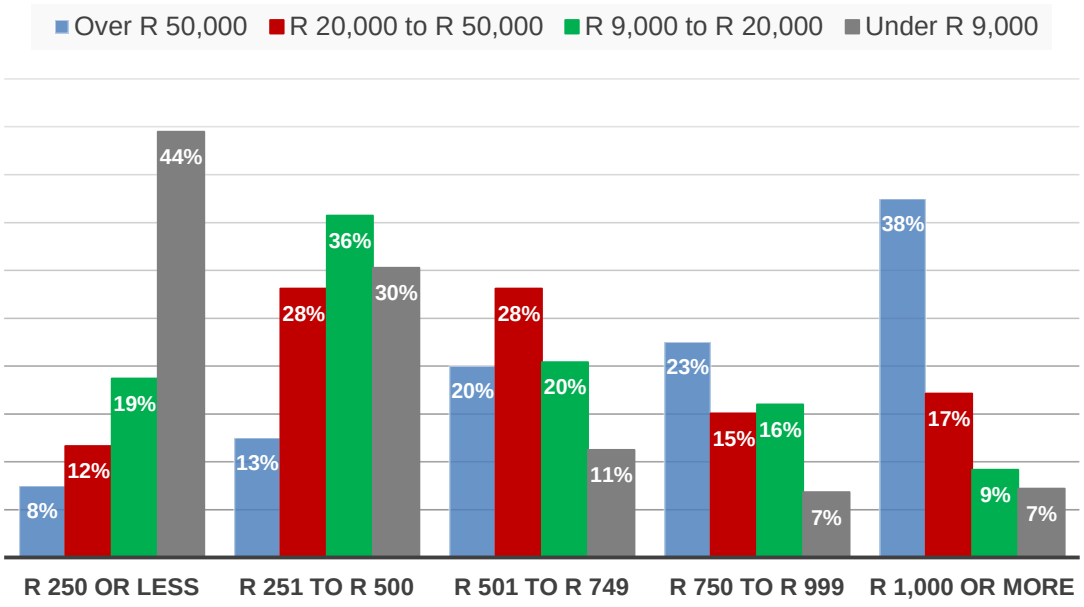

Figure 11 – Cost of Broadband per month compared to income

6.2.7 Income levels and Broadband Speed as barrier

The seventh finding is that there is an association between income levels and Broadband speed in South Africa.

The higher the income the higher the Broadband speed required. As highlighted in Table 61, those earning R 50,000 and above had 25% with access to Broadband with speed of 10 Mbs or more with each income band below this having less share of this speed bracket. This means that income levels can become a barrier to Broadband access and the required speed. Those with poor income level and lack of awareness might not know or understand the different speeds thus depriving themselves of the high speed access which could reduce their Broadband costs. The lack of understanding on Broadband speeds could be related to insufficient topic education. This was highlighted by Oh et al. (2003) who supported a clear link between Broadband adoption and customers who had knowledge of what benefits Broadband could bring.

Cost, speed and association between the two and income levels emerged as barriers to access and consumption of Broadband in South Africa. Income levels has a determinant relationship with cost and speed as barriers to access and

consumption of Broadband. These barriers adversely impact fixed and mobile connections even though the latter has been experiencing stronger growth.

6.3 Recommendations

As supported strongly in both literature and this study:

- Cost and speed are significant limitations for South African's accessing the internet for personal purposes, both from fixed and mobile technologies.
- Fixed line Broadband is limited due to high establishment costs. This results in the infrastructure only being available in areas with higher population and wealth density.
- Mobile Broadband is the future as it allows access without infrastructure cost limitations, just effective regulation of spectrum to enable private sector investment.

The identified barriers require intervention if South Africa is to improve its Broadband access and consumption with ultimate purpose of improving economic growth and quality of life. The intervention will require both public and private sector buy-in:

Public sector

- Government – should review its Broadband policy to achieve South Africa's need for broader and more inclusive Broadband. Whilst government policy already exists with targeted coverage, speed and cost benchmarks for the continued rollout of Broadband internet in South Africa, the reality is that there is a gap between policy objectives and implementation. South Africa Connect is already outpaced with technological advances and requires an extensive review.
- Economically speaking, South Africa needs access to cheaper and faster Broadband and the most viable broad-based solution is via mobile technology which hinges on the licensing of additional spectrum bands. Government therefore should license additional spectrum bands.
- Public sector should bring policy and regulatory certainty in the sector by acting in unison instead of bickering. ICASA announced in July 2016 that

South Africa would be following global best practice by auctioning off key spectrum bands. The Minister of Telecommunications and Postal Services, Siyabonga Cwele, subsequently went to court to stop the auction, saying government had to first formulate a policy before ICASA could go ahead with the process (Grootes, 2016).

- Government should exercise its political will by implementing the policy that will increase access and consumption instead of being held at ransom by dominant players who are resisting policy reforms for their own benefits. There is a theory that suggests that both Vodacom and MTN are simply using the spectrum situation as an excuse to maintain mobile Broadband high prices. The reality is that they are afforded this position by the South African government who are not able to make progress on either the digital migration or the licensing of additional spectrum.

Private sector

- Private operators should allow government to award additional spectrum licences for spectrums. The guidance on capital investment on infrastructure centres on spectrum. As discussed in the literature, both Vodacom and MTN have already invested heavily in order to overcome the spectrum pinch and are now limited in the next stage of their investment and growth. Whilst this research highlights the need, it cannot influence the deadlock between the private sector and government where each has differing positions.
- Private operators should continue to balance fixed and mobile Broadband investment. What is clear is that fixed line Broadband will continue to be a key Broadband technology for continued progress against both cost and speed barriers. However this technology will be limited to urban areas where the high capital costs related to infrastructure can be offset by demand. The real enabler for broad-based Internet access to all South Africans is through mobile Broadband which is currently shackled by the spectrum impasse.
- Existing operators should allow for lowering of barriers for new entrants. This leaves two opposing corners when it comes to the challenge of

lowering the cost of mobile Broadband in South Africa. From a private sector perspective, mobile Broadband is represented largely by Vodacom and MTN, who collectively hold 80% of the market (MyBroadband, 2016). Both companies should shoulder blame together with the South African government for the high cost of data based on the highly publicised crisis situation surrounding the licensing of spectrum and resistance to any policy reform that will lower barriers of entry.

The ongoing spectrum 'stagnation' also creates a convenient excuse for both Vodacom and MTN to keep their prices (and margin) intact. Both companies are listed on the Johannesburg Stock Exchange with annual profits averaged over the last 3-years of almost R 10 bn each (Moneyweb, 2016). Slashing prices is not in line with their stated mandates of returning value to shareholders. So whilst the market commentary is that the unavailability of spectrum is the roadblock to lower prices and faster access, one could argue that both Vodacom and MTN are merely taking advantage of the situation to make as much as they can whilst they can.

6.4 Suggestions for further research

This study provides insights into the current South African Broadband industry and makes a contribution to the body of knowledge on key enablers for broader access and consumption of Broadband in South Africa.

The research also provides recommendations for further research based on what was not covered in this research or other issues that arise based on the fast-changing dynamics of the South African telecommunications sector.

