Broadband Diffusion in Households of South Africa

MASTER THESIS

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"Productivity is never an accident. It is always the result of a commitment to excellence, intelligent planning, and focused effort."

Paul J. Meyer

American entrepreneur and author

Abstract

Broadband infrastructure is a key component of the knowledge economy. Countries around the world have nominated broadband networks as crucial infrastructure for their social, economic and scientific goals. Broadband has the ability to improve the lives of citizens as it can help children with ICT skills for employment and improve the way they have access to education. It can help consumers obtain better work/life balance attributed by more empowerment, more productivity and less stress.

South Africa has recognized the importance of a high-speed broadband technology to advance the communications infrastructure of the country. However, although the demand for broadband is quite high, it is seen that the adoption of the technology is lower than anticipated and this particularly within the households of consumers. South Africa has fallen behind international peers in both the developed and some developing markets in the race to rollout broadband services and when compared to its Northern African counterparts, South Africa is not a broadband leader.

While various studies and models aim to explain the adoption of broadband services in several countries, very few focus on the African continent. There are few available literatures on the adoption, use and impact of broadband services in African countries. Another prominent concern is that most of the literature available focuses on the factors which may influence intention to adopt a particular service but very few comprehensively explain the adoption and use process. This research attempts to investigate the adoption, use and impact of broadband services from a holistic point of view encompassing the factors influencing the adoption, use and impact of broadband.

This study explores the broadband developments in South Africa and discusses the challenges faced in increasing the broadband penetration rate within the country. The research begins with an initial literature review, followed by a qualitative study which is finally validated by a quantitative study. The initial literature review aimed to develop a model specific to broadband adoption, use and impact on a global scale. The qualitative study aimed to inductively propose a model for South Africa through an interview analysis. Finally, the quantitative study aimed to deductively combine the initial literature review and the qualitative study and formulate research hypothesis to validate the proposed South African model. This was done by investigating the extent to which the factors of the model were applicable to South Africa.

The study found that with regards to consumer attitude towards broadband, technological comfort had a significant influence on broadband adoption while their entertainment perceptions had a "somewhat" significant influence. With regards to perceived behavioural control factors, lack of skills, high costs and no access to PC were found to be inhibitors of broadband adoption.

A consumer's use diffusion determinants, namely household social context, technological dimension, personal dimension, external dimension and security, in the sustained adoption phase determined how a consumer used their broadband subscriptions after adopting it. By utilising the rate and variety of use from the factors that significantly had an effect on a consumers usage patterns showed that South African broadband users can be classified as experimental, specialised or intense users. The study has also shown that South African consumers have a much more comfortable lifestyle when using broadband, are more satisfied and show an interest in future-oriented communication technologies.

This research provides valuable insight into the market as from an academic perspective, it adds to the existing literature on broadband diffusion in South Africa. From a practical viewpoint this research provided a comprehensive analysis into the factors leading to the adoption and use of broadband in residential households that may be beneficial for various stakeholders such as government, Internet Service Providers (ISP), business consumers, public organisations as it can allow them to make better informed decisions on their target market.

Keywords: Broadband Internet, South Africa, Fixed Broadband, Mobile Broadband, Penetration Rates, Demand Side, Broadband Diffusion, Regulations, Policies

Declaration

1. I know that plagiarism is wrong. Plagiarism is to use another's work and pretend that it is one's own.
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Mogen Naidoo

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Preface

This research report is not confidential; however private details of all respondents have not been disclosed.

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Introduction

"Rien ne se perd, rien ne se crée, tout se transforme".

"Nothing is lost, nothing is created, everything is transformed".

Antoine-Laurent de Lavoisier

French intellectuel and chemist, 1743-1794

1.1 Chapter Overview

This chapter provides an introduction to this research thesis. It first provides a background on the importance of broadband and describes the research problem. It then outlines the objectives and set of questions that this research study has addressed. This is followed by an outline of the scope of this study. The chapter addresses the justification and importance of this study from an academic and practical perspective. Finally, a thesis outline is provided that details the chapters and structure of this study.

1.2 Background

Since the emergence of the Internet, Broadband is viewed as one of the most significant evolutionary technologies that offer end users fast 'always on' access to new services, applications and content with real lifestyle and productivity benefits (Sawyer, Allen and Heejin, 2003).

Countries around the world have nominated broadband networks as crucial infrastructure for their social, economic and scientific goals. In addition, broadband has been described as the universal remedy for a range of social and economic despair accredited to isolation from political, personal, geographical and other factors (Sacks, 2002; DCITA, 2008). Similarly, South Africa has recognized the importance of a high-speed broadband technology to advance the communications infrastructure of the country (Gillwald, 2002; Groenendaal, 2007, MyBroadband, 2010e).

Government objectives can be realised by providing high bandwidth access to all people for voice, data and video services. Broad based Internet access and ICT usage culture among the populace are two of the prerequisites for widespread E-commerce adoption (Gillwald, 2002; Groenendaal, 2007, MyBroadband, 2010e). Home-working and hot-desking, and the creation of new e-businesses are a range of new working practices that are created by the rapid advancements in bandwidth specification. Businesses are demanding higher levels of broadband technologies that provide faster and uninterrupted data connectivity (Spurge and Roberts, 2005).

Broadband has the ability to also improve the lives of citizens as it can help children with ICT skills for employment and improve the way they have access to education. Moreover, it can help consumers obtain better work/life balance attributed by more empowerment, more productivity and less stress (Dwivedi, 2008).

1.3 Problem Statement

South Africa, as an emerging market, is besieged with vast opportunities within the telecommunications sector. However, from a practical perspective, while the industry has seen much technological advancement, it has been undermined by low internet penetration rates, which currently stands at 10% (InternetWorldStats, 2010). The South African government has stated that the Information and Communication Technologies (ICT) industry is key for the country's development; however, regulations and policies have not always supported this stance (Francis, 2010). Moreover, once regarded as a telecommunication powerhouse, South Africa is slowly losing ground to its African counterparts such as Botswana, Zambia and Kenya due to stagnant inland infrastructure developments (Balancing-Act, 2010).

While the demand for broadband is quite high, it is seen that the adoption of the technology is lower than anticipated and this particularly within the households of

consumers (MyBroadband, 2010b). Broadband adoption within the country currently stands at a mere 1.4% when taking into account fixed wired connections and 7.7% for mobile wireless connections. These figures are multiple times lower than the OECD countries average of 'households with broadband access' percentage which stands at 57.8% (MyBroadband, 2009c; MyBroadband, 2010b).

From an academic perspective, while various studies and models aim to explain the adoption of broadband services in several countries, very few focus on the African continent, particularly with regards to emerging economies. There is little available literature on the adoption, use and impact of broadband services in African countries. This research investigates the adoption, use and impact of broadband services in South Africa as there is no appreciable amount of research or literature available in this regard.

Another prominent concern is that most of the literature available focuses on the factors which may influence intention to adopt a particular service but very few comprehensively explain the adoption and use process. Therefore, this research attempts to investigate the adoption, use and impact of broadband services from a holistic point of view encompassing the factors influencing the adoption, use and impact of broadband. In addition, the research also attempts to unpack reasons for the low broadband penetration rates which may assist government policy makers in increasing broadband adoption within the country.

1.4 Research Objectives

The study will be divided into three parts. The research starts with an initial literature review, followed by a qualitative study which is finally validated by a quantitative study. The initial literature review aims to develop a model specific to broadband adoption, use and impact on a global scale. The aim of the literature review is therefore to:

1. review and assess the appropriateness of previous technology adoption models to study broadband diffusion;
2. identify the various models and studies in literature to understand household broadband diffusion; and
3. propose a generic model for broadband diffusion.

The qualitative study aims to:

1. conduct an interpretive inductive analysis through qualitative interviews, identifying factors and links within the proposed model; and
2. inductively propose a model for South Africa through the interview analysis.

Finally the quantitative study aims to deductively combine the initial literature review and the qualitative study and formulate research hypotheses to validate the

proposed South African model. This will be done by investigating the extent to which the factors of the model are applicable to South Africa.

1.5 Research Questions

The main research objective is to ultimately expand and enhance the generic model within the South African household context. More precisely, the study will attempt to answer the following questions:

1. What factors affect a South African consumer's decision to adopt broadband?
2. What factors affect the way South African consumers use broadband?
3. What impact does broadband have on South African consumers and their interest in future oriented technologies?

Chapter 6 provides a more refined version of the research question and objectives.

1.6 Research Scope

The focus of this study will be based on the consumers. It is important, at this point, to distinguish between 'consumers' and 'users' of the technology. According to Rice (1997), consumers are those who pay for the goods and services while users are those who use the products and services but do not pay for it. An example would be where parents are the consumers as they are paying for the subscription of broadband. Their children will be users since they use broadband for online gaming or performing homework. Consumers will be the focus during evaluation of the adoption of broadband while the study will focus on both the consumers (ultimately users as well) and users during the evaluation of the usage and the impact of broadband.

Therefore the proposed model will consider those factors that are relevant to household consumers. This is due to:

1. previous studies paying little or no attention to the study of consumers;
2. growth is constrained by the demand side, as consumers are reluctant to subscribe to the technology in question; and
3. while supply side factors are also considered a problem in South Africa (Naidoo, Kaplan and Fransman, 2006), research into the supply side factors affecting broadband adoption in South Africa is a study on its own and is therefore out of the scope of this research study.

1.7 Justification and Importance of this Research

The importance of this research will be viewed from two perspectives. From an academic perspective this research will add to the existing literature on broadband

diffusion in South Africa. By using current research to form the foundation of the study, this research project will build on the body of knowledge to further the understanding and successes of broadband adoption in residential households.

From a practical viewpoint this research will provide various stakeholders such as government, Internet Service Providers (ISP), business consumers, public organisations and residential consumers (Choudrie and Dwivedi, 2004b) with an insight into the factors leading to adoption and use of broadband.

1.8 Thesis Outline

This research study consists of nine chapters including this introductory chapter. Chapter 2 examines the literature applicable to this research study. It begins by defining broadband, its technologies, its importance and its advantages and disadvantages. This is followed by the state of broadband in South Africa and compares South Africa to the rest of the world. The chapter then reviews and assesses the appropriateness of previous technology models and constructs used to study broadband diffusion. It further provides a theoretical justification for selecting the constructs that are used to study broadband diffusion and formulates a global model for broadband diffusion.

Chapter 3 provides the research design of this study. It explains the way in which the research is undertaken and at the same time, it justifies the research approach, strategy and tools that are used.

Chapter 4 focuses on the qualitative research method and the instrument used for the collection of qualitative data. This is followed by chapter 5 which provides an analysis of the qualitative data. Using the results obtained from the qualitative data analysis, a model for broadband diffusion in households specifically for South Africa was proposed.

Chapter 6 focuses on the quantitative research method and the instrument used for the collection of quantitative data. It also details the proposed hypotheses for this research study. Chapter 7 then provides the analysis of the quantitative data and research findings. The reliability and validity of the instrument is tested. The subsequent sections then validate the proposed hypotheses quantitatively.

The research study ends with chapters 8 and 9. Chapter 8 summarises and discusses the results obtained from the quantitative study in Chapter 7. Chapter 9 concludes the research by providing an overview of the research approach and findings. This is followed by a discussion on the limitations of this research and recommendations for future research.

1.9 Chapter Summary

This chapter provided an introduction to the research study. It discussed the research problem and defined the research objectives and research questions that this research study attempts to answer. It established the scope of the research study and provided a brief description for the justification and importance of the study. Finally a thesis outline was provided detailing the chapters and structure of this research study.

The next chapter begins the research study by examining the literature applicable to this research.

2

Literature Review

"The advance of technology is based on making it fit in so that you don't really even notice it, so it's part of everyday life."

Bill Gates

American business magnate, philanthropist, author and chairman of Microsoft

2.1 Chapter Overview

The aim of this chapter is to provide adequate background and world perspective on current research examining the questions surrounding broadband diffusion within households. It will do this by investigating the current body of knowledge in this field, and synthesising the available information into a logical flow.

The literature review is set out by first defining broadband and its technologies and follows with a comprehensive exploration of the potential positive impacts broadband can have for consumers. The review then focuses on examining the situation worldwide. The final section collates a multitude of resources to identify the key diffusion issues that need to be considered before successful broadband adoption and use can take place. These are mapped into a model, the Model for Broadband Adoption in the Household (Choudrie & Dwivedi, 2004b), and is used to contextualise the diffusion issues. Finally, a summary of the chapter is provided.

2.2 Broadband Defined

The term is widely used as shorthand for high-speed Internet access (Sacks, 2002). Broadband can also be defined in terms of the technology used, in terms of the transmission capacity provided, or in terms of the functionality enabled (Sacks, 2002). Compared to traditional narrowband connections, broadband access is immediate. Large volumes of data can be instantly transmitted, waiting times are reduced and efficiency for users is improved. Narrowband connections require users to wait while a connection is made before they can access the Internet. Internet use when connected is also slow – it is estimated that one third of user time online is spent waiting (Spurge & Roberts, 2005).

Typical speeds can vary between 256 Kilobits per second (Kbps) and several Megabits per second (Mbps). Broadband technologies are able to provide a mix of data, voice, and video services over one "pipe". For the purpose of this research broadband will be regarded as those technologies that offer speeds of 256Kbps or more as is currently defined by the South African Department of Communications (DoC) (MyBroadband, 2010f).

2.2.1 Broadband Technologies

For the purpose of the research the following set of broadband technologies will be considered. These will serve as a base to describe the impact of broadband and its potential for consumer households. The technologies mentioned below are divided into fixed line technologies, fixed wireless technologies and wireless mobile technologies.

2.2.1.1 Fixed Line Technologies

Digital Subscriber Lines (DSL)

DSL technology uses the existing copper telephone infrastructure to facilitate high speed data connections (Corning, 2005). DSL hardware can achieve this by splitting voice and data signals on the telephone line into distinct frequency bands.

The 'x' in the xDSL stands for various kinds of DSL technologies. The key technologies are ADSL (Asymmetric), SDSL (Symmetric), VDSL (Very High Bit Rate) and ADSL2+ (Corning, 2005). With ADSL the volume of data flow is greater in one direction than the other where download speeds are generally greater than upload speeds. These are provided to consumers who typically download from the internet, not needing to run servers for uploading intensive material. With SDSL the volume of data flow is equal in both directions. VDSL works on the same principal as ADSL however it uses up to 4 different frequency bands, two for upstream (from the client to the local exchange) and two for downstream thus providing a much higher bandwidth than ADSL (Bread, 2004).

According to Corning (2005) the maximum speed that ADSL (ADSL2+) offers can reach up to 24Mbps for download and a maximum of 3.5Mbps for upload and any speed higher than this will require a fibre to the home (FTTH) connection. These speeds are possible if the distance between a user and the local exchange is quite small. With SDSL maximum upload and download speeds can reach 3Mbps and VDSL can, theoretically, reach speeds of 52Mbps download and 13Mbps upload. Speeds currently available in South Africa for ADSL range from 384Kbps to 10Mbps download and 64Kbps to 1Mbps upload (Telkom, 2010b).

An advantage of ADSL is that it uses the existing telephone infrastructure and is available to most consumers around the world. Another advantage is that DSL technology allows for accessing the internet as well as making and receiving calls simultaneously. It is "always on" and there is no need for dialling into an ISP each time a connection to the internet is needed.

DSL Access Modules (DSLAMS) are placed at the local telephone exchange for transmitting and receiving data. xDSL are distance sensitive technologies and this is one of its disadvantages. As the connection length from the subscriber to the DSLAM increases, the signal quality decreases (Corning, 2005), thus DSL works best the closer a subscriber is to the local telephone exchange.

Cable Modems

A cable modem is a type of modem that is designed to modulate data signals over a cable television infrastructure. It is used to deliver broadband internet access, making use of the unused bandwidth on a cable television network (Bread, 2004).

The most common use for cable is cable television that provides television programming and other services to consumers via radio frequency signals transmitted directly to people's televisions through fixed optical fibres or coaxial cables as opposed to the over-the-air method used in traditional television broadcasting (via radio waves) in which a television antenna is required (Bread, 2004).

Typical speeds of residential cable modems range from 3Mbps to 15Mbps or more for downloads and 384Kbps to 1Mbps for uploads although lower speeds can be attained due to cable TV broadband services relying on shared network architecture. This, therefore, results in the limitation that the amount of bandwidth delivered to the customer is dependent on how many consumers share the connection back to the head-end (hub) and the actual bandwidth obtained by the excessive loading of the system by other users (Corning, 2005). There is no likelihood that cable TV will be at all significant in South Africa as there is no installed based and the cost of infrastructure is prohibitive (Naidoo, Kaplan & Fransman, 2006).

Broadband over Powerlines (BPL)

BPL, also known as power-line internet, makes use of Powerline Communications (PLC) technology to provide broadband internet access through ordinary power lines. High-speed data transmission or Broadband over Power Line uses the electric circuit

between the electric substations and home networks. A PC (or any other device) would need only to plug a BPL modem into any outlet in an equipped building to have high-speed Internet access (Bread, 2004).

PLC modems transmit in medium and high frequency (1.6 to 30 MHz electric carrier). The asymmetric speed in the modem is generally from 256 Kbit/s to 2.7 Mbit/s. In the repeater situated in the meter room the speed is up to 45 Mbit/s and can be connected to 256 PLC modems. In the medium voltage stations, the speed from the head ends to the Internet is up to 135 Mbit/s. To connect to the Internet, utilities can use optical fiber backbone or wireless link (Bread, 2004).

The benefits of BPL over cable or DSL is that the extensive infrastructure is already available, thereby having more people in more locations to have access to it. However one of the disadvantages is that the technology has the potential to interfere with radio transmissions. Power lines are typically untwisted and unshielded, they are essentially large antennas, and will broadcast large amounts of radio energy and because of their lack of shielding, the BPL systems are also at risk of being interfered with by outside radio signals (Bread, 2004; Groenendaal, 2009).

BPL could become very significant in South Africa if the current uncertainties over the ownership of municipal electricity networks are resolved, given the relative penetration of fixed line networks and electricity networks (Naidoo et al., 2006; Groenendaal, 2009).

Fibre Optics (FTTP and FTTH)

Fibre to the premises (FTTP) or Fibre to the home (FTTH) refers to a broadband telecommunications system based on fibre-optic cables and associated optical electronics for delivery of multiple advanced services such as the triple play of telephone, broadband Internet and television to homes and businesses (Bread, 2004).

Fibre optic cables use light pulses to carry data and have enormous bandwidth. The Internet “backbone” is made up of fibre optic cables and most customers connect to the backbone through copper-based technologies like twisted pair and DSL which have limited bandwidth and limited capacity to carry integrated voice, video, and data services (Bhansali, 2006).

Fibre optic cables can currently carry information at speeds greater than 2.5 gigabits per second. Residential/business FTTH typically offers speeds from 10 mbps to over 100 mbps, which is a hundred times faster than most cable or DSL service (Bhansali, 2006). According to Naidoo et al. (2006), FTTP or FTTH could play a part in a few affluent districts if the facilities market is deregulated and independent metro networks are created, but the cost of infrastructure for SA give wireless a considerable edge. Some private housing and business park estates offer FTTH as a value add. Recently “Metro-Ethernet” networks were launched by Vodacom Group Ltd, Telkom Ltd, Netotel Ltd and MTN Group Ltd offering ‘last mile’ fibre-optic

connections with speeds from 2Mbps to 1Gbps targeted at large enterprises and business markets in South Africa's metropolitan areas (SAInfo, 2010).

2.2.1.2 Fixed Wireless Technologies

Satellite

Satellite Internet access is used in locations where terrestrial internet access (such as cable or DSL) is not available and in locations which move frequently. The technology is available worldwide and is used by vessels at sea (Bhansali, 2006). Satellite broadband provides asymmetrical high-speed data transfers from the internet using a satellite dish. Data is transferred from a PC to the satellite to the ISP where it is processed and then sent back in reverse order (Bhansali, 2006).

There are two types of satellite broadband service: one-way and two-way. The one-way service requires the user to have an ISP (dial-up, cable modem, or DSL) for the uplink, while the downlink is supported by satellite. Two-way satellite configuration transmits and receives signals directly via the satellite without needing an additional phone line to support the connection for the upstream piece of the broadband service (Bhansali, 2006).

Satellite speeds range from 400-500Kbps with bursts of 1.5Mbps for download and 50-128Kbps for uploads. According to Naidoo et al. (2006), satellite connectivity is insignificant as a broadband residential technology and that the lack of an obvious backchannel combined with the high cost of ownership for satellite service will not have much impact in residential markets. Even in today's market, the cost of satellite broadband does not warrant its use as other technologies such as ADSL, WiFi and 3G/HSDPA offer faster speeds and with a more competitive price advantage.

Wi-Fi (Wireless Fidelity)

Wi-Fi is a brand licensed by the Wi-Fi alliance that describes the underlying technology of wireless local area networks (WLAN) based on the IEEE 802.11 specifications. The main application of Wi-Fi is to provide local radio links to end users with equipment such as a computer, VoIP telephone, or personal digital assistant (PDA) within consumer premises or residences (Corning, 2005). Wi-Fi products support data rates of up to 54Mbps. Hotspots are regions covered by one or several access points and are premises such as airports and restaurants which have set up local Wi-Fi connectivity to the Internet (Corning, 2005).

Although Wi-Fi is best suited to within buildings, cities' service providers have set up multiple Wi-Fi transceiver sites to provide city centres with Wi-Fi connectivity to individuals and businesses ranging over a 3km radius (Corning, 2005).

Although several start-ups such as Uninet are offering Wi-Fi services to end users, it remains to be seen if this will emerge as a true broadband technology in South Africa. Wi-Fi access and hotspots are available and is being used in some instances as a fixed wireless access technology, generally in the unlicensed band (ISM)

(Naidoo et al., 2006). More recently, as of September 2009, the IEEE 802.11n had been launched offering speeds of up to 600+ Mbps (Newman, 2009). The launch of smart phones such as Apple's iPhone, Google's Android and tablets such as Apple's iPad may increase the uptake of WiFi in the near future.

Worldwide Interoperability for Microwave Access (WiMAX)

WiMAX promotes conformance and interoperability of the standard IEEE 802.16, also known as WMAN (Wireless Metropolitan Area Network). Designed to deliver Wi-Fi type connectivity albeit over a much greater range, connecting buildings within a geographical region, WiMAX competes as a point-to-multipoint last mile broadband wireless access solution (Corning, 2005). There are two types of WiMAX available: Line of Sight (LOS) and Non-Line of Sight (NLOS). LOS is a point-to-point access while NLOS is a point-to-multipoint access. LOS WiMAX is able to transmit over a radius of 50km handling up to 70Mbps. Although LOS has better reach capabilities it will not facilitate a large consumer coverage area. NLOS has shorter reach capabilities but can facilitate a larger consumer coverage area. Speeds of 2-10Mbps over a 3-5Km radius can be acquired (Corning, 2005). Several Operators have been testing WiMAX as a fixed wireless solution, including Telkom, Vodacom, and Wireless Business Solutions (WBS). There is a high chance that WiMAX can become the standard for broadband wireless access (Naidoo et al., 2006). As of June 2010, the technology has been regarded as still in its infancy phase as companies such as Telkom Ltd and iBurst only offer fixed or nomadic connectivity. For growth within the WiMAX market, South Africa's regulator ICASA needs to define rules for spectrum auctions and it is said that four operators are required to kick-start the process. The 2.6 GHz and 3.5 GHz spectrums are available but allocations of these are dependent on ICASA proceedings (Smith, 2010).

2.2.1.3 Mobile Wireless Technologies

3G

Universal Mobile Telecommunications Services (UMTS) or 3G is the next generation of high speed mobile systems for existing 2G and 2.5G digital cellular systems that are based on GSM (Global Systems for Mobile) (Corning, 2005). 3G is recognised as a WWAN (Wireless Wide Area Network) and can be accessed over different geographical areas as it uses the existing upgraded mobile telephone networks infrastructure.

The 2G era offers voice and low data transfer rates, of around 14.4Kbps. 2.5G or General Packets Radio Services (GPRS) uses the existing upgraded 2G networks to provide higher data rates for the transfer of larger data files (Corning, 2005). Data rates of up to 170Kbps can be achieved. An advantage of 2.5G over 2G networks is that it is an "always on" connection. Users only pay for the amount of data that is downloaded as opposed to the amount of time that is spent online which proves more

costly. GPRS provides high speed delivery of emails with larger attachments, web surfing using WAP (Wireless Access Protocol) and access to corporate LANs (Corning, 2005).