The following has been identified for further research:

- Whilst literature highlighted the development of a new global digital divide which segments countries based on their Broadband access and penetration, a key statistic for South Africa was that the country has only 49% of their population accessing the Internet (We Are Social, 2016). This digital divide represents the gap between those that have access to Broadband and those that do not. This research focussed on consumers

who have access to the Internet. Further research into consumers who did not have access to the Internet would complement this paper and allow for a true understanding of what the key access and consumption limitations are. The economic benefit of Broadband is linked to broader access which is the goal for South Africa, getting more people onto the Internet is one of the primary aims of SA Connect

- Similar research can also be done over time in the same market to evaluate how much progress is being made against policy targets incorporating cost and speed.
- There is an opportunity for further research on other Broadband barriers such as education and fear of empowering the voters with information. The literature touched on how better education was supported as a Broadband enabler. With the complex political environment in South Africa and some authors purveying a left-field theory on African leadership and a fear of Broadband diffusion, further research would complement this area significantly.
- The same research can be conducted using a combination of quantitative and qualitative data collection and analysis methods. Qualitative research would add further depth to the results and conclusions.
- Further research could also focus on the types of devices that are being used to access Broadband and how the device could be limiting speed. This plays into the same point on education which was already highlighted by non-response to questions on access to fixed line Broadband. Further research would highlight the extent that lack of technological knowledge is also impacting South Africa's Broadband progress.

REFERENCES

Aaker, D. A., & Day, G. S. (1980). Increasing the effectiveness of marketing research. *California Management Review, 23*(2), 59-65.

Ackroyd, S. (1992). *Data collection in context*: Longman Group United Kingdom.

Akamai (Producer). (2016, 25 June 2016). Q4 2015 State of the Internet Report / Akamai. [Annual Report] Retrieved from https://www.akamai.com/us/en/multimedia/documents/content/state-of-the-internet/q4-2015-state-of-the-internet-connectivity-report-us.pdf

Alfreds, D. (2016). Vodacom and MTN want action on spectrum. Retrieved from http://www.fin24.com/Tech/Mobile/vodacom-and-mtn-want-action-on-spectrum-20160523

Barrell, R., & Pain, N. (1997). Foreign direct investment, technological change, and economic growth within Europe. *The Economic Journal, 107*(445), 1770-1786.

Bethlehem, J. (2010). Selection bias in web surveys. *International Statistical Review, 78*(2), 161-188.

Black, T. R. (1999). *Doing quantitative research in the social sciences: An integrated approach to research design, measurement and statistics*: Sage.

Bleicher, A. (2014). 4G gets real. *Spectrum, IEEE, 51*(1), 38-62.

Braver, S. L., & Bay, R. C. (1992). Assessing and compensating for self-selection bias (non-representativeness) of the family research sample. *Journal of Marriage and the Family*, 925-939.

Bresnahan, T. F., & Trajtenberg, M. (1995). General purpose technologies 'Engines of growth'? *Journal of econometrics, 65*(1), 83-108.

Calder, B. J., Phillips, L. W., & Tybout, A. M. (1982). The concept of external validity. *Journal of Consumer Research, 9*(3), 240-244.

Calmorin, L. P., & Calmorin, M. A. (2007). Research methods and thesis writing. *Published and distributed by Rex Book Store Phillippines*.

Chaudhuri, A., Flamm, K. S., & Horrigan, J. (2005). An analysis of the determinants of internet access. *Telecommunications Policy, 29*(9), 731-755.

Chen, J., Amershi, S., Dhananjay, A., & Subramanian, L. (2010). *Comparing web interaction models in developing regions.* Paper presented at the Proceedings of the First ACM Symposium on Computing for Development.

Chen, W., & Wellman, B. (2004). The global digital divide–within and between countries. *IT & society, 1*(7), 39-45.

Couper, M. P. (2000). Review: Web surveys: A review of issues and approaches. *The Public Opinion Quarterly, 64*(4), 464-494.

Creswell, J. W. (2013). *Qualitative inquiry and research design: Choosing among five approaches*: Sage.

Cronbach, L. J. (1951). Coefficient alpha and the internal structure of tests. *psychometrika, 16*(3), 297-334.

Crossman, A. (2016). What Nomothetic and Idiographic Mean, and Why They Matter in Research. Retrieved from http://sociology.about.com/od/I_Index/g/Ideographic-Nomothetic.htm

Cullen, R. (2001). Addressing the digital divide. *Online Information Review, 25*(5), 311-320. Retrieved from http://search.proquest.com/docview/194494149?accountid=15083

Czernich, N., Falck, O., Kretschmer, T., & Woessmann, L. (2011a). Broadband infrastructure and economic growth. *The Economic Journal, 121*(552), 505-532.

Czernich, N., Falck, O., Kretschmer, T., & Woessmann, L. (2011b). Broadband Infrastructure and Economic Growth*. *The Economic Journal, 121*(552), 505-532. doi:10.1111/j.1468-0297.2011.02420.x

Dahlman, E., Parkvall, S., Skold, J., & Beming, P. (2010). *3G evolution: HSPA and LTE for mobile broadband* (2 ed.): Academic press.

Delice, A. (2010). The Sampling Issues in Quantitative Research. *Educational Sciences: Theory and Practice, 10*(4), 2001-2018.

Department of Communications. (2013). *Electronic Communications Act: South Africa Connect: Creating opportunity, ensuring inclusion South Africa's Broadband Policy - 37119*. Government Gazette Retrieved from http://www.gov.za/sites/www.gov.za/files/37119_gon953.pdf.

Department of Communications. (2016). *Information Memorundum Government Gazette 39203_11-9.pdf*. ICASA Retrieved from https://www.icasa.org.za/Portals/0/Lic%20and%20Compliance/Submissions/Information%20Memorundum%20Government%20Gazette%2039203_11-9.pdf.

Department, W. B.-G. I. C. T. (2009). *Extending reach and increasing impact*. Washington DC: IBRD/World Bank.

Dwivedi, Y. K., & Lal, B. (2007). Socio-economic determinants of broadband adoption. *Industrial Management & Data Systems, 107*(5), 654-671.

Effective Measure. (2014, 2014-05-23). South Africa Online: gender, race and income - Effective Measure. Retrieved from http://www.effectivemeasure.com/south-africa-online-gender-race-income

EPRS. (2016). *Broadband infrastructure* (978). Retrieved from http://www.europarl.europa.eu/RegData/etudes/IDAN/2015/565891/EPRS_IDA(2015)565891_EN.pdf

Exchange-Rates.org. (2012). US Dollars (USD) to South African Rands (ZAR) exchange rate for February 25, 2012. Retrieved from http://www.exchange-rates.org/Rate/USD/ZAR/2-25-2012

Federal Communications Commission. (2016). Types of Broadband Connections | Federal Communications Commission. Retrieved from https://www.fcc.gov/general/types-broadband-connections

Fedor-Freybergh, P. G., & Mikulecký, M. (2005). From the descriptive towards inferential statistics. Hundred years since conception of the Student's t-distribution. *Neuroendocrinol Lett, 26*, 167-171.

Forbes. (2016). Uber expansion leaves taxi industry in urgent need of a lift - FT.com. Retrieved from http://www.ft.com/cms/s/0/c4ded228-1910-11e6-bb7d-ee563a5a1cc1.html

Fornefeld, M., Delaunay, G., & Elixmann, D. (2008). The impact of broadband on growth and productivity. *Comisión Europea (DG Information Society and Media), MICUS*.

Fransman, M. (2006). *Global broadband battles: Why the US and Europe lag while Asia leads*: Stanford University Press.

Fricker, R. D. (2008). Sampling methods for web and e-mail surveys. *N. Fielding*, 195-216.

Fuhr, J. P., & Pociask, S. B. (2007). Broadband services: economic and environmental benefits. *American Consumer Institute*.

Garcia-Murillo, M. (2005). International broadband deployment: The impact of unbundling. *Communications & Strategies*(57), 83.

GeoHive. (2015). GeoHive - Urban /rural division of countries. Retrieved from http://www.geohive.com/earth/pop_urban.aspx

Gillwald, A. (2005). Good intentions, poor outcomes: Telecommunications reform in South Africa. *Telecommunications Policy, 29*(7), 469-491.

Gillwald, A. (2007). Straddled Between Two Stools: Broadband development in South Africa. *Southern African Journal of Information and Communication, LINK Centre, Witwatersrand University, Johannesburg*.

Gillwald, A., & Kane, S. (2003). South African telecommunications sector performance review. *LINK Centre, University of the Witwatersrand*.

Gillwald, A., Moyo, M., & Stork, C. (2012). Understanding what is happening in ICT in South Africa. *Evidence for ICT Policy Action. Policy Paper 7*.

Gravetter, F. (2009). Forzano LAB. *Research Methods for the Behavioral Sciences, 2*.

Green, S. B. (2003). A coefficient alpha for test-retest data. *Psychological Methods, 8*(1), 88.

Grootes, S. (2016). High court blocks ICASA's R12bn mobile internet spectrum auction. Retrieved from http://ewn.co.za/2016/09/30/High-Court-sets-aside-Icasas-planned-spectrum-auction

GSMA. (2016a). *GSMA Global Mobile Economy Report 2015*. Retrieved from www.gsmamobileeconomy.com: http://www.gsmamobileeconomy.com/GSMA_Global_Mobile_Economy_Report_2015.pdf

GSMA. (2016b). What is Spectrum. Retrieved from http://www.gsma.com/spectrum/what-is-spectrum/

Guillén, M. F., & Suárez, S. L. (2005). Explaining the global digital divide: Economic, political and sociological drivers of cross-national Internet use. *Social Forces, 84*(2), 681-708.

Gulati, G. J., & Yates, D. J. (2012). Different paths to universal access: The impact of policy and regulation on broadband diffusion in the developed and developing worlds. *Telecommunications Policy, 36*(9), 749-761.

Gurgia, M. (2016). End of Moore's Law? What's next could be more exciting. Retrieved from http://www.telegraph.co.uk/technology/2016/02/25/end-of-moores-law-whats-next-could-be-more-exciting/

Hammond, F., Malec, J., Nick, T., & Buschbacher, R. (2014). *Handbook for Clinical Research: Design, Statistics, and Implementation*: Demos Medical Publishing.

Helpman, E. (1998). *General purpose technologies and economic growth*: MIT press.

Henn, M., Weinstein, M., & Foard, N. (2005). *A short introduction to social research*: Sage.

ICASA. (2015). *ICASA Annual Report 2015*. Retrieved from https://www.icasa.org.za/Portals/0/Regulations/Annual%20Reports/ICASA%20Annual%20Report%202015.PDF

Ilieva, J., Baron, S., & Healey, N. M. (2002). Online surveys in marketing research: Pros and cons. *International Journal of Market Research, 44*(3), 361.

Institute of Race Relations (Producer). (2015). The need for better broadband internet access in South Africa. [Interview] Retrieved from https://www.youtube.com/watch?v=6LoCNMjyuII

Investing News. (2013, 2013-08-01). High Copper Prices Leading to Increased Copper Theft - Investing News Network. Retrieved from http://investingnews.com/daily/resource-investing/base-metals-investing/copper-investing/high-copper-prices-leading-to-increased-copper-theft/

ITU. (2003). The birth of Broadband. Retrieved from https://www.itu.int/osg/spu/publications/birthofbroadband/faq.html

ITU. (2012). *Measuring the information society*. Retrieved from www.itu.com: http://www.itu.int/en/ITU-D/Statistics/Documents/publications/mis2012/MIS2012_without_Annex_4.pdf

ITU. (2015a). Active mobile-broadband subscriptions (Research) Retrieved from http://www.itu.int/en/ITU-D/Statistics/Pages/stat/default.aspx. Available from ICT, from ITU http://www.itu.int/en/ITU-D/Statistics/Pages/stat/default.aspx

ITU. (2015b). *Statistics confirm ICT revolution of the past 15 years*. Retrieved from ITU: http://www.itu.int/net/pressoffice/press_releases/2015/17.aspx#.V2-Scbh96hd

ITU. (2016). *Facts & Figures 2016*. Retrieved from www.itu.com: http://www.itu.int/en/ITU-D/Statistics/Documents/facts/ICTFactsFigures2016.pdf

Jin, D. Y. (2005). Socioeconomic implications of broadband services: Information economy in Korea. *Information, Community & Society, 8*(4), 503-523.

Jones, L. P. (1993). Appropriate regulatory technology: the interplay of economic and institutional conditions. *The World Bank Economic Review, 7*(suppl 1), 181-204.

Karasar, N. (2012). *Bilimsel araştırma yöntemi: kavramlar, ilkeler, teknikler*: Nobel Yayın Dağıtım.

Katz, R. (2012). The impact of broadband on the economy: Research to date and policy issues. *Broadband Series*.

Katz, R. L., & Avila, J. G. (2010). *The impact of broadband policy on the economy.* Paper presented at the Proceedings of the 4thd ACORN-REDECOM Conference, May.

Katz, R. L., Vaterlaus, S., Zenhäusern, P., & Suter, S. (2010). The impact of broadband on jobs and the German economy. *Intereconomics, 45*(1), 26-34.

Kerlinger, F. N. (1986). Foundations of behavioral science. *New York: Holt, Rinehart, and Winston*.

Khalil, M., Dongier, P., & Zhen-Wei Qiang, C. (2009). 2009 Information and communications for development: Extending reach and increasing impact *Information and Communications for Development* (pp. 40): World Bank Publications

Kolsaker, A., Lee-Kelley, L., Dwivedi, Y. K., & Weerakkody, V. (2007). Examining the factors affecting the adoption of broadband in the Kingdom of Saudi Arabia. *Electronic Government, An International Journal, 4*(1), 43-58.

Kose, M. A., & Ozturk, E. O. (2014). A world of change. *Finance & Development, 51*(3), 6-11.

Koutroumpis, P. (2009). The economic impact of broadband on growth: A simultaneous approach. *Telecommunications Policy, 33*(9), 471-485. doi:http://dx.doi.org/10.1016/j.telpol.2009.07.004

Kvochko, E. (2013, 11 April 2013). Five ways technology can help the economy. *Hyperconnectivity.* Retrieved from http://www.weforum.org/agenda/2013/04/five-ways-technology-can-help-the-economy/

Lam, P.-L., & Shiu, A. (2010). Economic growth, telecommunications development and productivity growth of the telecommunications sector: Evidence around the world. *Telecommunications Policy, 34*(4), 185-199.

Larsson, R. (1993). Case survey methodology: Quantitative analysis of patterns across case studies. *Academy of Management Journal, 36*(6), 1515-1546.

Lee, G. (2015). *Business Statistics Made Easy in SAS*: Sas Institute.