3G provides greater bandwidth capabilities than existing digital cellular systems. It enables data transmission rates of between 384Kbps to 2Mbps. These speeds make 3G a mobile broadband system as 3G mobile phone users have high speed internet access, videoconferencing and basic online-video and TV services (Corning, 2005). An advantage of 3G networks is that if there is no network coverage for 3G devices it will automatically switch to the 2.5G network where voice and data access can still be made, albeit at lower data rates. This ensures that mobile users always stay connected.

Although 3G offers transmission rates up to 2Mbps, this bandwidth is not sufficient enough to compete with existing broadband technologies. 3.5G or High Speed Downlink Packet Access (HSDPA), an evolutionary path for 3G was rolled out offering speeds of up to 14.4Mbps (Corning, 2005). Recently, speeds of up to 21Mbps (High Speed Packet Access – HSPA) and 42Mbps (High Speed Packet Access Plus – HSPA+) have been attained particularly by Vodacom Group Ltd and Cell C respectively. The successor to 3G, 4G or Long Time Evolution (LTE) technologies is currently in works worldwide and 4G is stated to have speeds of up to 100Mbps and over. Vodacom Group Ltd had in June 2010, switched on its trial LTE network which is capable of speeds of up to 150Mbps (MyBroadband, 2010d).

HSPA/HSPA+ could become a viable alternative to fixed wireless and fixed line access if the pricing is right. Extensive penetration of mobile telephony may enable faster penetration than fixed broadband technologies. Since the launch of 3G, Vodacom has effectively adopted Vodafone's 3G strategy and their service offerings (Naidoo et al., 2006). Other networks are also competing aggressively with their 3G offerings and competition may drive down the current high pricing. This can be seen with the recent launch of Cell C's 3.75G (labelled as 4Gs – 4 Great Speed and 4 Great Service) service offering that shook the mobile broadband market with its competitive pricing. There is also a high dependency on suitable devices and pricing plans as the high end of the mobile market is driven by subsidized handsets. The presence of strong competition in this sector is likely to be a key driving force (Mokgata, 2010).

2.2.2 Importance of Broadband

Countries around the world have nominated broadband networks as crucial infrastructure for their social, economic and scientific goals. In addition, broadband has been described as the universal remedy for a range of social and economic despair accredited to isolation from political, personal, geographical and other factors (Sacks, 2002). South Africa has recognized the importance of a high-speed

broadband technology to advance the communications infrastructure of the country (Gillwald, 2002).

Government needs to have objectives of providing faster access to all people for voice, data and video services (Gillwald, 2002; Groenendaal, 2007, MyBroadband, 2009e). Broad based Internet access and ICT usage culture among the populace are two of the prerequisites for widespread ecommerce adoption (Gillwald, 2002). Home-working and hot-desking, and the creation of new e-businesses are a range of new working practices that are created by the rapid advancements in bandwidth specification. Businesses are now demanding higher levels of broadband technologies that provide faster and uninterrupted data connectivity (Spurge & Roberts, 2005).

2.2.3 Broadband versus Narrowband

Sacks (2002) states that broadband offers the following advantages over narrowband:

- Information access and transfer of data using broadband is faster than narrowband;
- Broadband technology is "always-on", allowing for continuous access to information. This can be contrasted with standard dial-up Internet connections with which it is necessary to engage a new connection each time access is required;
- Broadband makes it possible for multimedia data to be transferred simultaneously over the same line, for example, it is possible to have a telephone conversation at the same time as transferring video images over one line.

A potential disadvantage of broadband is an increased security threat to users of broadband (Sacks, 2002). The use of broadband for Internet access is often via a permanent IP (Internet Protocol) address that may make the user more vulnerable to unauthorised attacks on their computer system (Sacks, 2002). Other disadvantages include higher service fees than dial-up and not all phone lines are equipped for DSL. Broadband may also not be available in rural or remote areas.

2.2.4 Impact of Broadband

The economies of the world today are information and knowledge driven. Value creation depends on the ability to efficiently and effectively manage raw data in order to transform it into valuable knowledge and then profitably exploit that knowledge (KPMG, 2004; KPMG, 2005). Many refer to broadband as the infrastructure of the knowledge economy (Sacks, 2002; KPMG, 2004; KPMG, 2005).

Broadband is an enabling technology. It allows businesses that are willing to embrace Internet business solutions to transform business processes and realize

significant returns on investment. It offers consumers new opportunities to work or learn more productively (at their desks or from home), publish multimedia, switch from viewers of entertainment to participants, and – most importantly – dramatically expand their communication possibilities (US Department of Commerce, 2003).

Broadband services are underpinning the development of e-commerce, and access to bandwidth at globally competitive prices is an increasingly important determinant of competitiveness in the global knowledge economy. Policies that encourage the provision of affordable broadband access to a nation's firms can put them ahead of global competitors. Benefits of broadband include important contributions to the quality of life, in terms of education, health services and social inclusion (Sacks, 2002; US Department of Commerce, 2003). It is evident that broadband is an important focus of public policy and is likely to be a significant part of economies in the future.

2.3 State of Broadband

2.3.1 First World Countries

Internationally broadband is growing rapidly. In many European countries prices have dropped, access speeds increased and both the dominant operators and the new service providers have shown strong growth in broadband penetration. However when compared to Japan, South Korea, the U.S. and Canada, Europe seems to be lagging behind in terms of the quality and reach of the networks. Japan, South Korea, Canada and the U.S. still outperform European averages in both the extensiveness (a measure of the percentage of people with access to terrestrial broadband) and competitiveness (a measure of competition, price and regulation governing broadband) (KPMG, 2005; Kim, Kelly and Raja, 2010).

By the end of 2005 there were 205 million broadband subscribers worldwide and these consisted of mainly DSL and Cable subscribers (Christian, 2006). By number of subscribers, the U.S. ranks first in broadband population and holds 15th-place rank in broadband subscribers (Kim et al., 2010; Bernabé, 2010). South Korea is significantly ahead of the rest of the world in percentage of total population using broadband and percentage of Internet users adopting high-speed access, with 25.5 subscribers per 100 inhabitants. This accounts for over 32 million subscribers, almost 72% of the country's population (Ovum, 2009; Bernabé, 2010). In Europe Internet usage had grown over 160% and around 37% of Europeans are surfing the Web (Fornefeld, Delauny and Elixmann, 2008). Figure 1, below shows the top countries in the world that are broadband leaders in terms of quality and penetration rates.

Figure 1: World Broadband Leadership 2010 (Source: Bernabé, 2010)

First world economies worldwide are offering higher speed services at lower costs. Being true single markets, their respective regulators appear to have more coordinated approaches and a holistic view where each nation has its own regulatory regime and national operator - a fragmented market and industry structure is the result (KPMG, 2005; Ovum, 2009).

Being the most advanced country in terms of broadband penetration, South Korea provides an excellent example for other countries to follow. Research by Yun, Lee & Lim (2002) analyzed actions and factors that contributed to the rapid penetration of broadband access in Korea. This was traced from three different viewpoints: public sector, private sector, and social and cultural environment factors and in each sector the demand for broadband and supply of broadband was considered. Although several factors played a role in the growth, two key factors were suggested that made the most important contributions: (i) infrastructure competition (supply side) and (ii) the high demand for broadband internet (demand side).

Infrastructure Competition between Technologies

The Korean government had played an important role of creating a competitive market environment through various policy measures of deregulation and this resulted in fierce competition in the broadband market. In infrastructure competition entrants into the market will have to build their own networks and in service

competition entrants can use existing networks and resell capacity on it (Yun et al., 2002). Therefore healthy competition between both infrastructure networks and within each network technology, for example within the ADSL market, plays an essential role in the deployment of broadband internet access. There has been vigorous infrastructure competition in Korea within and between ADSL and cable modem networks. Infrastructure competition was fuelled as new broadband Internet providers entered the market posing a serious challenge to existing Internet Service Providers (ISP). This inevitably led to price reductions and a low flat fee for quality service created greater demand for high-speed Internet access and the size of the market eventually grew exponentially (Yun et al., 2002).

Existing Demand and a Killer Application

Fierce competition induced lower prices and ultimately increased the demand for broadband Internet in Korea. This was not the only factor that contributed to increased demand as strong demand for fast connections existed prior to the commercial release of broadband (Yun et al., 2002). From 1996, access to the Internet grew at a rapid pace and many users who were "connected" via dial-up began demanding faster speeds. Internet cafés, referred to as "PC Bhangs" in Korea, introduced high speed access during the early stages of consumers Internet experiences and this was strong incentive for them to obtain a broadband connection.

"Killer Applications" are applications which force or urge users to buy or adopt the platform on which the application is running (Yun et al. 2002). Online gaming was listed as the main killer application for broadband demand as it required high bandwidth and Korea having a vast gaming culture (Kanellos, 2004) demanded higher access speeds to access it. If demand for high bandwidth can be matched by cultural expectations, in the case of Korea their emphasis was on education and knowledge, then diffusion would be fast. The Ministry of Information and Communications (MIC) of Korea setup Internet promotion policies based on the cultural demand for broadband Internet and this shows the importance of culture in the diffusion of technology (Yun et al. 2002).

Next Generation Broadband – Japan and South Korea take lead

Government's initiatives have led broadband to secure a strong foothold in Japan and South Korea. Japan offers the cheapest services to both consumers and businesses due to having some of the strongest competition at retail level. South Korea's government's Broadband Convergence Network (BcN) aims for 50Mbps access to 95% of the population by 2013. The country has already attained this in 2010 (Akamai, 2010). Almost US$50 billion of public funds were invested over five years in both software and fiber-to-the-home infrastructures (KPMG, 2005). Japan and Korea already have 99% of households using 8Mbps connections and recent reports show that 100Mbps connections are currently being provided in Japan (Akamai, 2010).

2.3.2 Developing Countries

Developing countries have been plagued by slow broadband growth with users numbering in the thousands (ITU, 2004). However, the broadband market in Africa is currently in a growth stage of development particularly with the launch of new undersea submarine cables and the influx of terrestrial fibre networks by the end of 2009. Albeit, it is still felt that Africa is lagging behind first world countries where broadband has taken off at quite a rapid pace.

Broadband services became commercially available during 2002 and 2003 where DSL, VSAT (two way satellite ground station) and cable technologies were deployed. Where monopoly exists, ISPs have to rely on the existing public telecoms operators, who wholesale their infrastructure to ISPs in order to resell it to subscribers. Regulations ensure that ISPs are not allowed to operate their own alternate infrastructure. In South Africa ISPs offer ADSL services over the infrastructure of Telkom South Africa. ADSL services in other countries, such as in Senegal or in Angola, had also been rolled out by incumbents (ITU, 2004).

High-speed broadband services over an incumbent's network in Africa are capped by a limited fixed infrastructure. With poor fixed line penetration rates ranging from 0.24 per 100 inhabitants in the Central African Republic or 0.5 in Ethiopia to 1.03 in Kenya and 12.98 in South Africa, the fixed line infrastructure is limited and focuses mostly in urban areas thereby limiting the rollout of broadband over DSL networks. According to ITU (2004) and MyBroadband (2009c), the lack of fixed line infrastructures in Africa and the lack of broadband technologies were not the only disabling factors, but also the lack of bandwidth. In 2001, for example, there was more international IP bandwidth (1.3Gbit/s) available to the 450 000 citizens of Luxembourg than the 820 million citizens of the African continent (1.2Gbit/s) (ITU, 2004). Other factors also include prices of PCs and devices needed to access broadband Internet. Although the exchange rate in certain African countries is strengthening against the US dollar, many still cannot afford these PCs and devices (Naidoo et al., 2006; MyBroadband, 2010b). In addition Africa has some of the world's highest costs for international calls and bandwidth, making it far more expensive for African ISPs to operate than their developed world counterparts (ITU, 2004). However, with international gateway switches and the launch of undersea submarine cables direct interconnectivity can be established with many international carriers resulting in cheaper international calls (Deign, 2010).

2.3.3 South Africa

2.3.3.1 Current Broadband Players

Telkom

Telkom is a semi-privatized, wire-line telecommunications provider and is a 39% state owned company that is listed on the Johannesburg Stock Exchange (JSE) and the New York Stock Exchange (NYSE). Telkom has a monopoly on both handling international connections to and from South Africa on the SAT3 (undersea cable) & SAFE backbone lines, which account for the majority of international bandwidth in the country, and fixed-line communications over public roads (Naidoo et al., 2006).

Telkom has been marketing its ADSL services since August 2002. It has had only limited success. This is due mainly to the high prices that it charges, and service restrictions such as bandwidth traffic caps placed on the majority of ADSL products. Telkom had started WiMAX wireless and intended to offer this as a complimentary service to ADSL (Naidoo et al., 2006). However, with the launch of the SEACOM undersea cables, Telkoms ADSL subscribers had increased in 2010 by 18.1% from the 2009 year with an estimated figure of 650 000 subscribers (Telkom, 2010). This can be attributed to various ISPs offering uncapped solutions and the recent increase of Telkom's ADSL line speeds to 10Mbps.

iBurst

iBurst is a recent addition to the wireless broadband market and offers access to high speed internet connectivity up to 1Mbps. iBurst services are based on IntelliCell technology from ArrayComm in the US. Wireless Business Solutions (WBS) was established in 1997 and holds a National Mobile Data Telecommunication license, as well as the South African license for the iBurst mobile broadband Internet technology. WBS is a shareholder in WBS Service Provider trading as iBurst, which has been operational since 1 April 2005 (iBurst, 2010).

Cellular Service Providers

Vodacom was the first mobile telecommunications company in South Africa and is the leading cellular provider accounting for more than 16 million subscribers. Moreover it was the first cellular company to roll out 3G and HSDPA in the country using marketing plans based on the global Vodafone mobile network that claims to be the world's largest. Initial roll-out had been slower than anticipated however with new price revisions and more favourable packages, this situation had improved (Naidoo et al., 2006, MyBroadband, 2010c).

Vodacom was initially 50% owned by Telkom and the other 50% owned by Vodafone, the world largest mobile phone operator based in Newbury, United Kingdom. Recently, Telkom had sold 15% of its stake to Vodafone and had unbundled its remaining 35% shares to Vodacom shareholders, who are members of the public (Goldstuck, 2008).

Vodacom's competitors are Mobile Telephone Network (MTN), Cell C and Virgin Mobile. Virgin Mobile, the latest addition in the mobile market, has a fifty-fifty joint venture with Cell C. MTN is the second largest cellular competitor followed by Cell C which is the third largest. Both companies offer 3G services to the country in

response to and comparable to Vodacom Packages (Naidoo et al. 2006, MyBroadband, 2010c).

Wireless Internet Service Providers (WISP)

WISPs are Internet Service Providers with wireless (Wi-Fi, WiMAX) last mile connections. WISPs make up only a tiny portion of the broadband market. There is some debate as to whether these WISPs do indeed offer genuine broadband connectivity (Naidoo et al. 2006). Uninet and Wireless-Online are two of many WISPs available in the market today.

Neotel

Neotel is the second national operator (SNO) formerly known as SNO Telecommunications. In 2006 it had won the right to become the second national operator in South Africa and is the first direct competition to Telkom. Neotel first began its service offerings in late 2007 to businesses and in May 2008 to consumers offering local and international leased lines, voice and data lines, and Internet services (Sverdlik, 2009).

Neotel is currently owned by Tata Communications, India's largest telecommunications provider, with a 56% stake and black empowerment group Nexus with local entrepreneurs CommuniTel and Two Telecom Consortium with stakes of 19%, 12.5% and 12.5% respectively (Stones, 2008).

Neotel in partnership with SEACOM, the developer of a private submarine fibre optic cable, launched the first majority African-owned, open access, undersea fibre optics cable linking southern and east Africa to India and Europe. Through the partnership, Neotel owns the cable landing station and all facilities within the South African territory (van der Merwe, 2009).

The SEACOM cable was switched-on on the 23rd of July 2009. There are hopes that the cable would increase internet connectivity speeds, decrease prices by up to 90% and decrease congestion of the monopoly owned SAT-3 cable (van der Merwe, 2009). In addition, SEACOM had initiated the first uncapped offerings by ISPs. It is yet to be seen whether the SEACOM cable would meet these offerings in the near future as Neotel's consumer service offerings are currently only available to major cities (Johannesburg, Pretoria, Cape Town and Durban) (van der Merwe, 2009).

2.3.3.2 Price of Broadband

The price of broadband depends on the Internet Service Provider (ISP) chosen and the service plan selected with that provider (Sacks, 2002). The costs therefore incurred are usually:

1. A once-off connection fee or installation charge;
2. A monthly access fee that is dependent on the amount of data transferred;
3. The cost of hardware or software required.

Although the prices of broadband are to some extent higher than narrowband, it is still comparable to the price of subscribing to an ISP using ISDN or a 56K modem (Zhang, 2002). Broadband prices are plunging worldwide and this is more noticeable in the mobile market. With the release of the "super-fast" HSDPA, Vodacom had decided to allow existing customers to swap their old cards for the new one. This had cost Vodacom an amount of R100 million and shows the commitment of the company to bring value to its users in the broadband space (Muller, 2006).

Recently, South Africa has seen a drop in broadband prices. Table 1 below illustrates the current market players and the prices of broadband internet access that they offered in South Africa in 2006. The standard pricing from operators was selected.

Telkom (www.telkom.co.za)			
Connectivity	**Monthly Rental (with 3Gb cap)**	**Download/Upload Speeds (Kbps)**	**Conditions**
HomeDSL192 – Consumer	R540	192/64	Installation extra (Once-Off), Modem extra, ISP extra, Higher Gig caps available at extra cost
HomeDSL 384 – Consumer	R630	384/128	
Business & HomeDSL 512	R750	512/256	
Business & HomeDSL 1024	R950	1024/512	
iBurst (www.iburst.co.za)			
Connectivity	**Monthly Rental (with 3Gb cap)**	**Download/Upload Speeds (Kbps)**	**Conditions**
iBurst 1Mb	R599	1Mbps	Modem extra, Installation extra, Higher Gig caps available at extra cost
Vodacom 3G (HSDPA) (www.vodacom.co.za)			
Connectivity	**Monthly Rental (with 3Gb cap)**	**Download/Upload Speeds (Kbps)**	**Conditions**
MyMeg 3Gb	R1497	1.8Mbps	24 month contract, Out of bundle charges, Higher Gig caps available at extra cost
Wireless-Online (WISP) (www.wirelessonline.co.za)			
Connectivity	**Monthly Rental (with 3Gb cap)**	**Download/Upload Speeds (Kbps)**	**Conditions**
@Work Velocity 3	R799	512/256 1Mbps bursts	Installation extra (Once-off) Out of cap charges Higher Gig caps available at extra cost

Table 1: Comparison of Broadband Pricing in South Africa in 2006 (Source: Individual Company Websites)

Table 75 in Appendix A illustrates the current prominent market players and prices of broadband internet access they offer as of November 2009. The standard pricing

from operators was also selected. The table illustrates the local speed of the service, international speeds when access international sites, the average speed obtained from the service, costs per month, the amount of GB (bandwidth) that can be used before being capped and the cost per Mbps per GB of international bandwidth.

Comparing the prices from the 2006 year to the 2009 year, it can be seen that prices have dropped during the course of the 3 years. For example, when comparing Telkom's 1Mb ADSL line with a 3GB cap in 2006 which costs R950pm to Telkom's 4Mb ADSL line with a 5GB cap in 2009 which costs R685pm, it can be seen that the price has been reduced significantly. At this lower price a consumer gets a higher speed line as well as higher bandwidth to use.

A more recent survey conducted by MyBroadband (2010c) in September 2010, showed a further decrease in prices. Table 76 in Appendix A illustrates the current prominent market players and prices of broadband internet access they offer as of September 2010. Cell C's new 21 Mbps HSPA+ service offers the best pricing in the South African cellular market. Historically fixed broadband offerings provided a superior value proposition; however, the survey shows that this may not be the case any longer.

These price cuts were partly driven by lower international bandwidth costs available through SEACOM (MyBroadband, 2009b). Operators of the existing cable delivering bandwidth to South Africa, the SAT-3 cable, have lowered prices by about 50% in anticipation of the increased competition from SEACOM (van der Merwe, 2009). However, when compared to international standards these prices are still exceptionally high and not affordable to the majority of consumers. According to Naidoo et al. (2006), Lopez & Rey (2009) and Bernabé (2010) the local call rates are relatively high in international terms and "increasing faster than inflation". When additional costs are factored in, the cost of internet access will be unaffordable to most consumers. Therefore future broadband uptake will depend heavily on Internet costs.

Moreover, according to MyBroadband (2009c), South Africa is ranked 103rd in the world broadband speed rankings taking into account the cost to speed ratio of broadband services. Among the highest is Korea still dominating the broadband speed race followed by Japan in second place and Aland Islands third. The top 10 are completed by Latvia, Romania, Lithuania, Sweden, Netherlands, Bulgaria and Andorra (MyBroadband, 2009c).

2.3.3.3 Availability and Uptake of Broadband

The year 1996 showed the first commercial launch of the Internet in South Africa. During this period South Africa was pronounced the leader of internet usage in Africa as the country had produced exceptional Internet user statistics (Gillwald & Kane, 2003). However, this is currently changing and South Africa is fast losing ground to its African neighbours. Gillwald and Kane (2003) indicate that the growth

rate of Internet users has rapidly dropped and the country has produced one of the slowest growth rates in the world.

In 2002 Telkom commercially launched broadband Internet. According to Gillwald (2002) the broadband internet adoption had been relatively slow. From its inception to the end of 2003, Telkom is estimated to have registered only 2500 ADSL subscribers (Gillwald & Kane, 2003).

As of 2006 only 7.4% of the South African population had access to the internet. Studies by Webchek Online Research (Boer, 2006) indicated that 11% of people in the metropolitan areas had internet access. Of that percentage, 6% attained their access to the internet from home while 9% had access via their work. Only 4% of rural-dwelling South Africans had access to the internet: 2% from their homes and the other 2% from their workplaces.

By 2010 Telkom estimated approximately over 650 000 broadband subscribers (Telkom, 2010). This, although a small figure, is a huge growth of the medium: it is significant if one considers that each of those 650 000 subscribers usually reach more than one person.

Vodacom is the second most popular service offering its HSDPA/3G packages. The subscriber base is seen to exceed 1 million mobile broadband subscribers (MyBroadband, 2010d). Telkom took over two years to attain a similar figure even though their market was completely untapped. MTN has now claimed third position with over 700 000 subscribers to its HSDPA/3G services (MyBroadband, 2010d). With Cell C's role out of its "4Gs" service, which is currently the cheapest and fastest broadband offering (MyBroadband, 2010c), it is expected that market share would be gained from Vodacom and MTN.

If broadband internet access is adopted more prevalently, BMI-TechKnowledge's report (Mzolo, 2005) estimates that much revenue can be generated. More subscriptions to broadband will occur if improvements in price and performance are made and larger shares of this potential revenue generated from broadband internet adoption will come from ADSL. Goldstuck (2010) speculates that the business market will contribute two-thirds of this revenue and contrasts international statistics for developed countries, where the majority of ADSL subscribers are residential, and residential subscribers produce half of the revenue generated. This suggests that South Africa has a low level of residential penetration (ibid) and even though improvements in price and performance will increase penetration rates, the internet access will remain underdeveloped.

As compared to the rest of the continent South Africa has a highly advanced telecommunications infrastructure (De Argaez, 2005, Goldstuck, 2010). It boasts the highest landline rate and accounts for nearly 5% of the continent's internet users (InternetWorldStats, 2010). Albeit, compared to the developed world, South Africa's broadband internet access is seen as inferior. In North America, Europe and Asia,

broadband gain new users daily at an exponential rate. So too does South Africa but at a much slower rate. South Africa currently has around 4 broadband connections per 100 inhabitants. This is well below the OECD standard of 23.3 fixed broadband subscribers per 100 inhabitants. Other figures show that fixed broadband penetration rate in South Africa falls below 0.5% which is below the lowest ranked OECD countries like Turkey (9%), Mexico (9.2%) and Chile (9.6%) (Goldstuck, 2010).

However, signs of accelerated growth are starting to show. Growth in the number of Internet users in South Africa was relatively stagnant from 2002 to 2007, when it never rose above 7%. However, this rate almost doubled in 2008, and continued accelerating in 2009 (Goldstuck, 2010).

Future of South Africa's Broadband

South Africa's broadband penetration rate remains poor when compared to developed countries (Goldstuck, 2010). However, reports have shown that there are signs of potential increase in broadband access in the country. The licensing of the second national operator (SNO), Neotel, by the government meant that the monopoly currently enjoyed by Telkom has come to an end (InternetWorldStats, 2010). The rollout of the SEACOM cable and the healthy rand-dollar exchange rate, will also significantly contribute to increased access in the country.

South Africa is already seeing reduction in prices by ISP players such as Afrihost selling 1GB bandwidth at R29 per GB as compared to the market standard of R70 (MyBroadband, 2009d). As mentioned, this was largely part to the introduction of the SEACOM cable, however, van der Merwe (2009) states that in future the prices will not go down but rather capacity will increase at the same price - 'more bang for buck'. A good example is when Telkom has announced improved data cap offerings to its customers and noted that packages with 2GB caps would be lifted to 3GB, and 3GB caps would be raised to 5GB keeping the same price levels (van der Merwe, 2009). In addition to the launch of the SEACOM cable, the EASSy cable was also launched linking South Africa to Sudan. This ensures that more bandwidth enters the country hopefully increasing competition and reducing the price of international bandwidth. Three new cables are expected to go live by the end of 2012, namely, the WACS, Main One and ACE. With the launch of these cables, South Africa is expected to see a capacity increase of nearly 400% (Goldstuck, 2010).

2.4 Developing the Broadband Diffusion Model

The Rogers (2005) definition of "diffusion" suggests that it involves the adoption of new innovation, its usage and subsequent impact of usage. The proposed model within this research will therefore include constructs relevant to adoption, usage and impact on household consumers. In this section, the current theories for broadband diffusion are reviewed and the theoretical gap that this research aims to fill is sketched. Secondly, a model based on previous literature is proposed.

Over the past two decades, an increasing body of work attempted to explain and predict user acceptance/adoption of new technologies. Subsequently, there have been various theoretical frameworks proposed on the subject of broadband adoption and use. Similarly, various studies, such as those mentioned above, have been performed using these theoretical frameworks to explain the adoption and use of broadband. Some of the most commonly used ones include the Technology Acceptance Model (TAM) by Davis (1989), the Innovation Diffusion Theory (IDT) by Rogers (1995) and the Decomposed Theory of Planned Behaviour by Taylor & Todd (1995). Other theoretical models, which have been used, include the Theory of Reasoned Action (TRA), proposed by Ajzen & Fishbein (1975) and the Theory of Planned Behaviour (TPB) by Ajzen (1991).

For the needs of IS research these theories were modified, extended and integrated in order to understand and predict technology adoption and usage. Examples include Taylor and Todd's (1995) decomposed TPB where the Theory of Planned Behaviour has been modified and integrated with the Diffusion of Innovations constructs. Venkatesh and Morris (2000) extended the TAM by integrating gender and subjective norm constructs with the original TAM. Venkatesh and Brown (2001) modified the TPB to study technology adoption issues in the household. According to Choudrie and Dwivedi (2004b), while these models and theories have been widely tested and validated to explain usage and adoption of technology from a users perspective, limited studies have been done with regards to consumers. This section will therefore review the various technology diffusion and adoption models in order to highlight their strengths and weaknesses to study the adoption and usage of technology from a consumer's perspective.

2.4.1 Technology Acceptance Model

Derived from TRA, the Technology Acceptance Model (TAM) denotes an important theoretical contribution towards understanding Information Systems (IS) usage and IS acceptance behavior (Malhotra & Galletta, 1999).

TAM suggests that when users are presented with a new technology (Broadband), a number of factors influence their decision as to whether to use it or not. TAM, as portrayed in Figure 2 essentially underlines two main principles: 'perceived usefulness' and 'perceived ease of use'. 'Perceived usefulness' is defined as "the degree to which a person believes that using a particular system (Broadband) would enhance his or her job performance" (Davis, Bagozzi & Warshaw, 1989). 'Perceived ease of use' on the other hand, relates to "the degree to which a person believes that using a particular system (Broadband) would be free of effort" (Davis et al., 1989).

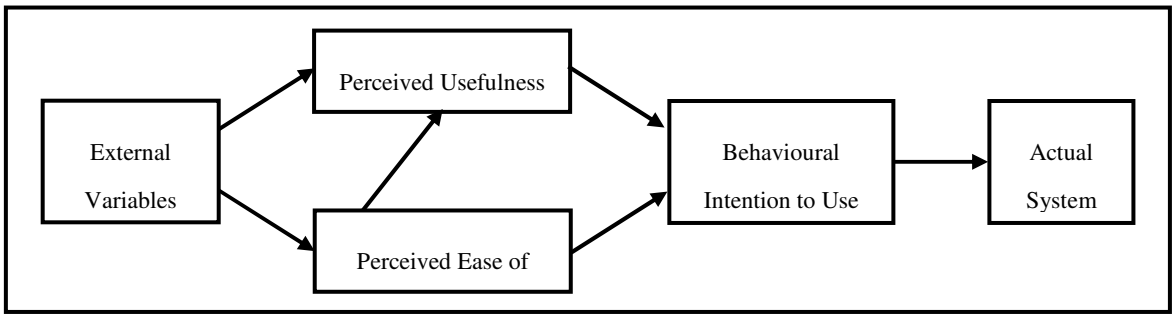

Figure 2: Technology Acceptance Model (Source: Davis et al., 1989)

TAM has been used to test a wide variety of applications and it has produced consistent results. TAM has certainly been the most widely used and tested model as compared to the other technology acceptance models proposed above, and there is substantial theoretical and empirical support in its favour (Venkatesh & Davis, 2000). The significance of 'perceived usefulness' and 'perceived ease of use' has been validated by numerous studies, hence demonstrating its strength and rigour in the field of Information System (Dillon, 2001). According to Choudrie and Dwivedi (2004b) the TAM model was successful in studying the user's intention of adoption of technology and its usage. However, its application is yet to be investigated for consumers within the household context. As a result, the TAM constructs were not considered for their broadband diffusion model, instead constructs similar to perceived usefulness, which is relative advantage, is considered in their conceptual model (Choudrie and Dwivedi, 2004b).

2.4.2 Theory of Planned Behaviour

The TRA has been applied to explain the behaviour beyond the acceptance of technology and includes four general concepts: behavioural attitudes, subjective norms, intention to use and actual use. It argues that individuals evaluate the consequences of a particular behaviour and create intentions to act that are consistent with their evaluations (Fishbein and Azjen, 1975). The TRA was criticised because it did not describe conduct of individuals who had little power or control over their behaviour. Therefore, a third construct namely 'perceived behavioural control' was added to the TRA model to make it more applicable to situations where the individual does not have full control over the situation (Ajzen, 1991). The major constructs of TPB are 'perceived behavioural control', 'attitude' and 'subjective norm' as shown by Figure 3 below.

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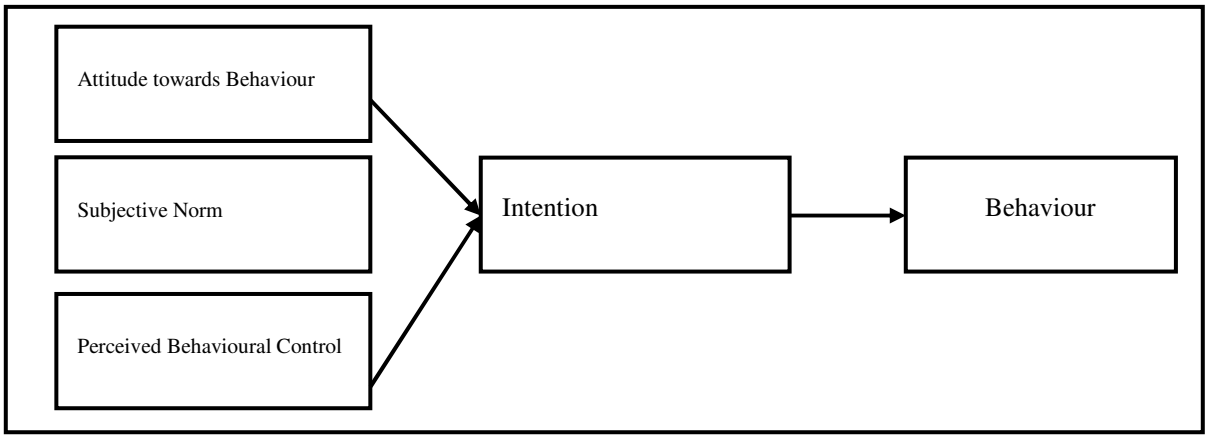

Figure 3: Theory of Planned Behaviour (Source: Taylor & Todd, 1995)

The significance of 'perceived behavioural control' on Information Technology adoption has been validated by numerous studies and can serve as an effective diagnostic tool to examine IT adoption or acceptance and usage (Benbasat & Zmud, 1999). Therefore Choudrie and Dwivedi (2004b) suggest that all the core constructs of this model be used to develop the proposed model.

2.4.3 Decomposed Theory of Planned Behaviour

The decomposed TPB model (DTPB), combines theoretical constructs from TAM and IDT with the TPB. Eight antecedents were added to the original TPB constructs as shown in Figure 4 below (Taylor & Todd, 1995). This was done in order to increase the predictability of TPB, therefore the decomposed attitudinal belief dimensions and innovations characteristics was included as different dimensions of the attitudinal construct.

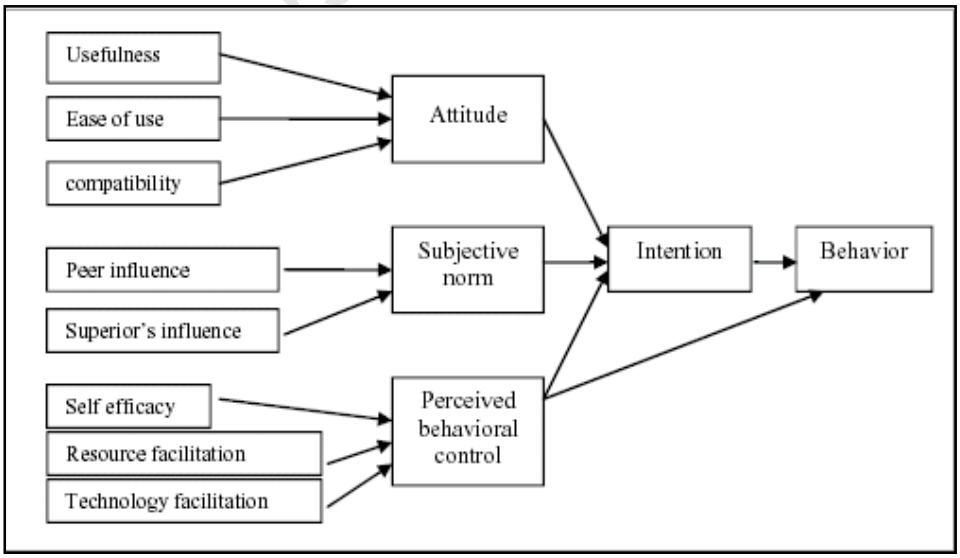

Figure 4: Decomposed Theory of Planned Behaviour (Source: Taylor & Todd, 1995)

2.4.4 Diffusion of Innovations

The Diffusion of Innovations (DoI) theory by Rogers (1995) provides a fundamental approach for the study of adoption of innovations and is the process through which an individual makes a decision of whether to adopt an innovation or not. Diffusion is a social change and is the process by which an innovation is communicated among members of the social system (Rogers, 1995). Diffusion takes place over time initially with a slow growth period, thereafter a rapid growth period, gradual stabilisation and finally a decline (Sacks, 2002).

According to Rogers (1995) innovation is an idea, practice or object that is perceived as new. Innovation can be material or immaterial. The adoption of material issues brings about social relations and therefore immaterial issues arise from the adoption of material innovations. For example culture changes with changes in material conditions (Rogers, 1995). Understanding relationships between social issues such as culture, values, existing practices and political, social and economic relations is a necessary element of technology transfer.

Rogers (1995) has identified five attributes of innovations that are interrelated with the adoption of innovations and determine the rate of diffusion of an innovation. These attributes are as follows:

- **Relative advantage**: The degree to which the innovation (Broadband) is perceived to be better than the existing technology (e.g. dial-up, ISDN or leased lines);
- **Compatibility**: The degree to which the innovation (Broadband) is perceived to fit with the experiences, needs and values of potential adopters;
- **Trialability**: The degree to which the individual can try out the technology before committing to its use;
- **Observability**: The degree to which the results of adoption of an innovation (Broadband) are visible to others;
- **Complexity**: The degree to which the innovation (Broadband) is perceived to be difficult to understand and use.

The first four factors are generally positively correlated with rate of adoption while the last factor, complexity, is generally negatively correlated with rate of adoption (Rogers, 1995). Rogers (1995) also proposes a 5 stage model through which a technological innovation passes and is illustrated by Figure 5 below:

- **Knowledge**: Exposure to its (broadband) existence, and understanding of its (broadband) functions;
- **Persuasion**: The forming of a favourable attitude to it (broadband);
- **Decision**: Commitment to its (broadband) adoption;

- **Implementation**: Putting it (broadband) to use; and
- **Confirmation**: Reinforcement based on positive outcomes from it (broadband).

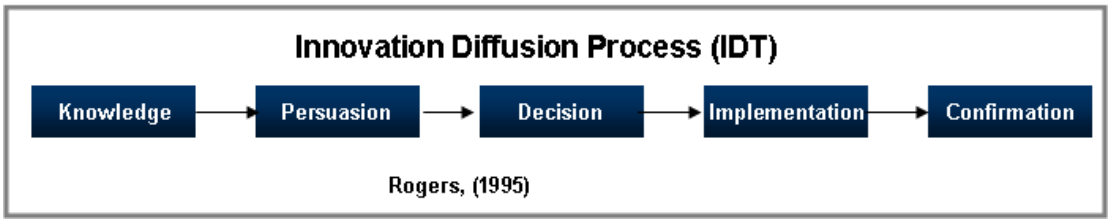

Figure 5: Innovation Diffusion Process (IDT) (Source: Rogers, 1995)

A meta-analysis on 75 articles on IS innovation research concluded that relative advantage, complexity and compatibility are the most probable determinants of adoption (Tornatzky and Klein, 1982). Since these characteristics are applied in diverse situations and easily integrated with constructs from other theories and models, it therefore becomes useful to consider the appropriate innovation characteristics to examine the diffusion of broadband (Choudrie and Dwivedi, 2004b).

2.4.5 Model of Adoption of Technology in Households

The model of adoption of technology in households (MATH) model states that technology adoption, particularly the Personal Computer (PC), in the household is determined by a number of factors (Venkatesh and Brown, 2001). These include the attitudinal belief structures such as utilitarian outcomes, hedonic outcomes and social outcomes; normative belief structures such as the influence of friends, family and secondary information sources; and control belief structure that consists of three barriers namely knowledge, difficulty of use, and cost. However the model focuses mainly on the PC and is different from broadband in terms of cost, durability, observability and use (Choudrie and Dwivedi, 2004b). In addition while the majority of constructs included in this model are also useful to study broadband adoption the constructs from this model do not provide insights to the phenomenon of diffusion. They only shed light upon the adoption part of it. Therefore only the important constructs within the model are used to examine the adoption of broadband in the household (Choudrie and Dwivedi, 2004b). The study by Dwivedi and Choudrie (2004a) suggested that demographic attributes such as age, education and occupation could have a moderate impact upon the important constructs. Therefore these socio-economic factors were also considered in the adoption model.

2.4.6 Use Diffusion Model

Figure 6 below represents a conceptual model of the use diffusion (UD) theory. Shih and Venkatesh (2004) state that previous diffusion studies have focused mostly on the adoption perspective. Researchers have stated that there are limitations to the adoption diffusion (AD) of technology and though the diffusion processes cannot be understood without studying the nature of adoption, to complete the diffusion story, use-diffusion processes also need to be examined (Shih and Venkatesh, 2004). Shih and Venkatesh's (2004) research extends the diffusion concept further with a systematic study of post-adoption UD.

While the variable of interest in AD models is rate or time, in the UD model, the variable of interest is use or, more specifically, rate of use and variety of use. The theoretical elements for the UD model are the evolving nature of use (rate and variety), sustained continuous use (or non adoption), and technology outcome considerations (technology integration, perceived essentialness of technology, impact of technology, and user proneness to adopt new technologies) (Shih and Venkatesh, 2004).

The study concludes that user segments vary on the basis of social context and technological makeup of the household, personal factors, external factors, user satisfaction with technology and interest in using future technologies (Choudrie and Dwivedi, 2004b).

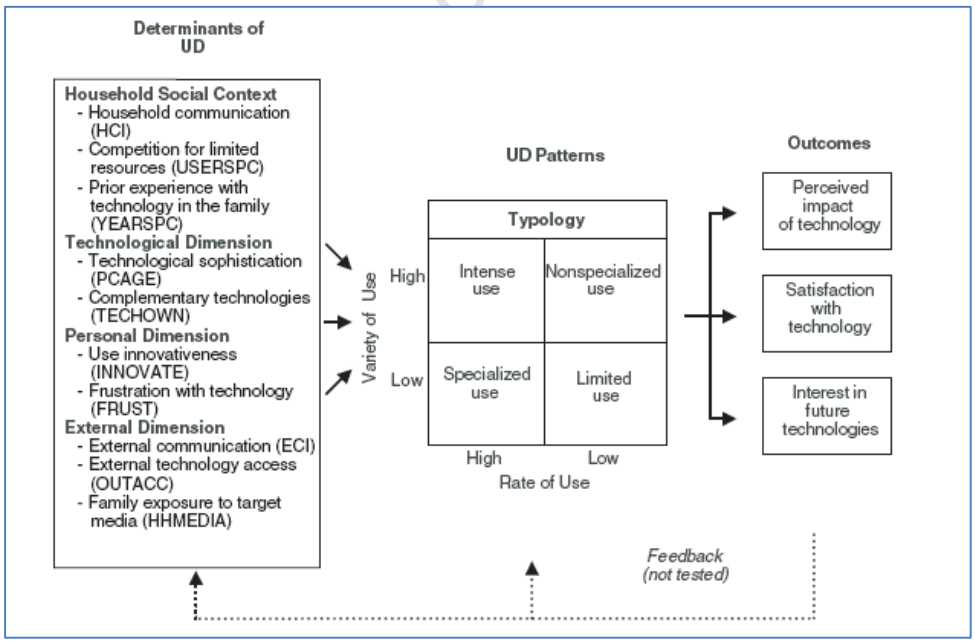

Figure 6: Use Diffusion Model (Source: Shih and Venkatesh, 2004)

2.4.7 Choudrie and Dwivedi's Model for Broadband Diffusion

Choudrie and Dwivedi's (2004b) model was used to determine diffusion factors of broadband adoption in the United Kingdom (UK). The research model was chosen due to the limitations of previously published models of broadband adoption. Choudrie and Dwivedi (2004b) included the constructs which are important to understand initial adoption as well as sustained adoption, usage and impact (Choudrie and Dwivedi, 2004b). This therefore provides a holistic view of the broadband diffusion phenomenon.

The model is derived from the Model of Technology Adoption in Households (MATH) (Venkatesh and Brown, 2001) which is based on the decomposed Theory of Planned Behaviour (TPB) (Taylor and Todd, 1995) and a subset of the Diffusion of Innovations (Rogers, 1995). The usage and impact component of the model was derived from Shih and Venkatesh's (2004) model of Use Diffusion.

For the adoption component the decomposed TPB provided better predictive power than TPB (Ajzen, 1991) and the Technology Acceptance Model (Davis, 1989). However, the limitation of the decomposed TPB is that it does not examine the adoption of a technology in the household context as it examined user's adoption of IT at an organisational level (Choudrie and Dwivedi, 2004b; Dwivedi, 2008). Choudrie and Dwivedi (2004b) had therefore used the MATH model as it examined the consumer's adoption of broadband within the household context. The proposed model for the adoption component, illustrated by Figure 7 below, postulates that a consumer's intention to adopt broadband at home is determined by three independent constructs (Taylor and Todd, 1995; Venkatesh and Brown, 2001). These are (Choudrie and Dwivedi, 2004b; Dwivedi, 2008):

- **Attitudes towards behaviour** – describes the perception towards broadband technologies
- **Subjective norms** – describes the social influences that may affect the intention to adopt broadband
- **Perceived behavioural control** - describes the beliefs about having the necessary resources and opportunities to adopt broadband in the home

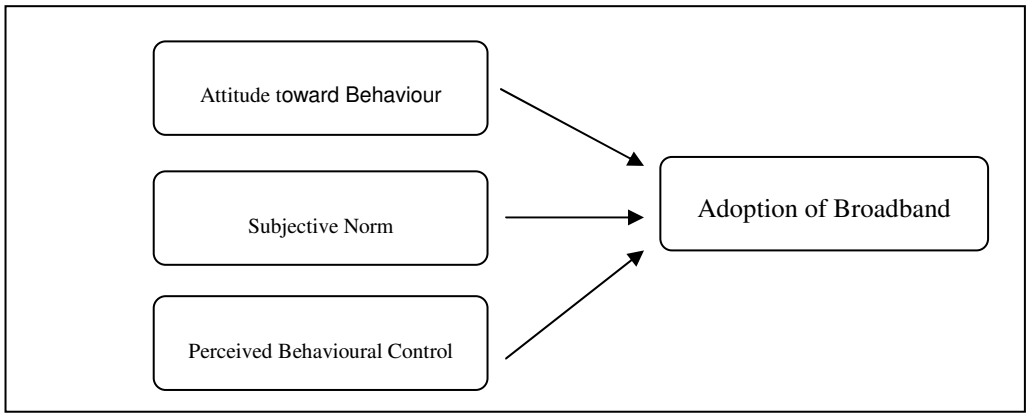

Figure 7: Model for the adoption of Broadband in the Household (Source: Choudrie and Dwivedi, 2004a)

According to Choudrie and Dwivedi (2004a), the three constructs determine and explain the intention to adopt broadband and this in turn is expected to predict the actual adoption of broadband.

The usage component of the model postulates that the actual usage of broadband can be determined by (Choudrie and Dwivedi, 2004b; Dwivedi, 2008):

- The social contexts of households
- Personal dimensions of consumers and users
- The variety of use
- The rate of use

The model also postulates that a consumer's intention to adopt and make use of broadband is explained by the socio-economic attributes of adopters and non-adopters. These are age, education, income and occupation that have an impact on attitude and perceived control behavioural constructs (Choudrie and Dwivedi, 2004a).

2.4.8 Proposed Model for Broadband Diffusion in Households of South Africa

Choudrie and Dwivedi's (2004b) study Towards a Conceptual Model of Broadband Diffusion was used as a basis for the development of the broadband diffusion model in the household within the South African context. The study is suitable in this respect as firstly, Choudrie and Dwivedi (2004b) have provided a comprehensive review of the existing information systems literature with respect to users and consumers adoption of technology. This is with an emphasis on broadband. Here the authors reviewed and assessed previous adoption models and constructs and have identified the appropriate constructs from the various models that are used to understand household diffusion of broadband. Based on the review they have developed a conceptual model.

Secondly, while the conceptual model was built to study broadband diffusion within the United Kingdom, in South Africa similar technologies such as ADSL, HSDPA and WiMAX, to name a few, are in place. Therefore constructs within Choudrie and Dwivedi's (2004b) model should be appropriate to determine the diffusion of broadband within the South African context. However certain factors, such as demographics and broadband costs within the constructs may prove to be different since the situation is quite different in these two countries.

Thirdly, developing the model based on Choudrie and Dwivedi's (2004b) research could possibly help to differentiate the usage and impact of broadband technology across culture. This would lead to understanding why there is fast uptake in one country, whilst slow in others.

Due to the large number of choices between the different theories and models, selecting an appropriate model or various constructs poses a problem for technology adoption researchers. Taylor and Todd (1995) proposed two main criteria for selecting an appropriate model:

1. The model must provide good prediction while being parsimonious
2. **The model must provide both reasonable predictive ability and contribute enough to understanding the phenomenon under investigation**

Dwivedi (2008) stated that the second criteria be chosen as all the constructs from various models are included in the model which may in the future provide insights to understanding the three stages of diffusion. To maintain parsimony of the exploratory model less significant constructs will be eliminated.

This section will provide a description of the proposed model for broadband diffusion in South Africa. It will first identify initial adoption which will attempt to identify the factors that affect the decisions of broadband adopters and non-adopters. It will then identify sustained adoption factors (if broadband is eventually adopted) that are responsible for the usage of broadband and how these impact on the lives of the consumers.

Constructs from the Use Diffusion Theory (Shih and Venkatesh, 2004) are used to investigate usage and impact of broadband technologies.

2.4.8.1 Initial Adoption

An initial study by Lee, O'Keefe and Yun (2001) on the deployment of broadband in South Korea had identified three factors that explained a high rate of adoption. Further research by Lee and Choudrie (2002), Choudrie, Papazafeiropoulou and Lee (2003) and Choudrie and Lee (2004) identified successful strategies for driving high penetration rates within South Korea. The exploratory study of Internet Service Provider (ISP) views on factors affecting broadband adoption in the UK showed that "high price, lack of content, and lack of awareness" (Dwivedi, Choudrie and Gopal, 2003; Choudrie and Dwivedi, 2004b, p325) influence the adoption of residential

broadband. Other studies include Sweden (Shim, Lee and Yun, 2003), Australia and Canada (Gardner, 2003; Chang, Lee and Middleton, 2003).