Lee, H., O'Keefe, R. M., & Yun, K. (2003). The growth of broadband and electronic commerce in South Korea: contributing factors. *The Information Society, 19*(1), 81-93.

Lee, M. H. (2011). Statistical methods for reducing bias in web surveys.

Lee, S., & Brown, J. S. (2008). Examining broadband adoption factors: An empirical analysis between countries. *info, 10*(1), 25-39.

Lee, S., Marcu, M., & Lee, S. (2011). An empirical analysis of fixed and mobile broadband diffusion. *Information Economics and Policy, 23*(3–4), 227-233. doi:http://dx.doi.org/10.1016/j.infoecopol.2011.05.001

Lehr, W. H., Osorio, C., Gillett, S. E., & Sirbu, M. A. (2006). Measuring broadband's economic impact.

Leiner, B. M., Cerf, V. G., Clark, D. D., Kahn, R. E., Kleinrock, L., Lynch, D. C., . . . Wolff, S. (2009). A brief history of the Internet. *ACM SIGCOMM Computer Communication Review, 39*(5), 22-31.

Levy, B., & Spiller, P. T. (1996). A framework for resolving the regulatory problem. *Regulations, Institutions and Commitment: Comparative Studies in Regulation, Cambridge University Press, Cambridge*, 121-144.

Makhaya, G., & Roberts, S. (2003). Telecommunications in developing countries: reflections from the South African experience. *Telecommunications Policy, 27*(1), 41-59.

Marrison, C. (2013). Connected fridge? What does M2M really mean for operators? Retrieved from http://www.iot-now.com/2013/06/22/13053-m2m-what-does-it-really-mean-for-operators/

Martins, J. H., Loubser, M., & Van Wyk, H. d. J. (1996). *Marketing research: a South African approach*: Unisa Press.

Matz, C. M. (1999). Administration of Web versus Paper Surveys: Mode Effects and Response Rates.

Mawson, N. (2014). ICASA held back by skills shortage. Retrieved from http://www.itweb.co.za/index.php?option=com_content&view=article&id=70770

McLeod, D. (2016). The spectrum crisis facing SA operators. Retrieved from https://www.techcentral.co.za/the-spectrum-crisis-facing-sa-operators/64153/

Mkhize, I. (Producer). (2016). Journalists take a stand against SABC censorship. Retrieved from https://www.enca.com/south-africa/journos-take-a-stand-against-sabc-censorship

Moira McGregor, B. B., & Mareike, G. (2016). Disrupting the cab: Uber, ridesharing and the taxi industry » The Journal of Peer Production. Retrieved from http://peerproduction.net/issues/issue-6-disruption-and-the-law/essays/disrupting-the-cab-uber-ridesharing-and-the-taxi-industry/

Moneyweb. (2016). Vodacom vs MTN. Retrieved from https://www.moneyweb.co.za/news/companies-and-deals/vodacom-vs-mtn/

Morey, N. C., & Luthans, F. (1984). An emic perspective and ethnoscience methods for organizational research. *Academy of Management Review, 9*(1), 27-36.

Morganti, Karen Donders, L., Stork, C., Calandro, E., & Gamage, R. (2014). The future of broadband in Africa. *info, 16*(1), 76-93.

Morlat, C. (2004). The Economist - Jun 12th 2004. *Technology Quarterly*. http://www.economist.com/printedition/2004-06-12 Retrieved from http://www.economist.com/printedition/2004-06-12

Moyo, A. G. M., & Christoph Stork. (2012). Policy Paper 7 - Understanding what is happening in ICT in South Africa. Retrieved from http://www.researchictafrica.net/publications/Evidence_for_ICT_Policy_Action/Policy_Paper_7_-_Understanding_what_is_happening_in_ICT_in_South_Africa.pdf

MTN. (2016). *Annual Results 2015*. Retrieved from MTN: https://www.mtn.com/Investors/FinancialReporting/Documents/ANNUALREPORTS/Transcripts/annual-results-2015.pdf

MyBroadband. (2016). Vodacom vs MTN vs Cell C vs Telkom – South African subscriber numbers. Retrieved from https://mybroadband.co.za/news/cellular/187377-vodacom-vs-mtn-vs-cell-c-vs-telkom-south-african-subscriber-numbers.html

Ngwainmbi, E. K. (2000). Africa in the Global infosupermarket: Perspectives and prospects. *Journal of Black Studies, 30*(4), 534-552.

Nielsen, B. (2015). Shameel Joosub - CEO of Vodacom.

Novatel Wireless. (2010). Novatel Wireless Secures Registered Trademark for MiFi (NASDAQ:MIFI). Retrieved from http://investor.novatelwireless.com/releasedetail.cfm?ReleaseID=466151

Nowak, D., & Murphy, J. (2005). *FTTH: The overview of existing technologies.* Paper presented at the OPTO-Ireland.

OECD. (2005). *OECD Broadband Statistics, June 2005*. Retrieved from http://www.oecd.org/sti/broadband/oecdbroadbandstatisticsjune2005.htm

OECD. (2016). OECD telecommunication price baskets. Retrieved from http://www.oecd.org/sti/broadband/price-baskets.htm

Oh, S., Ahn, J., & Kim, B. (2003). Adoption of broadband Internet in Korea: the role of experience in building attitudes. *Journal of Information Technology, 18*(4), 267-280.

Ookla. (2015). Ookla | Press Room. Retrieved from http://www.ookla.com/press-room/2010-10-05

Paul Vecchiatto, L. P. (2016). South Africa Urged by Regulator to Approve Spectrum Auction. Retrieved from http://www.bloomberg.com/news/articles/2016-02-16/south-africa-regulator-calls-on-state-to-allow-spectrum-auction

Qiang, C. Z.-W., Rossotto, C. M., & Kimura, K. (2009). Economic impacts of broadband. *Information and communications for development 2009: Extending reach and increasing impact, 3*, 35-50.

Qiang, C. Z.-W. R., Carlo M Kimura, Kaoro. (2009). Economic impacts of broadband. *Information and communications for development 2009: Extending reach and increasing impact, 3*, 35-50.

Quintal, G. (2016). ANC does not condone SABC censorship. Retrieved from http://www.timeslive.co.za/politics/2016/07/05/ANC-does-not-condone-SABC-censorship-%E2%80%93-Mthembu

Roller, L.-H., & Waverman, L. (2001). Telecommunications Infrastructure and Economic Development: A Simultaneous Approach. *American Economic Review, 91*(4), 909-923. Retrieved from http://www.aeaweb.org/articles.php?doi=10.1257/aer.91.4.909

Rouse, M. (2014). What is the Digital divide? Retrieved from http://whatis.techtarget.com/definition/digital-divide

Salahuddin, M., & Gow, J. (2015). The effect of the Internet on economic growth in Southern African countries: A combination of panel and time series approaches.

Samarajiva, R. (2000). Establishing the legitimacy of new regulatory agencies. *Telecommunications Policy, 24*(3), 183-187.

SAPA. (2014). Nene outlines plans to stop SA's economic slide. Retrieved from http://businesstech.co.za/news/government/71454/nene-outlines-plans-to-stop-sas-economic-slide/

Sapsford, R., & Jupp, V. (2006). *Data collection and analysis*: Sage.

Saunders, M. N. (2011). *Research methods for business students, 5/e*: Pearson Education India.

Sawyer, S., Allen, J., & Lee, H. (2003). Broadband and mobile opportunities: a socio-technical perspective. *Journal of Information Technology, 18*(2), 121-136.

Schwab, K. (2016). *The fourth industrial revolution*.

Shuttleworth, M. (2016). Different Research Methods - How to Choose an Appropriate Design? Retrieved from https://explorable.com/different-research-methods

Stacey, A. (2005). The reliability and validity of the item means and standard deviations of ordinal level response data. *Management Dynamics: Journal of the Southern African Institute for Management Scientists, 14*(3), 2-25.

StatsSA. (2011). *Census*. Retrieved from StatsSA: http://www.statssa.gov.za/census/census_2011/census_products/Census_2011_Key_results.pdf

StatsSA. (2015). *An analysis of household expenditure and income data using the LCS 2014/2015*. Retrieved from StatsSA: http://www.statssa.gov.za/publications/P0310/P03102014.pdf

Telkom. (2016). *Telkom IR 2015 Final*. Retrieved from http://www.telkom.co.za/ir/apps_static/ir/pdf/financial/pdf/Telkom%20IR%202015%20Final.PDF

The Institute of Race Relations. (2016). *The South African Survey 2016*. Retrieved from http://irr.org.za/reports-and-publications/south-africa-survey/south-africa-survey-2016

Thompson, H. G., & Garbacz, C. (2011). Economic impacts of mobile versus fixed broadband. *Telecommunications Policy, 35*(11), 999-1009.

Tice, C. (2016). $1 Billion In Under 5 Years: 12 Hot Tech Startups - Forbes. Retrieved from http://www.forbes.com/sites/caroltice/2014/12/29/1-billion-in-under-5-years-the-12-hottest-tech-startups/

Trochim, W. M., & Donnelly, J. P. (2001). Research methods knowledge base.

United Nations. (2015). *Taking Stock of the Global Partnership for Development*. Retrieved from http://www.un.org/millenniumgoals/pdf/MDG_Gap_2015_Executive_Summary_web.pdf

Van Dijk, J., & Hacker, K. (2003). The digital divide as a complex and dynamic phenomenon. *The Information Society, 19*(4), 315-326.

van Dijk, J. A. G. M. (2006). Digital divide research, achievements and shortcomings. *Poetics, 34*(4–5), 221-235. doi:http://dx.doi.org/10.1016/j.poetic.2006.05.004

Verbrugge, S., Casier, K., Lannoo, B., Van Ooteghem, J., Meersman, R., Co11e, D., & Demeester, P. (2008). *FTTH deployment and its impact on network maintenance and repair costs.* Paper presented at the Transparent Optical Networks, 2008. ICTON 2008. 10th Anniversary International Conference on.

Vitak, J., Crouse, J., & LaRose, R. (2011). Personal Internet use at work: Understanding cyberslacking. *Computers in Human Behavior, 27*(5), 1751-1759. doi:http://dx.doi.org/10.1016/j.chb.2011.03.002

Vodacom. (2016). *2015 Annual Results Presentation*. Retrieved from Vodacom: http://www.vodacom.co.za/cs/groups/public/documents/document/announcement_160516.pdf

Warf, B. (2011). Geographies of global Internet censorship. *GeoJournal, 76*(1), 1-23.

We Are Social (Producer). (2016). Digital in 2016 - We Are Social. Retrieved from http://wearesocial.com/sg/special-reports/digital-2016

Williams, M. (2005). Broadband for Africa. *Policy for Promoting the Development of Backbone Networks, InfoDev–World Bank*.

Wilson, E. J. (2004). *The information revolution and developing countries*: MIT Press.

World Bank. (2009). *GINI index (World Bank estimate)*. Retrieved from www.worldbank.org: http://data.worldbank.org/indicator/SI.POV.GINI

World Bank. (2016). Population Retrieved from http://data.worldbank.org/indicator/SP.POP.TOTL. from World Bank http://data.worldbank.org/indicator/SP.POP.TOTL

World Economic Forum. (2015). *Global Competitiveness Report 2015/2016*. Retrieved from http://wef.ch/18DfBxV

Wyche, S. P., Smyth, T. N., Chetty, M., Aoki, P. M., & Grinter, R. E. (2010). *Deliberate interactions: characterizing technology use in Nairobi, Kenya.* Paper presented at the Proceedings of the SIGCHI Conference on Human Factors in Computing Systems.

APPENDIX 1 – Research instrument – Questionnaire

Opening questionnaire note

Provided prior to survey commencing for added context.

Please note that the following questions all relate to your use of the Internet for 'personal purposes', not for business.

These 'personal purposes' include:

All social media platforms, downloading content, videos, reading, hobbies, shopping, music streaming, video on demand or any research / work that you may be doing (but one that is currently out of your existing employment).

In essence, include everything that you use the Internet for that is not in any way related to your current employment (if you are currently employed).

Exploratory Broadband questions:

How much does Broadband / Internet cost you per month – Actual cost which will cover all of what you personally pay towards data usage every month		
	R 1,000 or more	
	R 750 to R 999	
	R 501 to R 749	
	R 251 to R 500	
	R 250 or less	
What is the average speed of the Broadband / Internet connection that you use the most?		
	10 or more Megabits per second	
	5 to 9.9 Megabits per second	
	2.1 to 4.9 Megabits per second	
	2 or less Megabits per second	
	I am not sure	

Research questions:

Where do you access the Internet	Tick all that apply	
	Home	
	Work	
	Mobile	

If Home is selected		
Do you have access to fixed line Broadband at home (Copper wire ADSL or Fibre to the Home)		
	Yes	
	No	
Cost is an influence in your decision to access and use Broadband / the Internet from home?		
	Strongly disagree	
	Somewhat disagree	
	Neither agree or disagree	
	Somewhat agree	
	Strongly agree	
Download speed is an influence in your decision to access and use Broadband / the Internet from home?		
	Strongly disagree	
	Somewhat disagree	
	Neither agree or disagree	
	Somewhat agree	
	Strongly agree	
Cost limits your 'desired usage' of Broadband / the Internet at home?		
	Strongly disagree	
	Somewhat disagree	
	Neither agree or disagree	
	Somewhat agree	
	Strongly agree	
Download speed limits your 'desired usage' of Broadband / the Internet at home?		
	Strongly disagree	
	Somewhat disagree	
	Neither agree or disagree	
	Somewhat agree	
	Strongly agree	

Cheaper Broadband access at home would materially change my Internet usage habits		
	Strongly disagree	
	Somewhat disagree	
	Neither agree or disagree	
	Somewhat agree	
	Strongly agree	
Faster Broadband access at home would materially change my Internet usage habits		
	Strongly disagree	
	Somewhat disagree	
	Neither agree or disagree	
	Somewhat agree	
	Strongly agree	
My current home Broadband / Internet access solution disadvantages me		
	Strongly disagree	
	Somewhat disagree	
	Neither agree or disagree	
	Somewhat agree	
	Strongly agree	

If Work is selected		
I use the Internet at work because I do not have access to the Internet elsewhere		
	Strongly disagree	
	Somewhat disagree	
	Neither agree or disagree	
	Somewhat agree	
	Strongly agree	
I use the Internet at work because it is too expensive to access it elsewhere		
	Strongly disagree	
	Somewhat disagree	
	Neither agree or disagree	
	Somewhat agree	
	Strongly agree	
I use the Internet at work because it is fast		
	Strongly disagree	
	Somewhat disagree	