Oh, Ahn and Kim (2003) examined individual factors affecting the adoption of broadband in South Korea. The findings suggest that adopting new technologies affect users' attitudes through perceived usefulness, perceived ease of use and perceived resources (Choudrie and Dwivedi, 2004b). Other studies include Dwivedi and Choudrie (2004a) adaptation of the model of adoption of technology in the household. Choudrie and Dwivedi (2004a) provided a detailed description of the factors mentioned above and reasons for including these factors in the proposed model. This section aims at providing a summary of the factors and sub-factors included in the model.

Attitude

Venkatesh and Brown (2001) stated that the different magnitudes of attitudinal belief towards the adoption of the PC within the household can be measured using three core variables. These are utilitarian outcomes, hedonic outcomes and social outcomes. However, according to Choudrie and Dwivedi (2004a), since broadband is not directly an observable product, the social outcome construct was considered irrelevant and was removed from the model. Instead the relative advantage (Rogers, 1995) construct was used. The service quality construct (Choudrie and Dwivedi, 2004a; Dwivedi, 2008) was also included as this represents whether an individual will still use broadband or not after adopting it.

Relative Advantage

As broadband offers "faster, un-metered, always on access to the Internet", it provides "significant advantage, convenience and satisfaction" in comparison to dial-up access (Choudrie and Dwivedi, 2004a, p331).

Hedonic Outcomes

The entertainment offered by the PC was greatly enhanced by the start of the Internet. The opportunity of playing online games, downloading music and video, chat and sending online messages was made possible. However this was severely hindered by dial-up speeds. Broadband therefore offers faster download and streaming capabilities providing a more convenient and compelling environment (Choudrie and Dwivedi, 2004b; Koumbati, Lal and Chen, 2007).

Utilitarian Outcomes

Broadband can offer a more flexible lifestyle. In this sense Choudrie and Dwivedi (2004b) mentions that this is due to people subscribing to broadband to work at home instead of the office, assist children with homework and other household activities.

Subjective Norms

Social Influences

Venkatesh and Brown (2001) have considered social influence of family, friends, TV and newspapers as a construct that measures subjective norms. They suggest that social influences are important determinants of the purchasing behaviour of PC. Similarly Choudrie and Dwivedi (2004a) state that social influences are also important determinants of broadband adoption.

Perceived Behavioural Control

Venkatesh and Brown (2001) had identified five barriers that inhibit the adoption of PCs in the household. These are rapid change in technology, declining costs, the high cost of PCs, ease/difficulty of use and a requisite knowledge of the use of PCs. Choudrie and Dwivedi (2004b) suggest that since the subscription of cost of broadband is stable and technology is not changing rapidly, declining costs and rapid changing factors were omitted. It is important to note here that this is on the basis of the conditions of broadband subscriptions in the U.K. Therefore the factors of high costs, the ease/difficulty of PCs and Internet use, the lack of knowledge of broadband benefits, and the lack of needs are used as factors that inhibit the adoption of broadband (Choudrie and Dwivedi, 2004b; Koumbati, et al., 2007).

Cost

Choudrie and Dwivedi (2004a) state that previous studies in the UK suggest that high monthly cost is a major barrier that is inhibiting the adoption of broadband in the household and therefore "it is expected that if perceived cost is high, then adoption will be slow" (Choudrie and Dwevidi, 2004b, p333). Furthermore, broadband technology may not be compatible with old PCs and there is a need to upgrade or purchase new PCs. This may pose a problem as PCs are not an easily replaceable commodity for medium and lower income households (Choudrie and Dwevidi, 2004b; Koumbati, et al., 2007).

Requisite Knowledge

According to Rogers (1995), the level of knowledge about an innovation, its risks and benefits affect the adoption rate. In South Korea, consumers were made aware of the benefits of broadband and this was essential to satisfy their needs (Choudrie and Dwivedi, 2004b; Koumbati, et al., 2007). A clear message of broadband usage and its benefits need to be made.

Skills of Using PC and Internet

Since the use of broadband requires using the PC and Internet, the ease or difficulty of use and the requisite knowledge of a PC and Internet use are expected to have an impact on broadband adoption (Choudrie and Dwevidi, 2004b; Koumbati, et al., 2007).

During the initial adoption phase the model will follow the five stage process similar to that of the Diffusion of Innovations theory. Therefore initial adoption will start with knowledge (exposure and understanding), proceed with persuasion (favourable attitude) and end with decision (commitment to adopt). The Model of Broadband

Adoption in the Household (Choudrie and Dwivedi, 2004a; Choudrie and Dwivedi, 2004b; Dwivedi, 2008) is therefore deemed appropriate to identify factors for the initial adoption phase. The proposed model will use the same constructs as that of Choudrie and Dwivedi's (2004a) model of broadband adoption in the household for reasons outlined by Choudrie and Dwivedi (2004b) in section 2.4.7 above.

Other attitudinal factors that were not included by Choudrie and Dwivedi (2004b) but were found to be necessary are **security** and **technology comfort** (DCITA, 2004). DCITA (2004) states that the decision to adopt broadband depends on a number of physical factors and on the demographics of households involved, but also on the attitudes of the members of the household. These concern issues of security/privacy fear or lack thereof and technology comfort or discomfort which are explained below:

Security

Broadband can offer security to consumers concerned with invasion of privacy or the control of family content. Security in broadband can bring comfort when people are giving their credit card details online or when doing grocery shopping (DCITA, 2004).

Technology Comfort

Broadband can offer the comfort with learning a new technology and be used as an information tool (DCITA, 2004)

The perceived behavioural construct consists of cost, requisite knowledge, skills and needs. Therefore another factor that is deemed necessary is **content/applications** of broadband (Choudrie and Dwivedi, 2004a; Naidoo et al., 2006; Yun, Lee, Lim, 2002). If there is a lack of true broadband content and applications being made available, then it would be less likely that consumers would adopt broadband. Furthermore, Choudrie and Dwivedi (2004a) suggest that since the subscription cost of broadband is stable and technology is not changing rapidly, declining costs and rapid changing factors were omitted. However, in South Africa the situation is quite different in terms of declining cost. The costs of broadband are not very stable in South Africa as noted by Naidoo et al. (2006). As mentioned previously, the prices of broadband in South Africa are seen to be decreasing. But the cost may still be too high for the average consumer. Therefore **high cost**, **declining cost**, **knowledge**, **skill and needs** of a particular technology (Choudrie and Dwivedi, 2004b; Naidoo et al., 2006; Yun, et al., 2002) are included.

Demographics

The role of socio-economic attributes in broadband adoption is examined and the solitary use of demographic variables such as **age**, **income**, **education** and **occupation** help, through cross tabulations, differentiate the adopters from the non-adopters (DCITA, 2004; Choudrie and Dwivedi, 2004b; Dwivedi, 2008). Socio-economic attributes also play a role in the knowledge part of the DoI five stage

process (Rogers, 1995). These variables have an impact on attitude, and perceived control behavior constructs (Choudrie and Dwivedi, 2004b; Dwivedi, 2008).

2.4.8.2 Sustained Adoption

For usage, studies have been in the form of user surveys that examined broadband users' behaviour compared to narrowband. Results show that Internet users behave differently when they have access to broadband. Broadband users are online longer, use more services and applications. Broadband users also make more purchases online and procure more varied categories of products (Choudrie and Dwivedi, 2004a).

Use diffusion affects how consumers ultimately end up using high speed internet access after they have adopted the broadband technology (Choudrie and Dwivedi, 2004b; Shih and Venkatesh, 2004). According to Shih and Venkatesh (2004) the use diffusion model was developed to investigate technology use in the household context. It is guided by three key components namely UD determinants; UD patterns and; UD outcomes.

- **UD Patterns**: Comprises of two distinct dimensions: *Variety of use* which refers to the different ways the product is used and *Usage rate* which refers to the time a person spends using the product during a designated period. The combination of variety (low/high) and rate (low/high) yields a fourfold typology of use or users (Figure 6): intense, specialized, non-specialized, and limited.
- **Use Determinants**: Consist of four determinants that affect UD patterns. These are:
    - **Household Social Context**: in which the user operates. It consists of three variables: household communication, competition for limited resources, and prior experience with technology.
    - **Technology Dimension**: consists of two variables: technological sophistication and use of complementary technologies and refers to the overall technological environment.
    - **Personal Dimension**: consists of two variables: Use innovativeness and frustration with technology.
    - **External Factors**: higher exposure to media may stimulate involvement with the technology, which in turn may account for higher levels of use.
- **UD Outcomes**: Consist of three variables: Satisfaction with technology; perceived impact of technology and; interest in new (futuristic) technology.

Choudrie and Dwivedi (2004b) state that the variables in the UD model have the following effects on variety and rate of use of broadband:

- The higher the intensity of communication with other users about the broadband leads to a higher variety of use;
- The higher the previous experience of using the Internet results in a higher variety and rate of use;
- The higher the use of innovativeness within broadband users results in higher variety of use;
- The higher disturbance due to less security and advertising popup due to a broadband connection leads to lower variety and rate of use and;
- Access to a broadband Internet connection outside the home environment can lead to a higher variety of use but lower rates of use in the home.

Another factor to be considered that forms part of usage constructs is that of service quality (DCITA, 2004; Choudrie and Dwivedi, 2004b). Choudrie and Dwivedi (2004b) have included this factor in the attitude towards behaviour construct. However, it is felt that service quality is determined after the consumer had adopted broadband. Therefore for the purposes of this study service quality will be included in the usage construct.

Service Quality

Broadband is purchased on a contract and is paid for by consumers during this specific period. Therefore if the service is not satisfactory, consumers will stop subscription to the service. Also, as an alternative, if the consumer has a choice of providers then they might move to others (Choudrie and Dwivedi, 2004b; Naidoo et al., 2006; DCITA, 2004).

The sustained adoption phase will complete the five stage process of the Diffusion of Innovation theory. Therefore sustained adoption will start where the initial adoption phase has ended if initial adoption is favourable. Therefore sustained adoption will start with implementation (putting it in use) and end with confirmation (positive outcomes). Usage and impact will therefore fall into this process. The Use Diffusion model (Shih and Venkatesh, 2004) is therefore deemed appropriate to identify factors for sustained adoption.

2.4.8.3 Impact of Broadband

Previous impact studies have not yet touched on consumer's broadband usage and its effect on their daily lives (Shih and Venkatesh, 2004). The impact of broadband is postulated as the ultimate outcome of usage of broadband (Shih and Venkatesh, 2004). Since broadband offers an alternative way of work and entertainment, it is likely to have impact on a user's daily activities (Choudrie and Dwivedi, 2004b; Shih and Venkatesh, 2004). According to Choudrie and Dwivedi (2004b), broadband users are different from narrowband users in terms of the time spent on the Internet and the activities conducted using the Internet. Broadband usage affects other daily life activities undertaken by the users. It therefore becomes necessary here to also test

the effects (feedback) that outcomes of the usage of broadband have on UD determinates and UD patterns after sustained adoption.

Figure 8 below illustrates the mapping of the adoption, usage and impact factors within the constructs of the proposed model. This model is significant for policy and decision makers to realise the three levels of requirements individuals have before being ready to adopt and how to sustain the adoption thereafter. If all of these are addressed sufficiently, the desired outcome, broadband adoption and sustainability within the household, can be obtained.

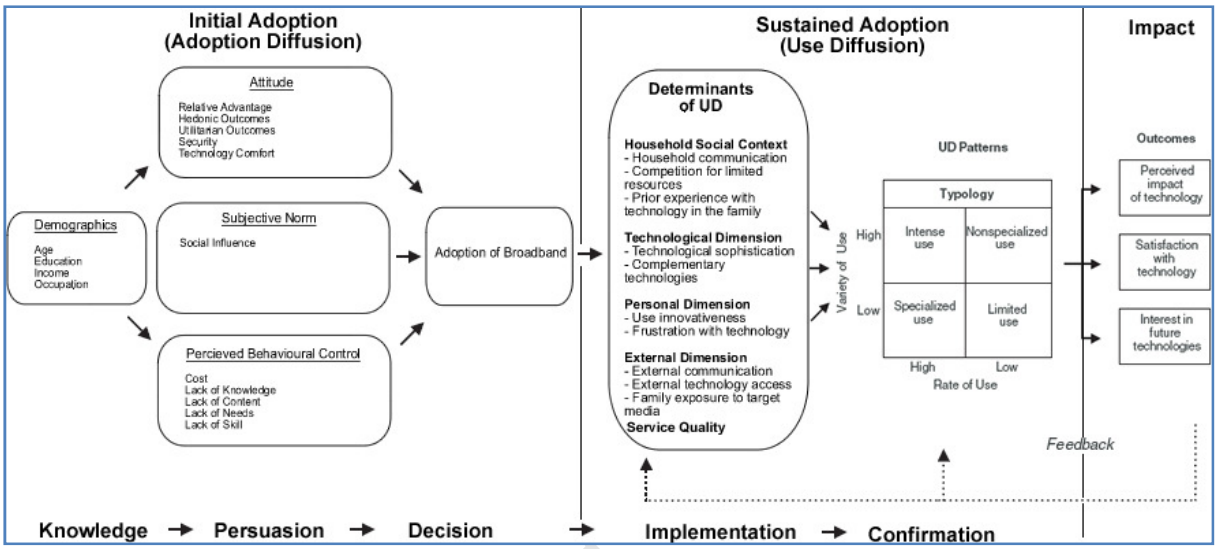

Figure 8: Proposed generic model for broadband diffusion in the household

2.5 Chapter Summary

This chapter provided a definition for broadband and listed the various broadband technologies that are available to South African consumers particularly fixed line, fixed wireless and mobile wireless technologies. From the literature it was seen that among the technologies that are in use today, ADSL is the most popular of the fixed line technologies while Wi-Fi and 3G/HSDPA are the most popular of the fixed wireless and mobile wireless technologies respectively.

Countries around the world are seeing the real importance of broadband and have nominated it as crucial infrastructure for their social, economic and scientific goals. South Africa has also realised the importance of high speed broadband to improve the communications infrastructure of the country.

A brief description of the advantages and disadvantages of broadband was provided. Some advantages include faster access to the internet, 'always on' and making calls while surfing the Internet. Disadvantages include security threats, higher service fees than dial-up and not being available in rural areas. This was followed by the impact that broadband has on our information economy particularly outlining the benefits broadband offers to businesses and consumers.

The chapter then outlines the current state of broadband focusing on first world countries and developing countries. Among the top countries in first world countries for broadband penetration were Japan, South Korea, the U.S. and Canada and European countries. The most advanced country in terms of broadband penetration is South Korea. Factors that contributed to this were infrastructure competition from a supply side and the high demand of broadband from the demand side. Low broadband penetration in developing countries were as a result of limited fixed line infrastructures, high costs of international bandwidth and monopolies held by telecommunication companies.

The current state of broadband penetration in South Africa was then discussed. Among the top broadband players in South Africa are Telkom for fixed lines, iBurst for fixed wireless, Cell C, Vodacom and MTN for mobile wireless and Neotel, the second network operator. Literature shows that the price of broadband has dropped significantly in a 3 year span from 2006 to 2009. This was mostly due to the introduction of the new SEACOM cable bringing in more international bandwidth to the country. Compared to international standards, these prices are still exceptionally high and not affordable by many consumers. South Africa is currently 103rd in the world in broadband speed rankings taking into consideration the cost to speed ratio. The uptake of broadband in South Africa is relatively slow but is slowly gaining momentum. With newer cables being laid connecting South Africa to the rest of the world, South Africa will hopefully see healthier competition and price reductions making it more affordable to consumers in the near future.

The chapter reviewed the various technology adoption and diffusion related theories and models including TAM, TBP, DTPB, DI, MATH and UD. Integrating the constructs across all models resulted in providing the most appropriate way to understanding the research problem as none of the models itself could examine broadband adoption, use and impact coherently. The result of this was Choudrie and Dwivedi's (2004a) Model for Broadband Diffusion. Choudrie and Dwivedi's (2004a) model for the adoption component postulates that a consumer's intention to adopt broadband at home is determined by Attitude towards behaviour, Subjective Norms and Perceived Behavioural Control. The usage component postulates that the actual usage of broadband can be determined by the social context of households, personal dimensions of consumers and users, technological dimensions, external factors such as external communication and variety and rate of use. The impact of broadband is postulated as the ultimate outcome of usage of broadband.

Finally, the chapter ends by proposing a model for Broadband Diffusion in Households of South Africa. Using Choudrie and Dwivedi's (2004a) model for broadband diffusion and combining this with literature a model specifically for South Africa was formulated and proposed. For attitudinal factors new constructs security, technology comfort and broadband content were added. Declining costs and rapid changing factors were omitted from Choudrie and Dwivedi's (2004a) model. However, in South Africa while prices seem to be decreasing these may still be too

high for the average consumer. Therefore high cost, declining cost, knowledge, skill and needs (rapid changing factors) of a particular technology are included. With regards to sustained adoption, Choudrie and Dwivedi (2004b) have included this factor in the attitude towards behaviour construct. However, it is felt that service quality is determined after the consumer had adopted broadband and was included in the sustained adoption phase as a use determinant. Finally, after the mapping of these constructs the model for Broadband diffusion in households in South Africa was proposed.

In the following chapters the proposed model for broadband diffusion in households of South Africa will be utilised as a basis for empirical investigation. The next chapter begins with a discussion of the research approaches chosen for this study and a discussion on the instruments used.

3

Research Paradigm and Approach

"As we go forward, I hope we're going to continue to use technology to make really big differences in how people live and work."

Segrey Brin

Co-founder of the successful search engine Google

3.1 Chapter Overview

This chapter explains how the research was conducted. It explains the way in which the research was undertaken and at the same time, it justifies the research approach, strategy and tools which will be used.

To recap, the main research objective is to ultimately expand and enhance the generic model within the South African household context. More precisely, the study will attempt to answer the following questions:

1. What factors affect a South African consumer's decision to adopt broadband?
2. What factors affect the way South African consumers use broadband?
3. What impact does broadband have on South African consumers and their interest in future oriented technologies?

Chapter 6 provides a more refined version of the research question and objectives.

3.2 Research Paradigm and Approach

Orlikowski and Baroudi (1991) identified three main research paradigms in IS research: positivist, interpretive and critical. Positivism is based on the assumption that there are universal laws that govern social events, and uncovering these laws enables researchers to describe, predict, and control social phenomena (Kim, 2003). On the other hand, interpretive research, seeks to understand values, beliefs, and meanings of social phenomena, thereby obtaining a deep and sympathetic understanding of human cultural activities and experiences (Kim, 2003). Critical science seeks to explain social inequities through which individuals can take actions to change injustices (Kim, 2003).

The overall research study will make use of multiple philosophies i.e. an interpretative and a positivist philosophy. Each philosophy when used independently in research has its advantages as well as its disadvantages. Therefore in order to attain accurate findings in any study it becomes necessary to rid the study of the disadvantages inherent in a particular philosophy (Lee, 1991). However using the advantages of one particular philosophy may not be enough. Lee (1991), who developed a framework that integrates both positivist and interpretive approaches, points out that it is possible that both positivist and interpretive research approaches can co-exist separately.

Therefore taking into consideration Lee's (1991) framework this study will first make use of an interpretative philosophy followed by a positivist philosophy then integrating them to ensure that the benefits of each study are realised. Below discusses each philosophy in more detail.

3.3 Qualitative Study

The initial literature review provides a basis for the interpretative study which follows a qualitative research approach to ensure that the diffusion process and the factors influencing the diffusion of broadband in South Africa are thoroughly explored. A qualitative approach is used "to study social and cultural phenomena" (Myers, 1997). By adopting qualitative research methods the researcher is able to consider the different contexts that influence the respondents' perceptions. This approach will therefore allow a deeper level of understanding of the different diffusion patterns in South Africa.

The qualitative study will attempt to expand and enhance the proposed model, provided by the initial literature review, through interviews. More precisely, semi structured individual interviews will be carried out to identify the process of diffusion. The data analysis compiles the data collected into patterns and themes and structures the data into a framework.

The findings from the interpretative study will then be compared to the literature review. Here additional factors may be added to the proposed model thereby creating a model distinctly for South Africa. The adoption, use process and impact outcomes of using broadband in the South African household will be explained which will provide a basis for the positivistic study understanding. The quantitative study will aim to verify the model if it indeed represents the state of broadband diffusion in the South African households.

3.4 Quantitative Study

Deduction begins with generalisation and theories and ends with the specific observations. Arguments that are based on laws, rules or other widely accepted principles are best expressed deductively (Thomas, 2003). The positivistic study of this research will be used to validate the data gathered from the qualitative data gathering methods. It starts with the theory developed by the interpretative study, allows for the collection of data from a wider population and finally validates the significance of the results obtained through the qualitative lens of the proposed framework.

Using the input from the interviews conducted, hypotheses and a questionnaire will be developed. The next step will aim at validating the model through the use of the developed questionnaire. Participants in South Africa will be sent questionnaires and the data obtained will be analysed quantitatively using statistical techniques. Relationships between the different variables within the model will be tested to develop a model of broadband diffusion in households of South Africa. This model will aim to explain the current state of broadband diffusion in households of South Africa.

3.5 Sampling

According to Dwivedi (2008), sampling involves the selection of a subset of a population that is representative of the whole population. When considering a good sample, it is necessary to apply techniques that give all respondents the same chance of being selected (Dwivedi, 2008). Fowler (2002) suggests that five critical issues need to be considered when sampling. These include: a probability or non-probability sample, the sample frame, the size of the sample, the sample design and finally, a non-response bias and response rate. These issues are discussed within this section.

3.5.1 Probability Sampling and Techniques

When generalising from a sample to a population a random sampling is required. Probability samples provide for random selections (Taylor-Powell, 1998; Dwivedi,

2008). Each respondent in the sample has the same chance of being selected thereby making it possible to confidently make estimates about the population as a whole based on the sample results (Taylor-Powell, 1998; Dwivedi, 2008).

Different strategies are available when conducting probability sampling. These include: simple random sampling, systemic sampling and stratified sampling.

Stratified Sample

In stratified sampling the total population is divided into separate groups (strata) which differ along selected characteristics such as gender, age, size of operation or geographical location (Taylor-Powell, 1998). Stratified sampling allows for greater precision and requires a far less sample than simple or systematic sampling however at a cost of more administrative efforts than systematic or simple random sampling. For the quantitative study a stratified sampling approach was chosen as different sub groups based on age, occupation and income were investigated.

A detailed discussion on each of the sampling techniques and the sample selected thereof for both the qualitative and quantitative studies is provided in their respective sections.

3.5.2 Non-Probability Sampling and Techniques

Probability sampling may be limited to those who agree to be included or a researcher may want more in-depth information regarding participants or delivery method (Taylor-Powell, 1998). In non-probability sampling there is no expectation that each respondent has an equal chance of being selected in the sample (Taylor-Powell, 1998; Dwivedi, 2008; Devers and Frankel, 2000). The findings would therefore not be generalised as the sample does not intend to represent the population.

Strategies available when conducting non-probability sampling include quota sampling and purposeful sampling.

Purposive Sample

Purposive sampling is a sampling strategy that serves some purpose rather than representativeness or randomness (Taylor-Powell, 1998; Dwivedi, 2008; Devers and Frankel, 2000). Purposive sampling becomes important for selecting "information rich" cases from which a researcher can learn much about the issues that are important to the study (Taylor-Powell, 1998; Dwivedi, 2008, Devers and Frankel, 2000).

Looking at non-probability sampling it is noticed that this sampling applies more towards qualitative studies due to researchers obtaining richer information for deeper understandings. This is verified by the qualitative part of this research study as purposive sampling was used.

3.6 Ethics

3.6.1 Qualitative Study

Interview questions were first approved by the Ethics Committee of the University of Cape Town before any interviews were undertaken. The Ethics Form can be found in Appendix B. An interview consent form, in Appendix C, was presented to all of the participants of this study for them to read, understand, agree to and sign. It assures the reader and the participants, who sign it, of the importance and significance of this practice. Permission for scribing notes and recording the interview was taken, and the reasons for the recording were explained as allowing an accurate and unbiased record of the conversation.

The interviewer guaranteed confidentiality and anonymity, protecting the individual and ensuring that no personal details of the individual will be published in the final report. Thereafter, provision was made to allow the interviewee to raise any queries or clarify any other issue.