	Neither agree or disagree	
	Somewhat agree	
	Strongly agree	
Using the Internet at work eats into my work productivity		
	Strongly disagree	
	Somewhat disagree	
	Neither agree or disagree	
	Somewhat agree	
	Strongly agree	
I have no limitations to Internet usage at work		
	Strongly agree	
	Somewhat agree	
	Neither agree nor disagree	
	Somewhat disagree	
	Strongly disagree	
The company that I work for limits the amount of Internet that can be used		
	Strongly agree	
	Somewhat agree	
	Neither agree nor disagree	
	Somewhat disagree	
	Strongly disagree	
If I had access to cheaper home or mobile Internet, I would spend less time on the Internet at work		
	Strongly agree	
	Somewhat agree	
	Neither agree nor disagree	
	Somewhat disagree	
	Strongly disagree	
If I had access to faster home or mobile Internet, I would spend less time on the Internet at work		
	Strongly agree	
	Somewhat agree	
	Neither agree nor disagree	
	Somewhat disagree	
	Strongly disagree	

If Mobile is selected		
Cost is a factor in your decision to access the Internet using your mobile device?		
	Strongly agree	
	Somewhat agree	
	Neither agree nor disagree	
	Somewhat disagree	
	Strongly disagree	
Download speed is a factor in your decision to access the Internet from your mobile device?		
	Strongly agree	
	Somewhat agree	
	Neither agree nor disagree	
	Somewhat disagree	
	Strongly disagree	
Cost limits your 'desired usage' of mobile Broadband to access the Internet?		
	Strongly agree	
	Somewhat agree	
	Neither agree nor disagree	
	Somewhat disagree	
	Strongly disagree	
Download speed limits your 'desired usage' of mobile Broadband to access the Internet?		
	Strongly agree	
	Somewhat agree	
	Neither agree nor disagree	
	Somewhat disagree	
	Strongly disagree	
Cheaper mobile Broadband would materially change my Internet usage habits		
	Strongly agree	
	Somewhat agree	
	Neither agree nor disagree	
	Somewhat disagree	
	Strongly disagree	
Faster mobile Broadband access would materially change my Internet usage habits		
	Strongly agree	

	Somewhat agree	
	Neither agree nor disagree	
	Somewhat disagree	
	Strongly disagree	
My current mobile Broadband solution disadvantages me		
	Strongly agree	
	Somewhat agree	
	Neither agree nor disagree	
	Somewhat disagree	
	Strongly disagree	

Demographic questions

What is your gender		
	Male	
	Female	
What is your population group		
	Black	
	Coloured	
	White	
	Indian	
	Other	
What is your age		
	Under 20	
	20-29	
	30-39	
	40-49	
	50-59	
	60+	
What is your monthly household income		
	Under R9000	
	R9000 to R20000	
	R20000 to R50000	
	Over R50000	
Where do you live?		
	Gauteng	
	Western Cape	
	Eastern Cape	
	Northern Cape	
	Kwazulu-Natal	
	Free State	
	Mpumalanga	
	North West	
	Limpopo	

APPENDIX 2 – Research covering note

Good day

Thank you for taking the time to assist me with my research.

This research forms an integral part of my Masters of Business Administration (MBA) degree at Wits Business School. The title of my research is “A study into Broadband usage barriers for South African consumers”.

Please note that you are under no obligation to either participate in or complete this survey.

High-level summary of the study:

The broad-based penetration of Broadband is proven to have a positive economic impact on a countries’ GDP. The purpose of this study is to understand what potential barriers exist within South Africa that could be limiting our potential economic growth.

There is a gap in academic research on this topic based on the high-growth experienced in Broadband over the last 10-years. Honest and accurate feedback from you will go a long way to assisting me to provide a research report that is both valid and relevant.

Anonymity.

Please note that the results of this exercise will be kept completely confidential. Your participation will be anonymous and only used for the purposes of this research report. The study also requires that no personal information is shared.

I truly thank you for taking the time out to assist me.

My research supervisor at Wits is Dr Renee Horne. Should you have any questions or concerns around this research survey, then please make contact with her directly:

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Kind regards,

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APPENDIX 3 – Research question responses

Home

Research question responses to all Likert scale survey questions completed by respondents who access Broadband from home

1. Question 1 – Cost is an influence in your decision to access and use Broadband / the Internet from home

	Observations	Percentage
Strongly disagree	57	10%
Somewhat disagree	34	6%
Neither agree or disagree	78	14%
Somewhat agree	150	26%
Strongly agree	253	44%
	572	100%

2. Question 2 – Download speed is an influence in your decision to access & use Broadband from home?

	Observations	Percentage
Strongly disagree	43	8%
Somewhat disagree	31	5%
Neither agree or disagree	74	13%
Somewhat agree	175	31%
Strongly agree	249	44%
	572	100%

3. Question 3 – Cost limits your 'desired usage' of Broadband / the Internet at home?

	Observations	Percentage
Strongly disagree	67	12%
Somewhat disagree	56	10%
Neither agree or disagree	59	11%
Somewhat agree	147	26%
Strongly agree	231	41%
	560	100%

4. Question 4 – Download speed limits your 'desired usage' of Broadband at home?

	Observations	Percentage
Strongly disagree	51	9%
Somewhat disagree	51	9%
Neither agree or disagree	86	15%
Somewhat agree	163	29%
Strongly agree	209	37%
	560	100%

5. Question 5 – Cheaper Broadband access at home would materially change my Internet usage habits

	Observations	Percentage
Strongly disagree	49	9%
Somewhat disagree	35	6%
Neither agree or disagree	34	6%
Somewhat agree	109	20%
Strongly agree	320	59%
	547	100%

6. Question 6 – Faster Broadband access at home would materially change my Internet usage habits

	Observations	Percentage
Strongly disagree	46	8%
Somewhat disagree	22	4%
Neither agree or disagree	32	6%
Somewhat agree	126	23%
Strongly agree	321	59%
	547	100%

7. Question 7 – My current home Broadband / Internet access solution disadvantages me

	Observations	Percentage
Strongly disagree	76	14%
Somewhat disagree	74	14%
Neither agree or disagree	128	23%
Somewhat agree	136	25%
Strongly agree	133	24%
	547	100%

Work

Research question responses to all Likert scale survey questions completed by respondents who access the Internet at work

1. Question 8 – I use the Internet at work because I do not have access to the Internet elsewhere

	Observations	Percentage
Strongly disagree	87	37%
Somewhat disagree	40	17%
Neither agree or disagree	30	13%
Somewhat agree	34	15%
Strongly agree	43	18%
	234	100%

2. Question 9 – I use the Internet at work because it is too expensive to access it elsewhere

	Observations	Percentage
Strongly disagree	59	25%
Somewhat disagree	37	16%
Neither agree or disagree	40	17%
Somewhat agree	50	21%
Strongly agree	48	21%
	234	100%

3. Question 10 – I use the Internet at work because it is fast

	Observations	Percentage
Strongly disagree	42	18%
Somewhat disagree	21	9%
Neither agree or disagree	40	17%
Somewhat agree	51	22%
Strongly agree	80	34%
	234	100%

4. Question 11 – Using the Internet at work eats into my work productivity

	Observations	Percentage
Strongly disagree	79	34%
Somewhat disagree	35	15%
Neither agree or disagree	34	15%
Somewhat agree	52	22%
Strongly agree	34	15%
	234	100%