3.6.2 Quantitative Study

Survey questions were first approved by the Ethics Committee of the University of Cape Town before any surveys were sent out to participants. The Ethics Form can be found in Appendix D.

A survey consent form was attached to all surveys handed to the participants of this study. The consent form guaranteed confidentiality and anonymity, protecting the individual and ensuring that no personal details of the individual will be published in the final report. The survey consent form can be found in Appendix E.

3.7 Chapter Summary

This chapter introduced the two main research approaches that this research study will undertake particularly an interpretative and positivistic approach. The chapter further mentioned that this study will first make use of the interpretative philosophy followed by the positivist philosophy and integrate them to ensure that the benefits of each study are realised. It provided an overview of the sampling techniques that used in research studies. This was followed by stating the sampling techniques that this research used namely purposive for the qualitative study and stratified for the quantitative study.

Finally, a brief description was provided on the ethics clearance obtained for both the interpretative and positivistic studies. A description of how the researcher ensured the confidentiality and anonymity of participants for each study was then presented.

4

Qualitative Research Design

"Rules make the learner's path long; examples make it short and successful."

Seneca

Roman rhetorician and writer, mid-1st century AD

4.1 Chapter Overview

This chapter starts by first outlining the research time frame for this qualitative study. It then provides a discussion on the research sample selected. This is followed by describing how the qualitative instrument was designed and how the data collection was conducted. A discussion into how the data was analysed is provided and how the researcher ensured the reliability and validity of the data collected. Finally the chapter concludes by describing the expected outcomes and limitations of the qualitative study respectively.

4.2 Qualitative Research Time Frame

The qualitative study was cross-sectional in that it analysed responses at a single point in time. This was selected firstly for pragmatic reasons, as there was limited time available for data collection. However, the research is interested in assessing the current demand for broadband in the sector. While past as well as future behaviour and attitudes are of interest, it is believed that the experience of change over time could be relayed by the respondents in a single interview. Data was collected during the months of June, July and August of 2007.

4.3 Qualitative Research Sample

Devers and Frankel (2000) explain that further to the specifics of research design the researcher needs "to understand and take into consideration the unique characteristics of specific research subjects and the settings in which they are located (Devers and Frankel, 2000, p264). Therefore in order to make the design more concrete a sample frame needs to be developed which includes criteria for selecting sites and subjects.

The sample frame must be capable of "answering the research questions, identifying specific sites and subjects and securing their participation" (Devers and Frankel, 2000, p264). Devers and Frankel (2000) suggested that in qualitative research purposive sampling is often employed. In purposive sampling the researcher attempts to choose subjects to participate in the study based on identified variables under consideration. It is used when the population under study is highly unique and for selecting "information rich" cases where individuals or groups provide the greatest insight into the research question (Devers and Frankel, 2000).

Miles & Huberman (1994, p. 34) note that three types of cases have the greatest payoff in purposive samples:

1. typical cases (i.e. those who are "normal" or "average" for those being studied);
2. "deviant" or extreme cases (i.e. those who represent unusual manifestations of the phenomenon of interest); and
3. "Negative" or disconfirming cases (i.e. those who are "exceptions to the rule").

This research followed "purposive sampling" for reasons outlined below. Table 2 shows the criteria in which the research subjects were selected from a subset of the population i.e. "household" residents within the Cape Town region was targeted.

Research Questions	Criteria for Selection
1. What factors affect a South African consumers' decision to adopt broadband?	• Must be 18 years and older. • Must have a steady income. • Will have some formal education (but not compulsory). • Are the subscription holders.

Research Questions	Criteria for Selection
2. How do South African consumers use broadband?	• Must be subscribed to broadband or have access to broadband. • Any age (but preferably older than 18). • User can be the consumer OR living in same household as consumer. Exceptions are made where consumer pays for a user not living with the consumer.
3. What impact does broadband have on South African consumers?	• Must be subscribed to broadband or have access to broadband. • 18 years and older • User can be the consumer OR living in same household as consumer. Exceptions are made where consumer pays for a user not living with the consumer.

Table 2: Research sample frame using Purposive Sampling

The research aimed to target residents in households of South Africa. However due to time constraints and expenses the target population interviewed were limited to the Western Cape province of South Africa looking at subjects particularly in the Cape Town region. The sample selected is designed to be purposeful and although it is not representative, an advantage of this would be to gather the richest data within a convenient location.

As highlighted in Table 2 typically the respondents for the adoption decision of broadband would be 18 years or older, have a steady income and some form of formal education. For those respondents who have adopted broadband must be the main subscription holders of the broadband services, that is, the respondents must be the sole person paying for the services. A sample of adopters and non-adopters of broadband were identified and interviewed matching the required criteria.

Users were made up of the consumers or subjects that make use of the consumer's broadband subscription. Users must be living in the same household as the consumer. However, exceptions were made where the consumer pays for a user who is not living with the consumer. An example would be where a student is living away from home and the parent pays for the student's broadband access if the student is living in a flat. Respondents of 18 years and over were selected due to the diverse and different needs of children which are out of the scope of this study. The interview process continued until saturation of data was achieved.

4.4 Qualitative Data Collection

This section attempts to describe how the data collection through interviews were designed and conducted. It further outlines how the data was prepared and the necessary steps taken to ensure that depth is achieved during the data collection process.

4.4.1 Semi-Structured Interviews

According to Myers and Newman (2006) within semi-structured interviews there is an incomplete script. The researcher may have prepared the questions before hand but there is need of improvisation. This is opposed to structured interviews where the questionnaire is set and there is no need for improvisation. The interviewer is the researcher (Myers and Newman, 2006).

For this research semi-structured exploratory interviews were carried out to expand and enhance the proposed model and to gain contextual data. The researcher allowed the interviewees to talk on their perceptions of broadband in general. Where necessary the researcher asked some probing questions.

Roode (1999) states that research projects always start with a problem or issue that is normally expressed as a question. These questions enquire about the ontological, phenomenological, epistemological and normative nature of the problem or issue at hand. Roode (1999) suggested that there should be a set of generic questions that a researcher selects from when formulating their research project.

The researcher would pose different questions from a set of mutually exclusive questions in order to explore different aspects of the problem or situation at hand (Roode, 1999). Table 3 below illustrates the generic research questions that were used to determine the main research questions for this study, as mentioned in Section 4 above, as well as the development of the interview questions for the interview analysis.

	What is?	
How does? →	Research problem	**← Why is?**
	How should?	

Table 3: Generic Research Questions (Source: Roode, 1999)

Using Table 3 a set of elementary questions was developed at each stage of the diffusion process i.e. initial adoption, sustained adoption and impact. These elementary questions were consolidated into clusters in which a Meta question for each cluster was formed. These Meta questions formed into the main research questions of this study which, when combined, provide the overall research question or problem situation (Roode, 2007).

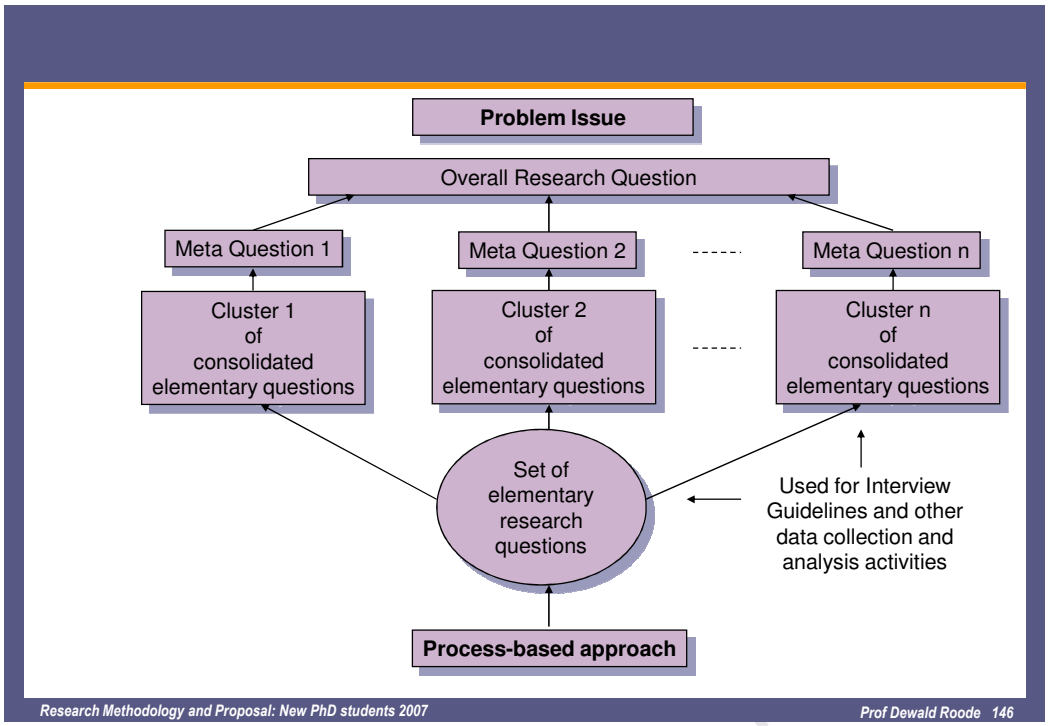

Figure 9: Guideline for the development of the semi-structured interviews (Roode, 2007)

The clusters of consolidated elementary questions were used as a guideline for the development of the semi-structured interviews. Appendix C shows the interview questions for the broadband consumer and user respectively. Table 4 shows the interview questions in relation to the research questions. C represents the consumer questions (adopters or non-adopters) and U represents the user questions.

Research Questions	Interview Questions
1. What factors affect a South African consumers' decision to adopt broadband?	C1, C1.3, C2, C2.2, C2.3, C3, C3.1, C4, C5, C5.3, C6, C6.3, C7, C7.3, C8, 8.3
2. How do South African consumers use broadband?	U2, U2.2, U3.2, U4.1, U5.1, U5.2, U6.1, U7.1, U8.1, U9.1, U12.1, U13.1
a. What factors affect the way consumers use broadband?	U3, U4, U5, U6, U7, U8, U9, U9.2, U10, U11, U12, U13
3. What impact does broadband have on South African consumers?	U14, U15, U16, U17
a. How does this affect their future use of the technology?	U14.1, U16.1, U17.1

Table 4: Research Questions in relation to Interview Questions

During the interview, interviewees were given the opportunity to talk freely on their perceptions and experiences on broadband services but the interviewer occasionally

intervened to ensure the interviewees' answers remained pertinent to the area of research. The likely time duration of the interview was 45 minutes. However, one hour sessions were allocated to each interview to allow sufficient time for detailed discussions.

4.4.2 Preparation of Data

Responses were recorded. Notes were taken during the interview. The results of the initial interviews were recorded and analysed before further interviews took place. This allowed the researcher to uncover whether the data obtained was relevant and appropriate. Minor changes to the interviews were affected if necessary.

Feedback allowed for increased clarity and for checking that the questions were less "leading" allowing respondents to respond with no interference. The pilot study also resulted in the addition of more questions specific to a section to gain more depth from the interviews.

4.5 Overview of Sample

The research findings discussed in this section are based on interviews conducted with 16 respondents who gave insight into the adoption, use and impact of broadband in households of South Africa during the months of June, July and August of 2007. The respondents consisted of six adopters who are ultimately users, one user and nine non-adopters of the technology. Respondents were assigned pseudonyms in order to maintain anonymity and confidentiality. The consumers of broadband technology were CX where X is the number ranging from 1 to 6. Users were UX and the non-adopters were coded NX where X is the number ranging from 1 to 9. The high level details of the respondents are discussed below to gain an impression of the general context within which these interviews took place.

4.5.1 Adopters and Users

The adopters and users sample consisted of seven respondents in total. One respondent, U1, who was not a consumer of the technology, was interviewed on the basis of solely being a user:

"The only reason why I have broadband is because I am a user and my mother is the consumer and because of her job she's in a high income bracket that is why she can afford it" (U1).

Table 5 below illustrates the demographics of the adopter and user respondents.

ID	Age Group	Disposable Income	Formal Education	Occupation	IT Related	Access
C1	50+	R20,000 - R30,000	B. Proc LLB	Magistrate	Non-IT	4Mb ADSL
C2	18-30	R5,000 - R10,000	Masters Degree	Student	IT	384Kb 3G
C3	31-40	R30,000+	Honours	Systems Architect	IT	1Mb IBurst
C4	50+	R20,000 - R30,000	Masters Degree	Lecturer	IT	4Mb ADSL
C5	18-30	R5,000 - R10,000	Diploma in IT	Sales Assistant	Non-IT	384Kb ADSL
C6	50+	R10,000-R20,000	PhD	Lecturer	IT	384Kb ADSL
U1	18-30	< R5000	B.Bus. Sci.	Postgraduate Student	Non-IT	4Mb ADSL

Table 5: Demographics of individual adopter and user respondents

All respondents had formal education ranging from university degrees to college diplomas. Most of these formal educations made way for their occupational roles.

From the combined total of seven respondents, four respondents' occupation involved those within the IT industry while three performed various work other than the IT industry as depicted in Table 5. Occupational roles within the IT industry ranged from being lecturers of IT, systems architects to postgraduate students in IT while the respondents' occupations other than the IT industry ranged from being a magistrate, sales assistant to postgraduate student in accounting. Therefore, in this context, the respondents were given the title either IT or non-IT depending on their occupational classification.

Most respondents were over ages of 50 or between the ages of 18-30 years with one respondent being between the age group 31-40 years. The high income brackets of respondents were mostly from those who were 31 years of age and older while the medium and low income brackets were shown mostly by those who were between the age groups of 18-30 years. The respondents who were in the high and medium income brackets had professional occupations while those in the lower income bracket were university students or casual workers in retail.

4.5.2 **Non-Adopters**

The non-adopters sample consisted of nine respondents in total. Table 6 below illustrates the demographics of the non-adopter respondents. Similarly to adopters

and users the non-adopters were given the title of IT or non-IT depending on their occupational classification.

All respondents had formal education ranging from university degrees to college/technikon diplomas. The non-adopters formal education also made way for their occupational roles.

ID	Age Group	Disposable Income	Formal Education	Occupation	IT-Related	Access
N1	18-30	5000-10000	Masters	PHD Student	Non-IT	Home dial-up
N2	18-30	5000-10000	Masters	PHD Student	Non-IT	Home Dial-up
N3	18-30	<5000	Honours	Masters Student	IT	None
N4	31-40	5000-10000	Technikon	Proprietor	Non-IT	None
N5	18-30	10001-20000	Diploma	Software Developer	IT	Home Dial-up
N6	41-50	20001-30000	PhD	Assoc. Professor	IT	Home Dial-up/Work LAN
N7	18-30	10001-20000	Masters	Lecturer	IT	Work LAN
N8	18-30	20001-30000	Honours	Equity Derivatives Broker	Non-IT	None
N9	31-40	20001-30000	PhD	Lecturer	IT	Dialup/Work

Table 6: Demographics of individual non-adopter respondents

The occupational roles for the non-adopters show five respondents performing IT-related job activities. These ranged from lecturers, associate professor and student in IT to software developer. Occupational roles within the non-IT industry ranged from post graduate students and equity derivatives broker to proprietors within the building industry.

Most respondents were between 18-30 years of age with two respondents being between 31-40 and one respondent being between 41-50 years of age. Table 6 shows that respondents within the low income brackets are generally the postgraduate students between the ages 18-30 with an exception of the proprietor, N4.

From the total of nine respondents, five respondents claimed that they had internet access at home via a dial-up 56K modem. These respondents expressed that they use this internet access for various activities as respondent N1 points out:

"I have a dialup connection at home. I am on the R7 from 7pm-7am plan. I use it for some research and checking the odd email now and again and to do the occasional surfing" (N1).

4.6 Qualitative Data Analysis

The purpose of analysis was to bring meaning, structure and order to data (Anfara, Brown and Mangione, 2002). Induction is the moving from specific observations to broader generalisations and theories. In other words arguments based on experience or observations are best expressed inductively (Thomas, 2003). The primary purpose of the inductive approach is to "allow research findings to emerge from the frequent, dominant or significant themes inherent in raw data, without the restraints imposed by structured methodologies" (Thomas, 2003, p2).

The following are some of the purposes underlying the development of the general inductive approach. These purposes are similar to other qualitative analysis approaches (Thomas, 2003, p2):

1. To condense extensive and varied raw text data into a brief, summary format.
2. To establish clear links between the research objectives and the summary findings derived from the raw data and to ensure these links are both transparent(able to be demonstrated to others) and defensible (justifiable given the objectives of the research).
3. To develop a model or theory about the underlying structure of experiences or processes which are evident in the text (raw data).

This interpretative research study followed an inductive approach to analyse data retrieved from the interview analysis. This was due to the general inductive approach providing a convenient and efficient way of analysing qualitative data (Thomas, 2003). Audio tapes recorded the interview session and were used to transcribe the conversations. The outcome from an inductive analysis is the "development of categories into a model or framework that summarises the raw data and conveys key themes and processes" (Thomas, 2003, p3).

The data analysis was conducted through code mapping using the three iterations of data analysis (Anfara et al., 2002). With data, coding reams of data are brought into smaller manageable chunks. Meaning and insights are brought to the words and acts of the participants' involved thereby generating themes (Anfara et al., 2002). With code mapping the analysis of data can be brought to a level of theory development. This was suitable as this was the intention of this qualitative study.

Table 7 illustrates the above appropriately. The three iterations of analysis must be read from bottom up.

Third Iteration: Application to Data Set		
Themes are generated		
Second Iteration: Pattern Values		
Meaning and insights are brought to the words and acts of participants		
First Iteration: Initial Codes/Surface Content Analysis		
Reams of data are brought into brought into smaller manageable chunks.		
DATA	**DATA**	**DATA**

Table 7: Code mapping with three iterations of analysis

Anfara et al. (2002) recommended that "constant comparative analysis" be used. This is when the analysis of data is done simultaneously with the data collection. As data is coded (first iteration), the responses are compared within categories and between categories (second iteration). Themes are then generated and the analysis is, as mentioned above, brought to a level of theory development (third iteration). Constant comparative analysis aids in identifying patterns, coding data and categorising findings (Anfara et al., 2002). To ensure at each stage that the data is coherent specific measures need to be taken from the inception of the data collection. The following section provides measures to ensure that data in this study is reliable and valid.

4.6.2 Data Reliability and Validity

The use of several data sources and different methods is called triangulation. The more agreement of different data sources on a particular issue, the more reliable the interpretation of the data (Cano, 1999). Reliability addresses how accurate research methods and techniques produce data.

Internal validity is concerned with how trustworthy the conclusions are that are drawn from the data (Anfara et al., 2002). "Multiple sources of evidence, an established chain of evidence, pattern-matching..." amongst many, add to the validity and reliability of any research (Anfara et al., 2002, p33). These also aid in the prevention of reliance exclusively on a single data collection method and therefore "neutralises any bias inherent in a particular data source" (Anfara et al., 2002, p33). To ensure validity and reliability of the data and findings of this study the following methods were used:

1. Triangulations of the interviews were done with audio tapes to record the interviews and notes taken during the interviews. The notes were presented to the research subjects showing excerpts of the researcher's interpretation of their interviews. This increased validity as the research subjects are in a position to corroborate or disapprove of the researcher's interpretations (Cano, 1999).
2. There was triangulation of interviews with one another (consumers to users) to get a "holistic understanding of the situation and generally converging conclusions" (Anfara et al., 2002, p33).

4.7 Expected Outcomes

The expected outcome of the exploratory interviews was to confirm whether the problem statement has substance: Are the factors identified by the proposed model relevant to South Africa? It also provided a general idea of whether the issues are comparable to those experienced in other countries and provides an indication of the expected relationship between variables. Furthermore, it was expected that some factors will correlate with those identified in the literature survey and some additional new factors/constructs may be discovered. This process allowed the researcher to gain an insight into some test items which were used in the instrument. This is important to add credibility to the developed instrument as some of the constructs have not been previously tested in the literature.

4.8 Limitations

The researcher's lack of experience in qualitative research may have had an impact on the collection of the in-depth data which is critical for a qualitative research project. This was overcome by presenting the notes taken during the interview session to the subjects showing excerpts of the researcher's interpretation of their interviews increasing the validity of the data collected.

The main limitation revolved around threats introduced by interviewee bias. In order to ensure objectivity of the interviewer, the personal views of the researcher were not mentioned during the interview, and the constructs of the research model used were also not introduced initially.

4.9 Chapter Summary

This chapter provided a description of how the qualitative research study was conducted. The research time frame was cross-sectional due to the limited time available for the data collection. Data for this qualitative study was collected over the months of June, July and August of 2007. A purposive sampling method was used due to the population being highly unique. This section set out the criteria in which

the research subjects were selected. The criteria were developed in conjunction with the research questions to ensure that the sample frame would be capable of answering the research questions.

The data collection instrument used in this qualitative study was a semi-structured interview. Each set of questions in the instrument were developed at each stage of the diffusion process. On average each interview conducted lasted for an hour. An overview of how the data analysis was conducted was then provided. The study followed an inductive approach to analyse the data collected. The result was the development of categories into a model and summarised the raw data to convey themes and processes. A constant comparative analysis was performed to ensure at each stage that the data is coherent specific measures need to be taken from the inception of the data collection.

To ensure that the data collected was reliable and valid, a triangulation of interviews was performed with audio tapes and notes taken, a triangulation of interviews with one another and use of audit trails of documentation.

It was expected that the factors identified by the proposed model relevant to South Africa. The qualitative study also provided a general idea of whether the issues are comparable to those experienced in other countries and provided an indication of the expected relationship between variables. Furthermore, it was expected that some factors will correlate with those identified in the literature survey and some additional new factors/constructs were discovered.

Finally, the chapter ends with providing a brief description on the limitations faced during the qualitative study. The following chapter will provide a detailed analysis of the qualitative data collected and aim to add or reduce the proposed model of Broadband Diffusion in Households of South Africa.

5

Qualitative Data Analysis

"It has become appallingly obvious that our technology has exceeded our humanity."

Albert Einstein

Famous Physicist, 1879-1955

5.1 Chapter Overview

This chapter is a narration of the themes and patterns that emerged from the data analysis. Each phase of the diffusion process is analysed specifically looking at interviewee responses for factors that affect each phase. A model for broadband diffusion in households specifically for South Africa was created by combining these factors. Finally, a brief discussion on the relationships between these factors is provided.

5.2 Factors Affecting Initial Adoption

The findings of this study suggest that the factors affecting initial adoption are similar to that of the proposed adoption model produced in the literature review with some new factors emerging from the data gathered. This section provides an overview of the factors gathered that affect initial adoption of broadband by synthesising the data gathered from the adopters, users and non-adopters interviewed.

5.2.1 Attitude

Attitude towards behaviour describes an individuals' perception towards broadband technologies. The perceived benefits of broadband technologies are the advantages that broadband can provide to the individuals. In the case of the adopters and users, these respondents have perceptions of the actual advantages that broadband provides. For the non-adopters these are the respondents' perceptions of potential advantages that broadband would provide. These include relative advantage, hedonic outcomes, utilitarian outcomes, security and technology comfort. While these factors form part of the generic model of broadband diffusion in the household a new factor, loyalty, emerged. These factors are described in more detail below.

Relative Advantage

Relative advantage is one of the dominant themes from adopters, users and non-adopters. The respondents believed that broadband offered numerous advantages especially over their previous dial-up connections. These range from faster and always on connections to freeing the home telephone line, multi-tasking and geographic convenience.

Respondents C4 and C6, respectively, mentioned that:

"At that stage I didn't like the slower normal Telkom line. We needed frequent access. And download capacity on the older line was difficult...also with broadband my telephone line is freed" (C4).

"The speed is an advantage. I have access to it 24/7/365. I can use the telephone at the same time. It is much cheaper than ordinary calls or cell phone calls. I feel the previous connection was too clumsy, slow and limited access." (C6).

In terms of multi-tasking, respondents believed that with broadband they can perform more tasks simultaneously as respondents C5 and N3 points out:

"I am innovative through multi-tasking. I can do more things at once. Run more applications. Because I can multitask I can do more of other things" (C5).

"With 3G I am able to browse on the phone, send MMS and emails. I can multi-task" (N3).

Another interesting advantage of broadband is that of mobility. Respondents expressed that having high speed internet access "on the go" can be beneficial to them for their work-related activities and for access in places where fixed lines are less frequent.

"...and with the wireless you can plug in the modem and get reception not everywhere but in most places. So it was the mobility and the price of it" (C3).

"If I could go wireless I would. There is no restriction in mobility. I would like to have access to satellite at difference places because in my holiday home I use my cell phone and GPRS is still a bit too slow" (C4).

"I would like to try 3G for the cell phones. Especially since I'm going to be in business next year and I have to go see clients. I am moving all the time and will need information when I'm not in the office. So 3G can offer me mobility" (U1).

Geographic convenience emerged from a few respondents particularly from the non-adopters. Although it was not mentioned by a majority of the respondents it is deemed important and worth noting. It is believed that this advantage is important as consumers are likely to adopt broadband technology if having the technology at home will be convenient for them as respondents N7 and N8 pointed out:

"I am currently moving at the moment, further away from the university so I'll probably end up getting broadband because it will be more convenient. When I live close to campus I could pop in. But now since I am going to live further away it will be convenient if I acquired it...If it is a pain to drive to work to check my email or download something then I could just do it at home" (N7).

"I think broadband will be very convenient for me in the sense that I can take my sick days off and look into trading as to what's going on all the time as it is always on. I can check my emails etc. which is very important for my job" (N8).

Hedonic Outcomes

The entertainment potential of the internet makes its offerings such as online radio, streaming audio and video and online games more attractive with the availability of broadband. Many respondents expressed that they gain pleasure from the consumption or use of broadband internet.

""Mostly because of my social network the whole MXIT chat rooms actually enticed me to get 3G. I started using it to get updates on sports scores and now I can watch live clips of sports. I can also make video conference calls" (C2).

The non-adopters expressed that they are aware of the potential benefits of broadband especially for entertainment purposes. The respondents believed that the faster connections would allow them to download movies without waiting for long periods, streaming digital media and online gaming.

"The ability to download movies, music...One of the classic things is viewing a video clip online, it is almost instantaneous. You don't have to wait for it to download or

you click on the download button and you go watch TV for half an hour and you come back and then you are able to play it....I would love to play online games especially on Xbox LIVE" (N5).

"If I wanted to download something I don't have to wait over night for it to download...Also new thing streaming, digital streaming media. Things like YouTube and things like TV series and ads as well and streaming radio stations" (N7).

Utilitarian Outcomes

Broadband internet usage can enhance the effectiveness of household activities. If broadband can assist consumers with everyday household activities this may take the stress out of everyday living for consumers. Most respondents emphasised that broadband allowed them the possibility to undertake office work at home, spend more time at home with the family, look for information or product search and purchases.

"It means that I am more flexible and enjoy the flexibility that my work hours allow me. I can work either here or at home. That is my sole use for it" (C4).

"Broadband made it easier for my wife. She can now do the studies at home instead of being at the hospital. Which means she is more at home and less time at the hospital and more time with the kids...I use it a lot for my studies, online banking, online shopping as well for groceries" (C3).

Security

Consumers can feel more comfort if broadband can provide security when performing activities such as entering credit card details online or controlling family content. Most respondents felt that broadband is secure while only a few felt neutral about the topic. Consumers who felt broadband was secure expressed that the security is watched by the ISP and ISPs could track any hacking being done. They also mentioned that it is much easier to control family content in terms of what can be available to the family.

"I believe that everything is routed better and watched from by the ISP. There is more tracking and less hacking. I feel that is easier to define family content. It is very handy as you can set what type of information can be shown at any time" (C6).

"I definitely believe that there is more security. You can't tap the phone line and as a person from a security background I know security is linked with broadband. Especially since broadband is always on, there has to be excellent security features to accommodate this. I mean ISPs won't dish out broadband to consumers if it's not secure" (C2).

The few that felt neutral about broadband security expressed that security on the internet was relatively the same whether accessing from any connection be it dial-up or broadband. However the consumers did feel that broadband does come with better control of family content. Consumer C4 mentioned the following respectively:

"Controlling family content I believe that is true. I have the normal firewalls because the connection is always on and things like that but I feel that it is exactly the same security as other connections" (C4).

Technology Comfort

All respondents expressed that they are comfortable using their broadband technology. This was due to their broadband subscription being easy to setup, user friendly and easy to learn.

"I think that the previous dial-up connection just gave a bit of a bad experience. But it is easier now because you just plug the modem in and you go" (C3).

"Yes definitely comfortable. I don't think I would be able to go back to the older connections. I think it is more user friendly, easier to use" (C6).

Loyalty

The loyalty factor was mentioned only by a few respondents. In terms of this study, respondents chose a particular broadband service due to having previous modes of internet access with a particular ISP. Therefore the loyalty factor is deemed important as those with already existing connections to the internet may upgrade to faster broadband connections based on their loyalty to their ISP.

"When I upgraded from my dial-up connection to broadband I kept my existing ISP, which is MWeb, I think because I am loyal to MWeb" (C6).

5.2.2 Subjective Norms

From the adopters and users perspective, many of the respondents expressed that social influence was one of the key factors that influenced their decision to adopt broadband technology. In the case of non-adopters, just over half of the respondents stated that there has been some influence from family members or peers.

Some who adopted these technologies were influenced by significant others in their environment that were already using them as respondent C1 mention:

"My son knows a lot about these technologies. I trust that he makes the right decisions on technology and I pay for the service based on his decisions" (C1).

Experiencing adoption and use within a social environment creates awareness and understanding of a specific technology, as well as involving peer-pressure as respondents C2 and N2 points out respectively:

"...I've always been in touch and before they released a product I've found out about it via my social network which mostly comprises of engineers" (C2).

"Well, mostly through my peers especially through online gaming" (N2).

5.2.3 Perceived Behavioural Control

Perceived Behavioural Control (PBC) is the individual's perception of their ability to perform a given behaviour. It is the beliefs of having the necessary resources and opportunities to adopt broadband in the home. PBC examines the non-adopters' views particularly looking at factors that inhibit the adoption of broadband. This will aim to uncover why South African consumers are reluctant to subscribe to broadband services. The adopters' and users' views were also taken into account as this looks at the disadvantages that broadband provides which could also help explain why non-adopters would not subscribe to broadband services.

The factors of PBC include cost, lack of knowledge or awareness, lack of content, lack of needs and lack of skills. These factors form part of the global model of broadband diffusion in the household, however new factors have also emerged. These include infrastructure and lack of a PC. These factors are explained in more detail below.

Cost

The price of any commodity plays a major role in determining whether a consumer will purchase the product or service or not. If the consumer perceives that the cost is too high, then adoption will be slow. The cost of broadband services was a dominant theme that occurred amongst non-adopters. All respondents felt that the price of the line rental, modem costs and the price of bandwidth caps are too high for them to acquire broadband services.

"Currently it is far too expensive. The initial cost, the initial payment of the modem, bandwidth caps, it costs too much. Frankly if you were in a non-African continent it will cost you far cheaper. The modem will be far cheaper and they have unlimited bandwidth for the same price or even less." (N5).

While the respondents were aware of recent price cuts in the South African broadband market this did not seem to change their perceptions on the cost of broadband services.

"Even with Telkom's recent price cuts which may make it more affordable to certain people I don't think it's worth it yet. I don't really work much at home mostly get my work done on campus. It's really the cost/work ratio" (N9).

"Currently I am paying R80 for ISP package with 75hours of Internet time. I think broadband is more expensive than that even with the recent price cuts. I think if broadband comes lower than R70 for package and R80 for line rental I would consider" (N6).

Most of the adopters mentioned that their reasons for acquiring broadband was due to their dial-up connections being too costly and by subscribing to broadband services they will be saving on costs in the long run.

"Broadband is faster than dial-up. You don't pay for the phone-call, broadband is a set thing. For the old dial-up modems you used to pay for as long as you are online and you couldn't use your phone. With broadband you can still use the phone and it doesn't affect what you pay. So it's cost efficient especially in the long term" (C2).

However, while this may be so, they also expressed that while they are saving in the long run over their dialup connections, broadband is still quite expensive especially for the cost to speed ratio. Respondents believe that for the prices they are paying they are not getting fast enough speeds.

"...I think the other broadband service providers are getting cheaper but they are not fast enough in terms of international standards. You hear in the UK that they have 4Mbps connections for 10pounds or something like that. And I don't think that they are competing enough here and there is not enough competition amongst themselves" (C3).

Requisite Knowledge

Having a level of knowledge about the risks and benefits of a technology affects adoption. If a consumer is aware of the benefits of broadband then they are likely to adopt the technology. A majority of the respondents, both adopters and non-adopters, stated that they are aware of the broadband technologies available to them and what broadband can do for them. Their awareness was affected by media, skill level, social influence, needs or following trends.

In terms of media and needs respondent C3 mentioned the following:

"I think I became aware through advertising. The companies advertise a lot. With media I became aware of it. And especially my need for it made me more aware of it as I did some research of what will suit me in that point in time" (C3).

Respondent C2, who works and studies in the environment, mentioned that he became more aware of the technology from his skill level and from social influence.

"It is mostly due to working in the academic development...and it is part of my work. I've always been in touch with technology and even before a product is released, I've found out about it via my social network which mostly comprises of engineers" (C2).

This shows that requisite knowledge is affected by social influence. Friends or family members can pass information on to consumers about broadband capabilities increasing the consumer awareness of the technology which may lead to the adoption of broadband.

In terms of following trends respondent C4 mentioned the following:

"Not so much media but more articles in our field of expertise...specifically computer magazines showing new internet technologies and things like that" (C4).

However two respondents felt that they were not aware of broadband technologies due to having a lack of skills and not making the necessary effort as respondent C1 mentions:

"I don't really know what broadband is. I just know that I'm using the internet and email. And that broadband gives me access to these...I have not made the necessary effort to make myself aware of it because of time constraints" (C1).

Another interesting theme that emerged was that of not having a personal computer in the household. It was felt that this affected the awareness or knowledge of the consumer. N4 states that:

"I don't have a home PC. I think if I had a PC at home it will actually broaden my knowledge" (N4).

Data shows that requisite knowledge is related to relative advantage. If consumers are made aware of the advantages of broadband then they are more likely to adopt the technology. Similarly, hedonic outcomes and utilitarian outcomes are also related to requisite knowledge as if consumers are aware of the entertainment and lifestyle change capabilities of broadband then consumers are likely to adopt the technology.

Broadband Content

Once users adopt broadband, there needs to be content available in order for consumers to use the service optimally. If there is a lack of true broadband content and applications then consumers are less likely to adopt the technology. Most respondents, particularly the adopters and users, felt that there is content being made available to them that allows them to make use of the service appropriately. Broadband content ranges from video streaming and movie downloads to applications such as VOIP and video conferencing. Even the non-adopters are aware of the content and applications available to broadband users as respondent N7 mentions:

"Faster you are able to do a lot more things. For example if I wanted to use Skype for instance I couldn't use Skype without broadband. If I wanted to download something I don't have to wait over night for it to download. You can use international sites, the whole international sites are built around, and they assume that you have broadband and if we don't have them in South Africa we can't wait for flash animations to load up. Also the new thing is streaming online digital streaming media. Things like YouTube and things like TV series and ads well and streaming radio stations" (N7).

Needs

There needs to be a requirement that broadband must fulfil in order for consumers to adopt the technology. Most respondents felt that broadband fulfilled specific needs.

In the case of the adopters these are the actual needs that their service fulfilled. In the case of non-adopters these are the potential needs that non-adopters feel that broadband would fulfil. The needs that broadband fulfilled or will fulfil ranged from entertainment needs such as online gaming and video streaming, communication needs such as keeping contact with relatives overseas via VOIP and video conferencing, multi-tasking to do more things at once and most importantly having high speed access to the internet for emails, product purchases and surfing the web.

"Well online gaming, video streaming, get a lot more done with multi-tasking" (N2).

"VOIP, cheaper calls, we would like to call everyone in the world and talk to them. With streaming audio and video it has the ability to chat meet and game with people from other countries....Communication is a priority. The ability to meet someone in the UK via broadband, dating etc. You can buy a car you can look for anything you want. You cut off the middle man" (N5).

Data shows that needs factors affect requisite knowledge. Respondents expressed that when the need arises they would research on the particular service that would best meet their needs. This therefore has an impact on the consumers' awareness of broadband technologies which may contribute to the adoption of broadband.

"And especially my need for it made me more aware of it as I did some research of what will suit me in that point in time" (C3).

Skills

Having skills and knowledge about using the PC and Internet was a dominant theme voiced by the adopters, users and non-adopters. The necessary skills and knowledge determines whether the users' experiences with a PC and the Internet is difficult therefore impacting on broadband adoption. While most of the adopters had advanced skills and knowledge in using the PC and the Internet, two respondents, C1 and C5, had a low skill level and a medium skill level respectively. The low skill level was attributed to the respondent being self taught with no formal PC or Internet training as well as not working in an IT-related environment.

"I really don't know how use Windows, MS Office and the Internet effectively. I only know how to receive and send email and I do Internet banking and flight reservations" (C1).

The medium skill level was enough to prove that the respondent knew how the PC and internet functions and therefore had good knowledge pertaining to broadband. Respondents with advanced skill levels has either worked or studied in the computer industry. Most of these respondents acquired these skills over the years in their work environment and through formal training prior to working.

Of the nine non-adopters five had advanced skill levels while three and one had medium and low skill levels respectively. It is interesting to note that one respondent, N4, had a lack of skills due to not having any formal training or having a PC at home.

Overall most of the respondents expressed that they acquired their skill levels through formal training, having an interest in PC and the Internet, were self-taught, started from a young age, through social influence and from working in the environment.

Skill levels are affected by the demographic variables of age, education and occupation. A more detailed overview of these relationships is explained in Section 1.3 which discusses the relationships between the factors and demographics variables.

Skill levels, however, affect requisite knowledge. As the consumers' skill level increases so to do their knowledge and awareness of broadband technologies increase. As is discussed in this section, those who have more advanced skills tend be more aware of broadband technologies and its capabilities.

Infrastructure

Infrastructure was mentioned by only a few respondents, particularly the adopters. The adopters expressed that one of the reasons that influenced their decision to acquire their particular broadband service in their household was having an existing telephone line. Therefore this factor becomes an important step towards adopting broadband in the household.

Having the infrastructure already available was the deciding factor for the adopter to choose their particular service provider. In the case of C1 who already had an existing Telkom landline, ADSL broadband was the choice of service that particular respondent had chosen. Respondent C1 expressed that it was easier to manage her accounts by linking the broadband service to her already existing telephone line.

"I chose ADSL because that was the service provided by Telkom or at least that could be linked to my telephone line" (C1).

Respondent C3 mentions that due to iBurst's (Wireless Broadband) infrastructure being available in his area, this lead to his decision to acquire this particular service.

"Luckily iBurst was available in my area; otherwise I would have had to make other arrangements or choice" (C3).

On the other hand, infrastructure was also the deciding factor for some non-adopters. This in the sense that there was no infrastructure in place for respondents to acquire broadband services:

"I don't currently have internet at home. I am renting a flat now so there's no landline and I don't have the necessary equipment yet" (N8).

Personal Computers

While only one respondent had mentioned that the reasons for not adopting broadband was because of not having a PC, this factor is deemed important as having a PC is the first step to acquiring broadband. Respondent N4 had mentioned that if he

had a PC he would consider acquiring broadband due to various needs. However due to affordability, in N4's case, buying a new PC and also paying for a broadband subscription was too costly. Therefore acquiring personal computers have an effect on the overall costs of subscribing to broadband services. If consumers perceive that the costs of buying a new PC and subscribing to broadband are too high then this may lead to not adopting broadband.

"To tell you the truth I wouldn't know because I don't know much about broadband. I'm sure if I had a PC then I would enquire about it...I'm really affected by the cost because I don't have a PC but once I have a PC I'm sure I would enquire about" (N4).

5.2.4 Summary of Initial Adoption

This section analysed the interviewees' beliefs and perceptions that influence a consumer's decision to adopt broadband services i.e. the initial adoption phase of this study. The researcher distinguished between consumers as adopters and users and non-adopters. The respondents' impressions were analysed, focusing particularly on the different perspectives between adopters and non-adopters.

While factors from the model of broadband diffusion emerged from the data, new factors also emerged. In the case of a consumers attitudinal belief these factors included relative advantage, hedonic outcomes, utilitarian outcomes, security and technology comfort and the new factor loyalty. The factor inherent in subjective norms was social influence. The factors of PBC included cost, requisite knowledge, broadband content, needs and skills and new factors that have emerged included infrastructure and personal computers (PC).

The next section will focus on the demographics of the respondents in more detail particularly looking at how these variables affect attitudinal belief and perceived behavioural control.

5.3 Relationships with Demographics

The previous sections looked at demographics of the respondents, separating the adopters from the non-adopters, and the factors that influence a consumer's decision to adopt broadband technologies. This section tracks back to the demographics of the respondents particularly looking at the relationships between the demographic variables and the factors of initial adoption. As illustrated by the generic model of broadband diffusion, the demographic variables affect attitudinal belief and perceived behavioural control. These variables include age, education, income and occupation. Their relationships are explained in more detail below.

5.3.1 Age and Education

Data shows that age and education have an impact on the skill levels of the respondents. Five out of the six adopters expressed that they had started making use of computers from a very young age while five out of the nine non-adopters had also expressed the same. This, with the interest in PCs and the Internet over the years, contributed to the increase in their skill levels in understanding newer Internet technologies particularly broadband technologies.

"I had an interest in it before high school. This was probably since primary school days. I enjoyed working with computers. The more you want to experiment the more you got to understand how they work" (N7).

Respondents also felt that it is important that students start from a young age in learning how to use PCs and the Internet in order to improve on their skill set as they become older. This will ultimately lead to children becoming more knowledgeable in the future.

"I think in the context of South Africa you need to educate the kids from the primary school level on how to use the computer. Just the basic things like word processing, Excel, how to use the internet, how to look up information and things like that. Children need a basic understanding of that" (C3).

In terms of education those respondents that had not started using PCs or the Internet from a young age had increased their skill levels through formal training particularly studying in that various subjects within the computer-related field. Therefore data shows that education has an impact on the skill levels of the respondents. It is necessary to note here that both adopters and non-adopters have expressed that they had some kind of formal training whether they had interests from a young age or not.

5.3.2 Occupation

Occupation affects the skills of the respondents and their knowledge of what broadband technologies and services are being offered. Therefore occupation is related to requisite knowledge. Occupation is also related to education as most respondents who studied within the computer-related field began working in that specific field. Data shows that those respondents who work in the IT environment have higher skills and are more knowledgeable about broadband technologies as respondent C2 expresses:

*“Besides being aware of it I’m actually working in the environment as well...it is part of my work. Before most companies have started out like Syntech and some other places I’ve always been in touch and before they released a product I’ve found out about it "(*C2).

Respondent C2 also mentions that he has earned a living in the computer industry as a technical support officer, analyst and was once a computer programmer. This environment has enabled him to become more aware of the broadband services in terms of what new technology is going to be released and what new services in terms of price and capping. Of the six adopters, four expressed similar situations. Five out of nine non-adopters had also mentioned the same.

5.3.3 Income

For the adopters, data showed that income was related to the type of connections that respondents had. The profiles of the respondents suggest that those in the higher income bracket tend to favour faster connections, if not the fastest, with higher caps (bandwidth) while those in the medium and lower income bracket tend to subscribe to slower connections with lower caps. C1 and C4 respectively, who are high income earners, mentioned the following about the type of broadband connections they have:

"Yes, I have ADSL. Apparently it's the fastest connection from what my son tells me" (C1).

"Yes. I have an ADSL line. It is the fastest line. I think it is 4Mb and I have a 3GB cap" (C4).

However, contrastingly, C5 and C6, being medium and low income earners respectively, mentioned the following about their type of broadband connections:

"I just have the normal ADSL 384Kbps line. I think it is the slowest" (C5).

"I have an ADSL 384Kbps line. I am also subscribed with a 1GB cap" (C6).

Costs were also related to the income levels, however the high costs that respondents complained about seemed to be out-weighed by the actual needs of the respondents.

With respect to the non-adopters, the respondents felt that it was the costs that drove them to not subscribe to broadband services. Data showed that income was not an issue amongst the respondents, even for those who fell within the low income brackets. Respondents highlighted that it was the costs to needs ratio that impacted on their decisions. Respondent N2 mentions the following:

"First would be the cost. And second I suppose the technology is new and there's no balance the cost and need for it. And also for basic requirements I use the dialup for email and surfing" (N2).

5.3.4 Summary of Relationships with Demographics

This section described the relationships between the demographic variables and the factors of initial adoption. Data showed that the demographic variables mostly affected factors within perceived behavioural control. It appears that age and

education affects the skill levels of the respondents, occupation also affects skills as well as requisite knowledge of broadband technologies and finally income affects the type of broadband services that a respondent subscribes to, which is related to the cost of the service. The relationships between the demographic variables and the factors affecting broadband adoption complete the findings of the initial adoption phase. The next section discusses the findings of the sustained adoption phase focusing more on the respondents who have adopted broadband services.

5.4 Factors Affecting Sustained Adoption

The sustained adoption phase focuses on the respondents who have already subscribed to broadband services particularly looking at their usage attributes and how these impact on their use patterns (variety and rate of use).

The qualitative analysis shows that all the factors in the global model of broadband diffusion are relevant to this research study. However, a new factor, skills of users, will be considered for the personal dimension of the determinants of use diffusion. This section will provide an overview of the factors determined for use and how these factors affect the use patterns of consumers by synthesising the data gathered from the seven adopters and users. It also looks at how the factors affect the variety of use and rate of use of the users' broadband service. Factors that emerged within the variables of household social contexts, the personal dimensions of users, technological dimensions and external dimension will be explained in more detail below.

5.4.1 Household Social Context

Household social context is the environment in which the user operates within the household. Here the context is made up of three variables namely household communication, competition for limited resources and prior experience with technology. According to data, respondents have expressed importance of these three variables and how it affects their household environment in terms of using their broadband technologies. These variables are explained in more detail below.

Household Communication

When people attempt different things in connection with broadband technology, there may be a greater need to communicate or consult with others for assistance particularly those who are more knowledgeable. Two of the seven respondents had mentioned that there is some form of internal communication that exists within their households. Respondents C1 and C5 mentioned that when they find anything difficult relating to their broadband service they would consult a particular member of the family who is more knowledgeable about the technology.

"My son knows a lot about these things. He has all these wireless devices connected. If anything goes wrong he is the one that can fix it. Also if we don't know much about something we can always ask him for advice" (C1).

"Well my brother is quite clued up on all these things. If I need help with something or if anything goes wrong I can always go to him" (C5).

Consulting with more knowledgeable people in the family will have an effect on the use patterns of consumers. If there is an increase in communication between members of the family then this may lead to a higher variety of use of broadband technologies.

Competition for Limited Resources

Competition for limited resources leads to family members negotiating times in determining who uses the technology and when. Sometimes tension can arise if technology is not available to all family members all the time. Respondent C5 states that due to the limited availability of PCs in his household there are clashes with the family in terms of who uses the PC and when.

"There can sometimes be clashes with the family. One uses the computer too much. If it's in the family then obviously equal rights to make use of it" (C5).

If there is competition for limited resources in the household then this may have an impact on the use patterns of consumers by lowering the rate of use of broadband.

Prior Experience with Technology in the Family

If the family has prior experience especially with using similar older technologies then this may provide them with the necessary skills to recognise any situation in which the technology can be applied and how to apply it. Five respondents had mentioned that due to the experience of having dial-up connections this made the learning curve with broadband easier. Respondents expressed that their experience had increased and they had become more knowledgeable.

"I had prior experience from dial-up, so using broadband wasn't difficult at all...Now that I have broadband my knowledge increased. I can go anywhere, anytime for information" (C6).

Continued use of broadband will increase the experience of using it. Therefore a higher accumulated broadband experience is likely to affect the use patterns of the consumer by increasing the variety and rate of use of broadband.

5.4.2 Technological Dimension

Technological dimension is the overall technological environment in which the user operates. This dimension consists of the two variables in the proposed model for broadband diffusion, namely, technology sophistication and complementary

technologies. These variables were also mentioned by the majority of the respondents and are explained in more detail below.

Technology Sophistication

Technology can be sophisticated without being difficult to use. It is expected that users with access to more advanced technologies seem to make more use of it. Respondents expressed that broadband is more sophisticated than their previous dial-up connections and they have found it easier to obtain information with the technology. Respondent U1 expressed that her previous dial-up connection was unsatisfactory and now with her more sophisticated broadband connection she can get more work done. This, therefore, ultimately leads to making more use of it:

"Dial-up was a very slow connection. Sometimes you get disconnected repeatedly on the line. It's frustrating because you are in the middle of something and then you might lose your work. And it takes you so much longer...Since we have broadband I actually spend longer and want to spend longer on the net because the connection is faster and you want to do much more by multi-tasking" (U1).

Therefore, using the more advanced broadband technology is likely to increase the variety as well as rate of use of the service.

Complementary Technologies

Complementary technologies complement the broadband technology in use. This therefore leads to a higher use of broadband technologies. Data shows that the complementary technologies generally arise from having a sophisticated technology setup within the household. Respondents expressed that their complementary technologies ranged from laptops, mobile phones, video editing devices to video game consoles for online gaming.