5. Question 12 – I have no limitations to Internet usage at work

	Observations	Percentage
Strongly disagree	45	19%
Somewhat disagree	29	12%
Neither agree or disagree	29	12%
Somewhat agree	46	20%
Strongly agree	85	36%
	234	100%

6. Question 13 – The company that I work for limits the amount of Internet that can be used

	Observations	Percentage
Strongly disagree	88	38%
Somewhat disagree	40	17%
Neither agree or disagree	25	11%
Somewhat agree	35	15%
Strongly agree	46	20%
	234	100%

7. Question 14 – If I had access to cheaper home or mobile Internet, I would spend less time on the Internet at work

	Observations	Percentage
Strongly disagree	49	21%
Somewhat disagree	18	8%
Neither agree or disagree	45	19%
Somewhat agree	43	18%
Strongly agree	79	34%
	234	100%

8. Question 15 – If I had access to faster home or mobile Internet, I would spend less time on the Internet at work

	Observations	Percentage
Strongly disagree	45	19%
Somewhat disagree	13	6%
Neither agree or disagree	53	23%
Somewhat agree	45	19%
Strongly agree	78	33%
	234	100%

Mobile

Research question responses to all Likert scale survey questions completed by respondents who access the Internet from a mobile device

1. Question 16 – Cost is a factor in your decision to access the Internet using your mobile device

	Observations	Percentage
Strongly disagree	86	10%
Somewhat disagree	36	4%
Neither agree or disagree	73	8%
Somewhat agree	187	22%
Strongly agree	479	56%
	861	100%

2. Question 17 – Download speed is a factor in your decision to access the Internet from your mobile device

	Observations	Percentage
Strongly disagree	88	10%
Somewhat disagree	70	8%
Neither agree or disagree	102	12%
Somewhat agree	224	26%
Strongly agree	377	44%
	861	100%

3. Question 18 – Cost limits your 'desired usage' of mobile Broadband to access the Internet

	Observations	Percentage
Strongly disagree	72	9%
Somewhat disagree	52	6%
Neither agree or disagree	78	9%
Somewhat agree	196	23%
Strongly agree	446	53%
	844	100%

4. Question 19 – Download speed limits your 'desired usage' of mobile Broadband to access the Internet

	Observations	Percentage
Strongly disagree	72	9%
Somewhat disagree	73	9%
Neither agree or disagree	119	14%
Somewhat agree	251	30%
Strongly agree	329	39%
	844	100%

5. Question 20 – Cheaper mobile Broadband would materially change my Internet usage habits

	Observations	Percentage
Strongly disagree	58	7%
Somewhat disagree	36	4%
Neither agree or disagree	45	5%
Somewhat agree	122	15%
Strongly agree	569	69%
	830	100%

6. Question 21 – Faster mobile Broadband access would materially change my Internet usage habits

	Observations	Percentage
Strongly disagree	49	6%
Somewhat disagree	34	4%
Neither agree or disagree	71	9%
Somewhat agree	148	18%
Strongly agree	528	64%
	830	100%

7. Question 22 – My current mobile Broadband solution disadvantages me

	Observations	Percentage
Strongly disagree	100	12%
Somewhat disagree	70	8%
Neither agree or disagree	172	21%
Somewhat agree	225	27%
Strongly agree	263	32%
	830	100%

APPENDIX 4 – Cost of Broadband in relation to income

Dollar prices converted into Rands at exchange rate of R 7.65 to 1 US$ which was the rate at the time (Exchange-Rates.org, 2012). Data sourced from 2012 ITU report titled “Measuring the information society” (ITU, 2012).

#	Country	Price in % of GNI	Price in ZAR
1	Gambia	747.4%	R 2 144
2	Eritrea	720.0%	R 1 561
3	Tajikistan	543.7%	R 2 773
4	Togo	405.5%	R 1 267
5	Swaziland	399.1%	R 6 691
6	Cuba	379.0%	R 13 408
7	Rwanda	257.8%	R 855
8	Kiribati	228.7%	R 2 931
9	S. Tomé & Principe	221.3%	R 1 693
10	Niger	193.4%	R 456
11	Uzbekistan	187.5%	R 1 530
12	Mozambique	135.5%	R 380
13	Comoros	128.3%	R 614
14	Burkina Faso	113.5%	R 398
15	Lao P.D.R.	111.0%	R 744
16	Iraq	108.3%	R 1 616
17	Madagascar	106.9%	R 293
18	Mali	94.6%	R 362
19	Ethiopia	85.0%	R 211
20	Zimbabwe	78.3%	R 230
21	Vanuatu	77.7%	R 1 308
22	Benin	77.1%	R 383
23	Tanzania	70.8%	R 239
24	Zambia	65.0%	R 444
25	Nepal	63.4%	R 178
26	Lesotho	61.2%	R 405
27	Nigeria	60.7%	R 457
28	Cameroon	59.1%	R 444
29	Kenya	57.4%	R 289
30	Timor--Leste	53.5%	R 757
31	Cambodia	48.0%	R 230
32	Côte dÍvoire	41.5%	R 307
33	Senegal	39.7%	R 276
34	Djibouti	39.5%	R 320
35	Uganda	39.0%	R 125
36	Namibia	31.6%	R 908

37	Ghana	30.8%	R 241
38	Mauritania	27.4%	R 180
39	Sudan	27.4%	R 222
40	Samoa	24.3%	R 465
41	Tonga	22.8%	R 477
42	Micronesia	22.0%	R 383
43	Nicaragua	21.1%	R 150
44	Yemen	18.7%	R 128
45	Bolivia	16.9%	R 195
46	Angola	16.5%	R 415
47	Pakistan	16.2%	R 109
48	Belize	15.6%	R 380
49	Bangladesh	14.3%	R 63
50	Philippines	12.9%	R 169
51	Honduras	12.2%	R 145
52	Guatemala	12.0%	R 209
53	Vietnam	10.8%	R 80
54	Guyana	10.4%	R 190
55	Indonesia	10.4%	R 165
56	Syria	9.4%	R 165
57	Paraguay	8.5%	R 147
58	Suriname	8.5%	R 322
59	Moldova	8.1%	R 93
60	Armenia	7.9%	R 161
61	Peru	7.6%	R 226
62	Jamaica	7.3%	R 222
63	Bhutan	7.0%	R 83
64	Ecuador	7.0%	R 173
65	St. Vincent	6.4%	R 257
66	Fiji	6.2%	R 143
67	Jordan	6.2%	R 173
68	Dominica	5.9%	R 252
69	Thailand	5.8%	R 155
70	El Salvador	5.6%	R 121
71	India	5.5%	R 47
72	Saint Lucia	5.4%	R 224
73	South Africa	5.4%	R 210
74	Botswana	5.2%	R 227
75	Colombia	5.2%	R 181
76	Grenada	5.1%	R 225
77	Seychelles	5.1%	R 320
78	Antigua & Barbuda	5.0%	R 420
79	China	5.0%	R 136
80	Morocco	4.9%	R 90
81	Algeria	4.8%	R 136

82	Dominican Rep.	4.5%	R 145
83	Cape Verde	4.3%	R 90
84	Serbia	4.2%	R 151
85	Egypt	4.0%	R 61
86	Barbados	3.8%	R 303
87	Georgia	3.8%	R 64
88	Kazakhstan	3.8%	R 183
89	St.Kitts and Nevis	3.7%	R 281
90	Belarus	3.6%	R 138
91	Albania	3.5%	R 90
92	Argentina	3.4%	R 186
93	TFYR Macedonia	3.4%	R 98
94	Montenegro	3.3%	R 141
95	Malaysia	3.2%	R 157
96	Tunisia	3.0%	R 80
97	Ukraine	3.0%	R 58
98	Sri Lanka	2.9%	R 42
99	Azerbaijan	2.8%	R 96
100	Bulgaria	2.6%	R 103
101	Costa Rica	2.5%	R 106
102	Mexico	2.5%	R 139
103	Panama	2.5%	R 112
104	Lebanon	2.4%	R 135
105	Chile	2.3%	R 151
106	Brazil	2.2%	R 129
107	Uruguay	2.2%	R 148
108	Czech Republic	2.1%	R 239
109	Bosnia & Herzegovina	2.0%	R 60
110	Hungary	2.0%	R 166
111	Mauritius	2.0%	R 100
112	Saudi Arabia	2.0%	R 203
113	Maldives	1.9%	R 71
114	Poland	1.9%	R 148
115	Slovakia	1.9%	R 200
116	Brunei Darussalam	1.8%	R 369
117	Bahamas	1.7%	R 230
118	Estonia	1.7%	R 161
119	New Zealand	1.7%	R 310
120	Oman	1.7%	R 198
121	Slovenia	1.7%	R 262
122	Turkey	1.7%	R 106
123	Croatia	1.6%	R 139
124	Korea (Republic)	1.6%	R 197
125	Venezuela	1.6%	R 120
126	Australia	1.5%	R 423

127	Portugal	1.5%	R 211
128	Romania	1.4%	R 70
129	Bahrain	1.3%	R 203
130	Latvia	1.3%	R 99
131	Russian Federation	1.2%	R 76
132	Spain	1.2%	R 236
133	United Arab Emirates	1.2%	R 311
134	Germany	1.1%	R 301
135	Lithuania	1.1%	R 79
136	Malta	1.1%	R 139
137	Austria	1.0%	R 301
138	Iceland	1.0%	R 205
139	Ireland	1.0%	R 252
140	Trinidad & Tobago	1.0%	R 96
141	Denmark	0.9%	R 336
142	Finland	0.9%	R 271
143	France	0.9%	R 242
144	Greece	0.9%	R 147
145	Italy	0.9%	R 203
146	Qatar	0.9%	R 420
147	Canada	0.8%	R 226
148	Cyprus	0.8%	R 158
149	Hong Kong, China	0.8%	R 162
150	Netherlands	0.8%	R 252
151	Singapore	0.8%	R 200
152	Sweden	0.8%	R 253
153	Belgium	0.7%	R 193
154	Japan	0.7%	R 185
155	Norway	0.7%	R 376
156	Luxembourg	0.6%	R 291
157	United Kingdom	0.6%	R 153
158	Switzerland	0.5%	R 250
159	United States	0.5%	R 153
160	Israel	0.4%	R 67
161	Macao, China	0.3%	R 65

APPENDIX 5 – Consistency matrix

Title: A study into access and consumption of Broadband data by South African consumers

Research Problem: Despite the existing South African Broadband policy the continuing unavailability of a universal, high-speed and reliable Broadband service for businesses and citizens has impacted negatively on the country's development and global competitiveness.

Thesis Statement:

1. Cost is a significant limitation for the desired use of the Internet (for personal use) at home in South Africa.
2. Speed is a significant limitation for the desired use of the Internet (for personal use) at home in South Africa.
3. Cost is a significant limitation for the desired use of the Internet (for personal use) via mobile in South Africa.
4. Speed is a significant limitation for the desired use of the Internet (for personal use) via mobile in South Africa.
5. Is there an association between income levels and access to fixed line Broadband in South Africa?
6. Is there an association between the monthly costs of Broadband in South Africa access relative to income levels?
7. Is there an association between income levels and Broadband speed in South Africa?

Research Objective: The purpose of this research is to investigate the barriers that exist for the desired use of Broadband by South Africans who access the Internet for personal purposes.

Main Research Question (RQm): The question being addressed in this study are the barriers to Broadband access and consumption in South Africa. This study investigated the Broadband access and consumption limitations that exist for South African consumers connecting to the Internet for personal use.

Secondary research questions		Research objective	Chapter	Deliverable
RQ$_1$	Cost is a significant limitation for the desired use of the Internet (for personal use) at home in South Africa.	To identify existing barriers of Broadband access and consumption	Chapter 2 Barrier to Broadband access and consumption	Cost as barrier Chapter 4 - results Chapter 5 – discussion of results Chapter 7 – conclusion and recommendation
RQ$_2$	Speed is a significant limitation for the desired use of the Internet (for personal use) at home in South Africa.	To identify existing barriers of Broadband access and consumption	Chapter 2 Barrier to Broadband access and consumption	Speed as barrier Chapter 4 - results Chapter 5 – discussion of results Chapter 7 – conclusion and recommendation
RQ$_3$	Cost is a significant limitation for the desired use of the Internet (for personal use) via mobile in South Africa.	To identify existing barriers of Broadband access and consumption	Chapter 2 Barrier to Broadband access and consumption	Cost as barrier for mobile Chapter 4 - results Chapter 5 – discussion of results Chapter 7 – conclusion and recommendation
RQ$_4$	Speed is a significant limitation for the desired use of the Internet (for personal use) via mobile in South Africa.	To identify existing barriers of Broadband access and consumption	Chapter 2 Barrier to Broadband access and consumption	Speed as barrier for mobile Chapter 4 - results Chapter 5 – discussion of results Chapter 7 – conclusion and recommendation
RQ$_5$	Is there an association between income levels and access to fixed line Broadband in South Africa?	To identify existing barriers of Broadband access and consumption	Chapter 2 Barrier to Broadband access and consumption	Income level as determinant barrier to fixed line Chapter 4 - results Chapter 5 – discussion of results Chapter 7 – conclusion and recommendation

RQ_6	Is there an association between the monthly costs of Broadband in South Africa access relative to income levels?	To identify existing barriers of Broadband access and consumption	Chapter 2 Barrier to Broadband access and consumption	Monthly Costs and income levels as determinant barrier Chapter 4 - results Chapter 5 – discussion of results Chapter 7 – conclusion and recommendation
RQ_7	Is there an association between income levels and Broadband speed in South Africa?	To identify existing barriers of Broadband access and consumption	Chapter 2 Barrier to Broadband access and consumption	Speed and income levels as determinant barrier Chapter 4 - results Chapter 5 – discussion of results Chapter 7 – conclusion and recommendation
Methodology	How can a detailed research methodology be provided in order to understand and reproduce this research study in future	Explain the research methodology used for this research study in detail, to allow it to be reproduced in future	Chapter 3 Research methodology	A detailed description of the research methodology used to conduct this research project so that it may be repeated in future
Research results and Discussion	What results are obtained from the empirical findings of the study?	Conduct empirical study of the Broadband access and consumption limitations that exist for South African consumers connecting to the Internet for personal use	Research Hypotheses 1-7 Chapter 4-5	Individual case results – results per cases and research question Cross-case synthesis per research question – models and equations
RQ_m	RQ_m	RQ_m	Conclusion Chapter 6	Seven findings Recommendations addressing major findings on costs and speed as barriers