"We have a wireless connection network. Especially with the laptop it makes it easier for us in the household and it is more efficient because we have two computers, a PC and a laptop. Also my brother has an Xbox 360 connected to the wireless network which he uses for online gaming" (U1).

Complementary technologies can reduce competition for limited resources. If consumers have a sophisticated network setup with devices such as laptops and PCs to access the network, then this affects the amount of people that can have access to broadband at a given time.

In terms of a consumer's use patterns, if a consumer uses other complementary technologies, as described above, then this may lead to a higher variety of use of their broadband subscription.

5.4.3 Personal Dimension

Personal dimension consists of personal variables that have an effect on the usage behaviour of consumers. According to the proposed model of broadband diffusion the personal dimension consists of the variables use innovativeness and frustration with technology.

Use Innovativeness

If consumers are to be innovative then they must use the product in multiple novel ways. They must also have the creativity and curiosity to learn new things with the technology. All respondents expressed that they are more innovative now that they have obtained broadband. Respondents felt that they are more adventurous, creative and performed more of other activities at the same time. Respondents C6 and C2 had mentioned the following respectively:

"I feel that there is more scope. I am now more adventurous to move into new areas. I can multi-task excellently now" (C6).

"I don't have to spend a lot time waiting for things to happen. With broadband connections I can multi-task. So I have to learn and adapt to newer technologies faster as the field evolves so rapidly. So I actually have become much more innovative and better at multi-tasking and I actually have a chance to deal with things that are more important in life as result of having a quick connection. Finishing work quickly and collaboration is made easy with a good enough connection" (C2).

Respondent C3 had mentioned that innovativeness depends on what the user intends to do with the technology. If the user had an online business then the user would be more inclined to be innovative.

"I think it depends what you want to do with it. If I wanted to start an online business selling stuff from my house or whatever, then maybe I would think more creatively. I'm just using it for my studies so I don't think it increased my creativity that much, I think as soon as people can start making money from it then I think it can be more creative" (C3).

Therefore, in terms of consumers' use patterns, higher use innovativeness may lead to a higher variety of use.

Frustration with Technology

Frustration with broadband technologies arises when a specific technology is very difficult to learn or use. However, it is shown that respondents expressed frustrations with broadband services in terms of speed and costs.

"At the moment I am very frustrated about the costs...Fluctuating speeds...I think that the advertising for iBurst is very misleading in that they tell you can get up to 1Mbps but you never get that" (U3).

If frustration with the technology increases then this may lead to a lower rate and variety of use.

Skills of Users

Skill levels have an effect on use innovativeness. Respondents who had more advanced skills seemed to be more innovative then those who had lower skill levels. Respondents with more advanced skills seemed to know more about how the technology worked and therefore used it in many different ways while low skilled users used broadband to perform basic activities. However, even low skilled users are becoming more innovative and therefore, through this, use innovativeness has a recurring effect on skill levels.

5.4.4 External Dimension

Data reveals that external factors contributing to the usage behaviour of consumers with regards to broadband technologies are external communication, external technology access and family exposure to target media. The majority of the respondents placed emphasis on how these factors affect their usage behaviour externally. Details of these factors are explained below.

External Communication

If a person speaks to friends and co-workers about products, such communication reinforces user belief systems and, consequently, behaviours. All respondents expressed that there was some form of external influences that had made them adopt broadband services. Such influences were from friends or family living overseas expressing the benefits of broadband for communications, friends expressing the benefits of broadband for online gaming and co-workers expressing the benefits of broadband in terms of performing work-related activities at home. If friends or family members, through external communication, make a consumer aware of broadband capabilities then the consumer is more likely to adopt broadband technologies. An increase in external communication pertaining to broadband services is likely to increase the variety of use.

External Technology Access

The use of broadband technology outside the household, particularly at work or school, has an overall effect on how the consumer will make use of the technology within the household. Five respondents mentioned that they had high speed internet access at their work place while respondents U1 and C5 mentioned the use of the University of South Africa's (UNISA) internet access and internet cafes respectively.

"I make use of UNISA's LAN whenever I am at the university. I use it for communication with lecturers and for accessing our admin information" (U1).

"Other than Internet Cafes I haven't made use of any other technology outside my home" (C5).

Having access to technology outside the household can lead to an increase in the overall variety of use of broadband services but at the expense of a lower rate of use of broadband services within the household.

Family Exposure to Target Media

If consumers are exposed to media, this may stimulate their involvement with broadband technology. Three respondents expressed that through media exposure their knowledge of what broadband can do had increased. Consumers had become more aware of the video, voice and online-chat capabilities of broadband. Data shows that the killer applications for broadband adoption are the various applications for video and voice calling.

"I became more aware of broadband technologies and what it can do through advertising. The companies advertise a lot. With media I became aware of it" (C3).

"We communicate with my sister who is overseas. We do it through video conferencing. Webcam, Skype, Yahoo and MSN. And we also email. More emphasis on video conferencing though, if it wasn't for the media I don't think we would have known such things" (C5).

It is shown that family exposure to target media has an effect on use innovativeness. As consumers are exposed to the different media available, they can use this experience to become more innovative.

Exposure to more target-related media may result in a higher variety and rate of use of broadband services.

5.4.5 Service Quality

The final determinant of use diffusion is service quality. After the user has adopted and has been making use of broadband technology the quality of service provided by the service provider determines whether the user will continue using the service or not. Four respondents had mentioned that they receive very good service from their service providers while two respondents had mentioned they were not entirely happy with the service. One respondent was neutral about the situation.

Respondents who felt that they experienced good service quality had mentioned that the main factor was excellent customer service received by their service provider as respondent C3 points out:

"I got quite a good service. Their handlings are very professional. I think that because they don't have a large footprint they can't reach a large audience and they

need to find some way to differentiate themselves from Vodacom, Telkom etc. So the way they decided to go is to provide the best level of service to their clients" (C3).

Factors that contributed to respondents not experiencing good service quality were frequent downtimes; poor help desk services and general quality of the technology.

"I say it's not that great because when we had a problem when the area network was down. You had to phone repeatedly to sort it out. And it took a week, which is a lot of time which is important especially for business people who can't afford to have those sort of mess ups" (U1).

"The service quality is not good enough. Still takes a while to load up. It is very expensive especially with HSDPA cards. Download rate that they offer is very slow in comparison to dedicated ADSL line" (C2).

Therefore, if a consumer experiences good service quality then this is likely to have an effect on use patterns in that it increases the rate of use.

5.4.6 Summary of Sustained Adoption

This section analysed the responses of those users who have subscribed to and are making use of broadband technology. It analysed their usage characteristics in order to determine which factors impact on their use patterns.

All factors remain and fall within the variables of household social contexts, the personal dimensions of users, technological dimensions and external dimensions respectively. A new factor emerged, skill of users, which has an impact on use innovativeness. The next section discusses the impact of broadband on consumers' lives. The findings of the sustained adoption phase will be used to determine the impact of broadband in terms of work, entertainment and other daily activities.

5.5 The Impact of Broadband

Broadband can offer entertainment and alternative ways to work. This is likely to have an impact of people's lives especially with their normal daily activities. This section attempts to explain the impact that broadband has, particularly on South African household consumers. Based on the usage characteristics of broadband, respondents were asked how these impacted on their lives. Findings reveal that the impact outcomes mentioned by the respondents are similar to that of the proposed model of broadband diffusion. Respondents expressed impact of broadband technology on lifestyle, satisfaction with broadband services and their interests in future technologies.

5.5.1 Lifestyle

A majority of the respondents had mentioned that broadband has had a major impact on their lifestyles. Lifestyle changes include easier communication with the family, saving on time to do more of other activities, cost savings and the ease of working from home. One respondent in particular had mentioned that broadband has become such an integral part of his lifestyle that he doesn't go a day without performing e-activities:

"Broadband has a major impact on my lifestyle. I'm actually restless if I don't have internet access. In fact e-activities as I call it have become an integral part of life. I don't go a day without checking email, even on holiday" (C2).

5.5.2 Satisfaction with Broadband Technologies

All respondents expressed that they are satisfied with their broadband subscriptions. Respondents felt that broadband allowed them to have more control over their lives, they are less frustrated now than when they used the slower dial-up connections and it makes life easier and gets things done.

"It's just great to have that, but come to think of it perhaps it is. It's not frustrating. If you want to know something you can search for it" (U4).

"I'm satisfied with the faster connection. That's the main reason why I would use broadband" (U7).

5.5.3 Interest in Future Technologies

Five respondents showed interest in future technologies. This was mostly interest in faster connections as well as interest in wireless connections as respondents C2 and C5 mentions respectively:

"Well, I am a techno junkie. I would like to see what the future holds in terms of speed in terms of how fast the connections going to be in the future. If I had money right now I would get myself a 4Mb connection to see what is going on" (C3).

"I wouldn't mind trying 3G. I would like to enquire more about it but about getting more knowledge about it. I think it needs to be more widely exposed here. It has taken off overseas but has taken us quite a while to adopt it here" (C5).

One respondent, however, explained that she is satisfied with her current broadband service and that she currently has no interest in future technology:

"At the moment I don't need faster or other technologies as its suits me fine" (C1).

5.5.4 Summary of Impact of Broadband

This section identified the different ways in which broadband had impacted on consumers lifestyles. Findings show that consumers perceptions of broadband are that it provides them with easier communications with the family, time savings to do more of other activities, cost savings and the ease of working from home. Moreover, consumers are satisfied with their broadband service as it allows them to have more control over their lives, consumers are less frustrated due to faster connections and it makes it easier to gets things done. Realising the benefits of broadband and its potential, consumers have expressed interest in future technologies of broadband particularly in increased speeds and wireless connections. The impact phase completes findings of the various factors that are needed to build the model specifically for South Africa. The impact of broadband is the ultimate usage of broadband and therefore through repeated usage will have a changing effect on certain use determinant factors in the sustained adoption phase. This changing effect caused by the impact of broadband, is known as the feedback loop and will be explained within the section below.

5.6 Feedback Loop

The feedback loop exists through the continued use of broadband where the impact of broadband has a continued changing effect on the use determinants as well as the rate and variety of use of broadband by the user.

The feedback loop can cause the use determinants to change over time. For example if a user was frustrated with the technology at first, through continued use of the broadband service the user may become more comfortable and eventually less frustrated. In the case of rate and variety of use, the effect can cause a user to move within the topology. An example would be where a limited user can move to become a specialised or an intense user. It therefore becomes necessary to investigate how the impact of broadband affects each of the use determinants and the rate and variety of use through the feedback loop. However, the feedback loop requires that study be longitudinal in order to assess the changes of use determinants over time. Therefore, for the purposes of this study, as this being a cross-sectional study, the feedback loop will fall out of scope of this study.

The next section consolidates the different variables and factors from each phase of this qualitative study to create a model of broadband diffusion more representative of South Africa.

5.7 Model for Broadband Diffusion in Households of South Africa

Qualitatively analysing the data acquired, the researcher attempted to expand and enhance the proposed model of broadband diffusion in the household. The responses of each consumer was analysed which determined the factors within each phase of the model.

In the initial adoption phase the attitudinal belief factors include relative advantage, hedonic outcomes, utilitarian outcomes, security and technology comfort and the new factor include loyalty. Subjective norms include social influence. The factors of PBC include cost, lack of knowledge or awareness, lack of content, lack of needs and lack of skills and the new factors that have emerged include infrastructure and lack of a PC.

It is shown that demographic variables affect certain factors within perceived behavioural control. Age and education affects the skill levels of the respondents, occupation also affects skill levels as well as requisite knowledge of broadband technologies. Finally, income affects the type of broadband services a respondent subscribes to which is related to the cost of the service.

In the sustained adoption phase all the factors within the variables of household social contexts, the personal dimensions of users, technological dimensions and external dimension remain including frustration with technology, within personal dimension. The new factor, skill level of users, was added to personal dimension. These factors help determine the use patterns of a consumer which in turn determines the impact outcome of broadband on consumers lives. Findings reveal that consumers perceived an impact of broadband, were satisfied with the technology and showed interest in future technologies.

The factors from each phase were consolidated and a model distinctly for South Africa was proposed. Figure 10 below illustrates the new model for broadband diffusion in households of South Africa.

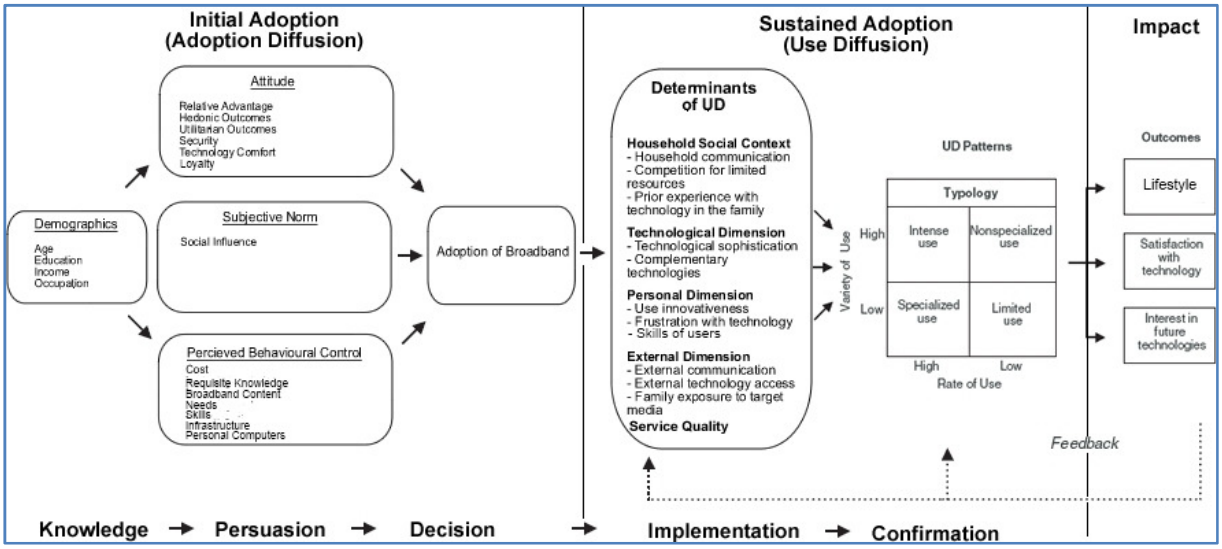

Figure 10: Proposed model for broadband diffusion in South African households

5.8 Chapter Summary

This chapter provided a narration of the themes and patterns that have emerged from the data analysis. Each phase of the diffusion process was analysed specifically looking at interviewee responses for factors that affected each phase. The findings of this study suggested that the factors affecting initial adoption were similar to that of the proposed adoption model produced in the literature review with some new factors emerging from the data gathered. In the case of a consumers attitudinal belief these factors include relative advantage, hedonic outcomes, utilitarian outcomes, security and technology comfort and the new factor includes loyalty. The factor inherent in subjective norms was social influence. The factors of PBC included cost, requisite knowledge, lack of content, lack of needs and lack of skills and the new factors that have emerged include infrastructure and lack of a PC.

The sustained adoption phase analysed the responses of those users who have subscribed to and are making use of broadband technology. It analysed their usage characteristics in order to determine which factors impact on their use patterns. All factors remained and fell within the variables of household social contexts, the personal dimensions of users, technological dimensions and external dimensions respectively. A new factor emerged, skill of users, which had an impact on use innovativeness.

The impact phase identified the different ways in which broadband had impacted on consumers lifestyles. Findings showed that consumers perceptions of broadband are that the technology provides them with easier communications with the family, time savings to do more of other activities, cost savings and the ease of working from home. Moreover, consumers were satisfied with their broadband service as it allows them to have more control over their lives, consumers are less frustrated due to faster connections and it makes it easier to gets things done. Realising the benefits of

broadband and its potential, consumers have expressed interest in future technologies of broadband particularly in increased speeds and wireless connections. The impact phase completed findings of the various factors that are needed to build the model specifically for South Africa. The next chapter looks at the approach taken to validate this model.

6

Quantitative Research Design

"As technology advances, it reverses the characteristics of every situation again and again. The age of automation is going to be the age of 'do it yourself'"

Marshal McLuhan

Canadian communications theorist and educator, 1911-1980

6.1 Chapter Overview

This chapter starts by first outlining the research time frame for this quantitative study. It then provides a discussion on the research sample selected. This is followed by a recap on the research questions and stating the aim of this quantitative study. The main research hypotheses are proposed which is followed by describing how the quantitative instrument was designed and how data collection was conducted. A discussion is provided on how the researcher ensured the reliability and validity of the instrument and how the analysis of the data was performed. Finally, the chapter

concludes by describing the expected outcomes and limitations of the quantitative study respectively.

6.2 Research Time Frame

The quantitative study was cross-sectional in that it analysed responses at a single point in time. While past as well as future behavior and attitudes are of interest, it is believed that the experience of change over time could be relayed by the respondents during the survey phase. Quantitative data was collected during the months of June to September 2009.

6.3 Quantitative Research Sample

This study aims to target residents in households of South Africa. However due to time constraints and expenses the target population to be included in the research was limited to the Western Cape province of South Africa looking at subjects particularly in the Cape Town region.

Typically the respondents for the adoption decision of broadband would be 18 years or older, have a steady income and some form of formal education. Those respondents who have adopted broadband must be the main subscription holders of the broadband services, that is, the respondents must be the sole person paying for the services. A sample of adopters and non-adopters of broadband was identified matching the required criteria.

Users were made up of the consumers or subjects that make use of the consumer's broadband subscription. Users would essentially be living in the same household as the consumer. However, an exception was made in the case where the consumer pays for a user who is not living with the consumer. An example would be where a student is living away from home and the parent pays for the student's broadband access. Respondents of 18 years and over were selected due to the diverse and different needs of children which are out of the scope of this study.

6.3.1 Sample Size

A stratified random sample will be used to look at distinct sub groups based on age, occupation and income of adopters and non-adopters. In order to determine the correct sample size, three pieces of information are required. These include (Bartlett, Kotrlik and Higgins, 2001):

1. a rough estimate of the total sample size;
2. the desired error level (confidence interval) and
3. the desired confidence level

Fowler (2002) suggests that in order to perform rigorous statistical analysis, such as principal component analysis, regression analysis, t-tests and chi-squared tests, the sample size should be above 300. According to Dwivedi (2008) a rough estimate of the total sample size of 1500 was selected in order to achieve 300 responses. This was calculated by taking the total responses required (300) multiplying it by 100 and dividing this figure by the pilot response rate (20). However to compensate for any shortfalls, such as incomplete or partially completed responses, the figure was increased to 1600. For the purposes of this study the 1600 figure was used as a benchmark. This is due to, as section 6.8 discusses, this study performing similar statistical analysis and having the equivalent number of respondents for the pilot study.

To determine the amount of survey respondents needed a 5% error level was tolerated with a 95% level of confidence. This means that if the researcher conducts the same survey 100 times, the results would be within +/- 5% of the first time the researcher ran the survey 95 times out of 100. Therefore the amount of survey respondents required amounted to 310 out of 1600 taking into account the 5% confidence interval and the 95% confidence level.

If 310 survey respondents are needed and it is estimated that 80% of the respondents will complete the surveys (on the basis that a higher estimate was required than Dwivedi's (2008) larger number of survey respondents) then 388 surveys will need to be sent to respondents in order to allow for incomplete or partially completed responses.

6.4 Research Questions

The main research objective was to ultimately expand and enhance the proposed model within the South African household context. More precisely, the study will attempt to answer the following questions:

1. What factors affect a South African consumers' decision to adopt broadband?
2. What factors affect the way they use broadband and how do South African consumers use broadband?
3. What impact does broadband have on South African consumers and how does this affect their future use of the technology?

Furthermore, the aim of this quantitative study is to:

1. Design an instrument to validate the proposed model.
2. Using the instrument, validate the proposed model quantitatively in the South African context.
3. Attempt to provide an explanation for each of the research questions above.

6.4.1 Proposed Research Hypothesis

Based on the model for broadband adoption in households of South Africa derived from both the literature review and qualitative study, the main research hypotheses are split between the three stages of diffusion i.e. initial adoption, sustained adoption and the impact of broadband. The direction for all hypotheses came from the literature review and qualitative study. The main research hypotheses for the initial adoption phase are as follows:

H_1: There will be demographic differences between adopters and non-adopters of broadband

H_{1a}: *Adopters of broadband will have a younger age distribution than non-adopters.*

H_{1b}: *Adopters of broadband will have a higher annual household income than non-adopters.*

H_{1c}: *Adopters of broadband will have higher education levels than non-adopters.*

H_{1d}: *Adopters of broadband will belong to a higher occupation category than non-adopters.*

H_2: Overall demographics influence a consumer's Perceived Behavioural Control

H_{2a}: *The older the consumer, the higher the skills in using broadband.*

H_{2b}: *The higher the level of the consumer's education, the higher the consumer's skills in using broadband.*

H_{2c}: *The higher the level of the consumer's occupation, the higher the consumer's skills in using broadband,*

H_{2d}: *The higher the level of the consumer's occupation, the greater the consumer's knowledge about broadband.*

H_{2e}: *The higher a consumer's monthly income, the more affordable broadband will be for the consumer.*

H_3: Overall attitudinal factors positively influence the adoption of broadband

H_{3a}: *The greater the perceived relative advantage of using broadband over dial-up, the more likely that broadband will be adopted in the household.*

H_{3b}: *The greater the perceived entertainment (hedonic outcomes) potential of using broadband, the more likely that broadband will be adopted in the household.*

H_{3c}: *The greater the perceived usage (utilitarian outcomes) of Broadband for household activities the more likely its adoption.*

H_{3d}: *The greater the perceived security of broadband the more likely it will be adopted.*

H_{3e}: *The greater the technology comfort provided by broadband the more likely its adoption.*

H_{3f}: *The greater the consumer loyalty to a particular service provider the more likely broadband is adopted.*

H_4: Overall PBC factors will have an influence on the consumer's intention to adopt broadband

H_{4a}: *The lack of knowledge on broadband, its availability and benefits the inhibits broadband adoption.*

H_{4b}: *The lack skills in using the PC and the Internet, the less likely that broadband will be adopted.*

H_{4c}: *The lack of perceived need for broadband, the less likely that it will be adopted.*

H_{4d}: *The greater the monthly cost of broadband access, the less likely that it will be adopted.*

H_{4e}: *The perceived lack of broadband content, the less likely that broadband will be adopted.*

H_{4f}: *The lack of infrastructure will inhibit broadband adoption.*

H_{4g}: *The lack of owning a PC or the greater the perceived cost of upgrading the old PC or buying a new PC the less likely broadband is adopted.*

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H_5: Overall subjective norms will have a positive influence on the consumer's intention to adopt broadband

H_{5a}: *The greater the social influence by family, friends and colleagues the more likely broadband will be adopted.*

The main research hypotheses for the sustained adoption phase are as follows:

H_6: Overall determinants of use diffusion influence a consumer's use diffusion patterns

H_{6a}: *Higher intensity of household communication with other users about broadband leads to a higher variety of use (intense and experimental use).*

H_{6b}: *Greater competition for limited resources within the household leads to a lower rate of use (specialised use).*

H_{6c}: *Greater previous experience in the family of using the Internet results in a higher variety and rate of use (intense and experimental user).*

H_{6d}: *Greater technology sophistication of broadband leads to higher variety and rate of use (intense, specialized, experimental use).*

H_{6e}: *The greater the complementary technologies that access the broadband service, the higher the variety and rate of use (intense, specialized, experimental use).*

H_{6f}: *Higher use innovativeness within broadband users results in higher variety of use (intense and experimental use).*

H_{6g}: *The higher frustration with broadband technology leads to a lower variety and lower rate of use (low use).*

H_{6h}: *Higher skills of users lead to higher variety of use (intense and experimental use).*

H_{6i}: *Higher levels of international communication with family and friends leads to variety of use (intense and experimental use).*

H_{6j}: *Access to broadband Internet connection outside the home environment leads to a higher variety of use but lower rate of use in the home (experimental use).*

H_{6k}: *Increased family exposure to target media leads to an increase in variety of use and rate of use of broadband services (intense, specialized, experimental use).*

H_{6l}: *An increase in the quality of broadband will increase its rate of use (intense use).*

The main research hypotheses for the impact that broadband has on consumers as a result of its use are as follows:

H_{7a}: *The greater a user's rate and variety of use, the easier it is for users to communicate with distant families.*

H_{7b}: *The greater a user's rate and variety of use, the more a user will be able to commence with other life activities.*

H_{7c}: *The greater a user's rate and variety of use, the more a user will be able to save on costs.*

H_{7d}: *The greater a user's rate and variety of use, the easier a user will be able to perform work related activities at home.*

H_{7e}: *The greater a user's rate and variety of use, the more satisfied a user will be with the technology.*

H_{7f}: *The greater a user's rate and variety of use, the higher the level of interest in acquiring futuristic-oriented technologies.*

6.5 Quantitative Data Collection

6.5.1 Justification for use of Questionnaires

Questionnaires or surveys are non-experimental, descriptive research methods that are used to collect quantitative information about items in a population (Babbie, 1973). From the findings highlighted by Dwivedi (2008), although there exist numerous research approaches for IS researchers, it is the survey approach that is most widely used for technology adoption issues. The choice of approach depends on the unit of analysis. A case study was favoured where the researcher considered the organisation as the unit of analysis (Dwivedi, 2008). Studies relating to individual users or consumers show that the survey approach was favoured. This is due to issues such as convenience, cost, time and accessibility (Gilbert, 2001).

The development and validation of a research instrument to test the broadband diffusion model for South Africa is seen as a valuable research contribution in its own right. The research instrument can also be used and/or built upon by other researchers seeking to adopt the framework in the future. Questionnaires are deemed to be suitable for this purpose as they allow objective data to be collected from a large sample in a standardised way.

6.5.2 Aim of Questionnaire

The survey is a way of moving from observations to theory validation (Newsted, Huff, Munro and Schwarz, 1998). Since the qualitative study of this research developed a theory for broadband diffusion of households in South Africa, the aim of the survey is to validate the theory.

The way in which surveys can move from observations to theory validation can be achieved by (Newsted et al., 1998):

1. observed responses becoming data on single questions;
2. the questions are aggregated into scales and
3. allows for appropriate numerical formulas to be applied to numbers.

Through the use of a questionnaire the model for broadband adoption in households of South Africa will be validated. The constructs of the model will be of interest here and the approach is to determine the relationship of these constructs as a way of making sense of consumer behaviour. The survey will attempt to validate each of the proposed hypotheses outlined in section 6.4.1 above.

6.5.3 Design of Questionnaire

Using the inputs from the qualitative study and some prior relevant studies a pilot questionnaire was devised. The relevant studies include Choudrie and Dwivedi (2004b), Shih and Venkatesh (2004) and Dwivedi (2008).

Using similar information from previous questionnaires and studies is advantageous as they have been validated already. This, therefore, will add to the credibility of the instrument of this research. However, some factors of the broadband diffusion model for households of South Africa are new and have not been previously validated and operationalised. In these instances, inputs from the qualitative study have been used in order to construct the related test items.

From the analysis of the qualitative study and with relation to the test hypotheses Table 8 and Table 9 summarises a list of constructs and items and their corresponding codes to examine broadband diffusion.

Dependent Factors	Codes	Number of Items	Independent Factors	Single & Multiple item Constructs	Related Hypothesis
Initial Adoption					
Adoption of Broadband [Question 6]	RA1-RA6	5	Attitude	Relative Advantage	H_{3a}
	HO1-HO5	3		Hedonic Outcomes	H_{3b}
	UO1-UO8	4		Utilitarian Outcomes	H_{3c}
	SEC1-SEC4	3		Security	H_{3d}
	TC1-TC8	3		Technology Comfort	H_{3e}
	LOY1-LOY2	2		Loyalty	H_{3f}
	SN1-SN3	3	Subjective Norms	Social Influence	H_{5a}
	RK1-RK6	3	Perceived Behavioural	Requisite Knowledge	H_{4a}
	SK1-SK2	1		IT Skills	H_{4b}

	N1-N6	2	Control	Needs	H_{4c}
	C1-C4	3		Cost	H_{4d}
	BC1-BC2	1		Broadband Content	H_{4e}
	INF1-INF2	2		Infrastructure	H_{4f}
	PC1-PC3	1		Personal Computer	H_{4g}
	AGE	1	Demographic Factors	Age	H_{1a}
	INC	1		Income	H_{1b}
	EDU	1		Education	H_{1c}
	OCC	1		Occupation	H_{1d}
PBC (Skills) **SK1-SK2** **[Question 7]**	AGE	1	Demographic Factors	Age	H_{2a}
	EDU	1		Education	H_{2b}
	OCC	1		Occupation	H_{2c}
PBC (Knowledge) **RK1-RK6** **[Question 7]**	OCC	1		Occupation	H_{2d}
PBC (Cost) **C1-C4** **[Question 7]**	INC	1		Income	H_{2e}
Sustained Adoption and Impact					
Use Diffusion	HSC1-2	2	Household Social	Household Communication	H_{6a}

Patterns **(Rate & Variety of Use)** **[Question 9]**	HSC3	1	Context	Competition for Limited Resources	H_{6b}
	HSC4	1		Prior Experience with Technology in the Family	H_{6c}
	TD1-2	2	Technology Dimension	Technological Sophistication	H_{6d}
	TD3	1		Complementary Technologies	H_{6e}
	PD1	1	Personal Dimension	Use Innovativeness	H_{6f}
	PD2-3	2		Frustration	H_{6g}
	PD4	1		Broadband Skills	H_{6h}
	ED1	1	External Dimension	International Communication	H_{6i}
	ED2	1		External Technology Access	H_{6j}
	ED3	1		Family exposure to target media	H_{6k}
	SQ1-2	2	Service Quality	Overall Service Quality (Support, Security, Service and Downtime)	H_{6l}

Table 8: Master List of Constructs and Items for Initial Adoption and Sustained Adoption

Dependent Factors	Code	Number of Items	Independent Factors	Related Hypothesis
Communication	LIF1	1	Rate of Use [Q9a] Variety of Use [Q9b]	H_{7a}
Life Activities	LIF2	1		H_{7b}
Costs	LIF3	1		H_{7c}
Work Activities	LIF4	1		H_{7d}
Satisfaction	SAT1-SAT2	2		H_{7e}
Future Technologies	FT1-FT6	6		H_{7f}

Table 9: Master List of Items for the Impact of Broadband

The list of constructs and items and their corresponding codes to examine broadband diffusion in Table 8 and Table 9 above were used to help design the questionnaire. Together with the list of constructs and items the scale of measurement was determined based on the four types that are measured namely nominal, ordinal, interval and ratio. The scale of measurement was used to determine what statistical procedures are best for the quantitative data analysis (Bartlett et. al, 2001).

The questionnaire contained a total of 17 questions. The questions were divided into four broad categories:

- (SECTION A) is multiple choice questions addressing the social attributes (demographic variables) including age, education, occupation and income. The measurement of scale utilised for demographic variables is ordinal scale as the researcher assigned the subjects to certain categories or groups.
- (SECTION B) uses 7-point Likert scale questions to assess the perception of the adopters and non-adopters of broadband. For the adoption factors an ordinal scale was utilised. To determine broadband adoption a nominal scale was utilised as consumers provided a yes/no answer for the adoption of broad-band. For statistical purposes the yes/no answer is represented by a 0 for no and a 1 for yes.
- (SECTION C) assesses the consumers' usage of broadband by (1) assessing the determinants of use with a 7-point Likert scale set of questions and (2) determining the consumers' usage of time upon various activities. An ordinal scale is utilised to assess the determinants of use and a nominal scale for assess consumer usage of time upon various activities as the study aimed to categorise determinants of use as per typology for the use diffusion patterns.

- (SECTION D) uses a 7-point scale to assess the impact of broadband based on their lifestyles and satisfaction as well as a 4-point Likert scale to assess the consumers interest in future technologies. An ordinal scale is used.

The final version of the proposed questionnaire is illustrated in Appendix G.

6.6 Pilot Testing

The primary aim of the pilot test was to "ensure that the various scales demonstrated the appropriate levels of reliability" (Dwivedi, 2008, p93). The pilot test "ironed out" any difficulties that respondents faced when completing the questionnaire.

The pilot questionnaires were sent out to 20 respondents particularly those in educational institutes and/or industry who have experience in research studies in order to get a more professional opinion on the structure and content of the questionnaire. Included with the pilot questionnaire, four other questions were asked in order to determine the respondents understanding of the questionnaire. The four questions were (Dwivedi, 2008):

1. Is the length of the questionnaire acceptable?
2. Are the questions understandable?
3. Is the layout of the questionnaire acceptable?
4. How long did it take the respondent to complete the questionnaire?

An "additional comments" question was also added to acquire any other comments that may have been missed by the four questions.

Table 10 illustrates the four questions that were included in the questionnaire. A page was included with the questionnaire providing definitions of acronyms related to Internet access (Dwivedi, 2008).

Questions	**Frequency**		**Percent**	
	Yes	***No***	***Yes***	***No***
Is the length of the questionnaire acceptable?	17	3	85	15
Are the questions understandable?	20	0	100	0
Is the layout of the questionnaire acceptable?	20	0	100	0
	Time used to complete questionnaire (minutes)			

How long did it take the respondent to complete the questionnaire?	10	15	20	25	30
Frequency	4	6	5	1	4
Percent	20	30	25	5	20

Table 10: Pilot Test Questionnaire and Figures

6.7 Data Collection and Preparation

Based on the feedback received from the pilot study, the questionnaire was reviewed and refined. See Appendix G for the final survey. The refined questionnaire was then delivered to the respective samples. The researcher first made some initial contact with targeted respondents. This initial contact was initiated in order to encourage participation of the respective samples, hence ensuring a higher response rate. This was also performed in order to determine if the respondents had met the criteria of stratified sampling.

Using this approach meant that the researcher had delivered the surveys by hand from "house to house". In most cases the respondents were not interested in participating in the survey or had not returned completed surveys to the researcher. Of the 50 surveys that were hand delivered, only 27 completed surveys were received.

Due to the lack of participation from respondents when hand delivering the surveys to households, the researched then created a web-based online survey based on the original survey. The web-based survey was created using an online survey creator called SelectSurveyASP Advanced which was hosted by the University of Cape Town. The links were then emailed to various respondents, placed on local broadband and gaming forums and placed on the popular social networking website Facebook. The researcher had run a competition where upon completion of the survey the respondent would be entered into a lucky draw to win an ADSL modem or R1000 cash prize. The competition was run in order to ensure that the response rate was high. The criteria for selecting the sample was included as part of the rules of the competition in order to ensure that the correct sample was selected.

Responses received were checked for completeness and accuracy. Questionnaires which were not answered or not filled out completely have not been considered for the analysis. For the total of 310 surveys (hard copy and web-based) that were received, 133 surveys were discarded due to being incomplete or inaccurate. A total of 177 completed surveys were used for the data analysis.

The 177 "correct" responses was a large "drop" from the required 310 responses. As a result, due to the low response rate (low sample size) of the data collected, a significance level of 0.1 was chosen for the hypothesis testing. Furthermore, the low

responses may have mirrored the behaviour of the sample less accurately and as a result the data was deemed less confident (Kalla, 2009). A 90% confidence interval was selected which allowed for the decrease of the significance level from 0.05 to 0.1. Choosing the significance level of 0.1 may also allow for the less confident data to have more significant results albeit at a weaker significance level (Kalla, 2009).

6.8 Data Coding and Analysis

The results of the questionnaire have been coded using Microsoft Excel spreadsheets and then transferred to Statistica. The initial Excel spreadsheet of coded data can be found on the CD-ROM included with this research study.

Different tests such as reliability and factor analysis, descriptive statistics, correlation and regression have been performed using Statistica and SPSS. These are discussed in more detail in the following sections.

6.8.1 Testing Normality of Data

In research, there are two types of test data which have different types of analysis. These include parametric and nonparametric techniques for the testing of data. Parametric techniques test hypotheses about population parameters and assume that the population being sampled has a particular distribution, for example a normal distribution (Bernstein and Bernstein, 1999). Nonparametric techniques are distribution free and test hypotheses about population distribution instead of population parameters (Bernstein and Bernstein, 1999). Based on the two types of test data mentioned, this section provides an overview of the different statistics that were used to test the relationships between the different constructs and items of the proposed model.

To test whether the data was normally distributed, the descriptive statistics "Kolmogorov-Smirnov" and "Shapiro-Wilk" tests were performed in SPSS. If the significance value was less than 0.05 the normality assumption was rejected. However, if the significance value was greater than 0.05 then there was insufficient evidence to suggest that the distribution was not normal. In other words, normality assumption was accepted. See Table 11,

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
HSC_1_2_Average	.115	152	**.000**	.912	152	**.000**
HSC3	.234	152	**.000**	.797	152	**.000**
HSC4	.217	152	**.000**	.851	152	**.000**
TD_1_2_Average	.202	152	**.000**	.810	152	**.000**

PD1	.282	152	**.000**	.775	152	**.000**
PD_2_3_Average	.240	152	**.000**	.740	152	**.000**
PD4	.353	152	**.000**	.562	152	**.000**
ED1	.294	152	**.000**	.647	152	**.000**
ED2	.255	152	**.000**	.757	152	**.000**
ED3	.155	152	**.000**	.911	152	**.000**
SQ_Average	.269	152	**.000**	.666	152	**.000**
Variety of Use	.201	152	**.000**	.891	152	**.000**
Rate of Use	.205	152	**.000**	.849	152	**.000**

Table 12 and Table 13 below for the results of the tests performed for Initial Adoption, Sustained Adoption and Impact data respectively.

If the significance results from either the "Kolmogorov-Smirnov" or "Shapiro-Wilk" tests were greater than 0.05 then the normality assumption would be accepted. The outcome shows that the Security (SEC_Average), Loyalty (LOY_Average), Requisite Knowledge (RK_Average) and Cost (C_Average) construct data was normally distributed (significance > 0.05) for the adoption phase. Therefore parametric tests were deemed appropriate to analyse the data collected for these specific constructs.

It should be noted that although the four initial adoption constructs mentioned above were normally distributed, certain tests required that all of these four constructs be included with non-normal data. It was then necessary to analyse the normal data with non-parametric tests. Moreover, it is acceptable to use non-parametric tests for data that are non-normal albeit weaker results are expected than that of parametric tests (Keller, 2005).

All other constructs and items data from the Initial, Sustain and Impact phase were not normally distributed as the significance levels were less than 0.05. Therefore, nonparametric tests were deemed appropriate to analyse the data collected. Moreover, when working with dependent variables that have a nominal scale of measurement, a non-parametric statistic test should be used (Keller, 2005).

		Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Adopter	**Statistic**	**df**	**Sig.**	**Statistic**	**df**	**Sig.**
RA_Average	No	.231	23	**.003**	.723	23	**.000**
	Yes	.227	154	**.000**	.757	154	**.000**
HO_Average	No	.227	23	**.003**	.798	23	**.000**
	Yes	.172	154	**.000**	.873	154	**.000**
UO_Average	No	.187	23	**.037**	.867	23	**.006**

	Yes	.175	154	**.000**	.844	154	**.000**
SEC_Average	No	.146	23	**.200***	.920	23	**.068**
	Yes	.066	154	**.094**	.977	154	**.011**
TC_Average	No	.444	23	**.000**	.591	23	**.000**
	Yes	.362	154	**.000**	.586	154	**.000**
LOY_Average	No	.220	23	**.005**	.934	23	**.130**
	Yes	.140	154	**.000**	.939	154	**.000**
RK_Average	No	.168	23	**.090**	.817	23	**.001**
	Yes	.244	154	**.000**	.770	154	**.000**
SK1	No	.496	23	**.000**	.491	23	**.000**
	Yes	.456	154	**.000**	.422	154	**.000**
N_Average	No	.432	23	**.000**	.567	23	**.000**
	Yes	.294	154	**.000**	.665	154	**.000**
C_Average	No	.206	23	**.013**	.922	23	**.074**
	Yes	.154	154	**.000**	.894	154	**.000**
BC2	No	.313	23	**.000**	.768	23	**.000**
	Yes	.281	154	**.000**	.790	154	**.000**
INF_Average	No	.258	23	**.000**	.767	23	**.000**
	Yes	.240	154	**.000**	.768	154	**.000**
PC3	No	.324	23	**.000**	.618	23	**.000**
	Yes	.250	154	**.000**	.749	154	**.000**
SN_Average	No	.218	23	**.006**	.839	23	**.002**
	Yes	.153	154	**.000**	.917	154	**.000**

Table 11: Test for Normality (Initial Adoption)

	Kolmogorov-Smirnov[a]			**Shapiro-Wilk**		
	Statistic	**df**	**Sig.**	**Statistic**	**df**	**Sig.**
HSC_1_2_Average	.115	152	**.000**	.912	152	**.000**
HSC3	.234	152	**.000**	.797	152	**.000**
HSC4	.217	152	**.000**	.851	152	**.000**
TD_1_2_Average	.202	152	**.000**	.810	152	**.000**
PD1	.282	152	**.000**	.775	152	**.000**
PD_2_3_Average	.240	152	**.000**	.740	152	**.000**
PD4	.353	152	**.000**	.562	152	**.000**

ED1	.294	152	**.000**	.647	152	**.000**
ED2	.255	152	**.000**	.757	152	**.000**
ED3	.155	152	**.000**	.911	152	**.000**
SQ_Average	.269	152	**.000**	.666	152	**.000**
Variety of Use	.201	152	**.000**	.891	152	**.000**
Rate of Use	.205	152	**.000**	.849	152	**.000**

Table 12: Test for Normality (Sustained Adoption)

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	**df**	**Sig.**	**Statistic**	**df**	**Sig.**
LIF1	.235	154	**.000**	.801	154	**.000**
LIF2	.154	154	**.000**	.901	154	**.000**
LIF3	.178	154	**.000**	.878	154	**.000**
LIF4	.240	154	**.000**	.799	154	**.000**
SAT_Average	.150	154	**.000**	.888	154	**.000**
FT1	.539	154	**.000**	.145	154	**.000**
FT2	.421	154	**.000**	.615	154	**.000**
FT3	.360	154	**.000**	.721	154	**.000**
FT4	.427	154	**.000**	.597	154	**.000**
FT5	.356	154	**.000**	.722	154	**.000**
FT6	.537	154	**.000**	.210	154	**.000**

Table 13: Test for Normality (Impact - Lifestyle, Satisfaction & Interest in Future Technologies)

6.8.2 Reliability and Validity Testing

Reliability and validity tests are crucial to ensure the dependability, consistency and strength of the test items proposed in the survey instrument (Boudreau and Straub, 2001). For the purposes of this study a Reliability Test (Cronbach Alpha) and Confirmatory Factor Analysis was used to validate the survey instrument. A detailed discussion on the criteria used and the analysis of the reliability and validity tests is provided in Chapter 7, Section 7.4.

6.8.3 Statistical Techniques for Testing Difference

As mentioned in Section 6.5.3 above, an ordinal scale of measurement was utilised to address the social attributes of the survey instrument. Therefore, in order to test the statistical significance of nominal/ordinal variables, in this case the demographic differences of the adopters and non-adopters of broadband, a Mann-Whitney test was

deemed most appropriate (Motulsky, 1995; Keller, 2005). The dependent variable (in this case adoption of broadband) and the independent variable (demographics) are nominal and ordinal respectively (Keller, 2005; Dwivedi, 2008). Section 7.6.1 explains the Mann-Whitney Test used in further detail.

6.8.4 Statistical Techniques for Testing Relationships

Initial Adoption

As mentioned in the qualitative study, demographic variables seemed to have an influence on consumer's perceived behavioural control. To explain the relationship between demographic variables and perceived behavioural control, a non-parametric Spearman Rho test was deemed appropriate. This is due to the demographic variables being ordinal and the PBC factors are ordinal in nature. Section 7.6.2 explains the test used in further detail.

To explain the relationships between the factors affecting broadband adoption (Attitude, Subjective Norms and Perceived Behavioural Control) and the adoption of broadband a logistic regression was deemed appropriate as the dependant variable (adoption of broadband) is ordinal in nature (Keller, 2005; Dwivedi, 2008). Moreover, logistic regression is used since the factors affecting broadband adoption were used to predict whether broadband was adopted or not. Section 7.6.3 explains the test used in further detail.

Sustained Adoption

Similarly, the determinants of use diffusion are ordinal in nature and the use diffusion patterns (rate of use and variety of use) are also nominal. Furthermore, the study determines whether there is a relationship between use determinants and diffusion patterns. Therefore, a non-parametric Spearman's Rho test was deemed appropriate (Keller, 2005; Dwivedi, 2008). Section 7.6.4 explains the test used in further detail.

Impact

Finally, to explain the relationships between the use diffusion patterns which are nominal in nature and are made up of two categories (rate of use and variety of use) and the impact variables which are also ordinal in nature, the non-parametric Spearman's Rho test was deemed appropriate (Keller, 2005; Dwivedi, 2008). Section 7.6.5 explains the test used in further detail.

Table 14 below provides a summary of the above tests that were used for the quantitative data analysis of this study.

Dependent Variables	Measurement Level	Independent Variables	Measurement Level	Analysis Method
Initial Adoption				
Broadband Adoption	Nominal	Demographic	Ordinal	Mann-Whitney Test
PBC	Ordinal	Demographic	Ordinal	Spearman's Rho
Broadband Adoption	Nominal	Attitude, SN, PBC	Ordinal	Logistic Regression
Sustained Adoption				
UD Determinants	Ordinal	UD Patterns (Rate & Variety of Use)	Nominal	Spearman's Rho
Impact of Broadband				
Use Diffusion Patterns (Rate & Variety of Use)	Nominal	Lifestyle, Satisfaction and Interest in Future Technologies	Ordinal	Spearman's Rho

Table 14: Summary of Statistical Tests used for Quantitative Analysis

6.9 Expected Outcomes

It was expected that the sample chosen was interested in this particular area of study; hence they would be have been keen to participate in the survey. The proposed framework created in the qualitative study was expected to have a fair degree of validity in South Africa. However, there were some differences revealed.

6.10 Limitations

One of the main limitations is that the distribution of the questionnaire is mainly focused in the Western Cape Province due to time and resource constraints. Although this sample is representative of the South African population in terms of age, education, income and occupation, the results will not be representative of the total broadband market of South Africa.

6.11 Chapter Summary

This chapter started by first outlining the research time frame for this quantitative study. A cross-sectional study was selected as it analysed responses at a single point in time since there was limited time available due to the context of broadband

changing quite rapidly. A discussion on the research sample selected was then provided. Typically the respondents for the adoption decision of broadband would be 18 years or older have a steady income and some form of formal education. Due to time constraints and expenses the target population to be included in the research was limited to the Western Cape province of South Africa looking at subjects particularly in the Cape Town region.

A stratified random sample was used to look at distinct sub groups based on age, occupation and income of adopters and non-adopters. It was determined that 388 surveys were needed to be sent to these respondents to accommodate for incomplete responses.

This was followed by a recap on the research questions and stating the aim of this quantitative study. Based on the model for broadband adoption in households of South Africa derived from both the literature review and qualitative study, the main research hypotheses were provided and split between the three stages of diffusion i.e. initial adoption, sustained adoption and the impact of broadband.

A description of how the quantitative instrument was designed and how the data collection was conducted was then provided. Studies relating to individual users or consumers show that the survey approach was favoured. Questionnaires were deemed to suitable for this purpose as they allow objective data to be collected from a large sample in a standardised way. Through the use of the questionnaire the model for broadband adoption in households of South Africa will be validated. Using the inputs from the qualitative study and some prior relevant studies a pilot questionnaire was devised. The primary aim of the pilot test was to "iron out" any difficulties that respondents faced when completing the questionnaire. The pilot questionnaires were sent out to 20 respondents in educational institutes and industry who have experience in research studies in order to obtain a professional opinion on the structure and content of the questionnaire.

A discussion was provided on how the researcher ensured the reliability and validity of the instrument and how the analysis of the data was performed. To test whether the data was normally distributed, the descriptive statistics "Kolmogorov-Smirnov" and "Shapiro-Wilk" tests were performed. Results showed that data was not normal and nonparametric tests were deemed appropriate to analyse the data collected. For the purposes of this study a Reliability Test (Cronbach Alpha) and Confirmatory Factor Analysis was used to validate the survey instrument.

In order to test the statistical differences between adopters and non-adopters which were ordinal variables, a Mann-Whitney test was deemed most appropriate. For the initial adoption phase, in order to explain the relationship between demographic variables and perceived behavioural control, a non-parametric Spearman’s Rho test was deemed appropriate. To explain the relationships between the factors affecting broadband adoption (Attitude, Subjective Norms and Perceived Behavioural Control) and the adoption of broadband a logistic regression was deemed appropriate as the

dependant variable (adoption of broadband) is nominal in nature. For the sustained adoption phase, a non-parametric Spearman's Rho test was deemed appropriate as it determines whether there is a relationship between use determinants and diffusion patterns. The non-parametric Spearman's Rho test was also deemed appropriate for explaining the relationships between the use diffusion patterns which are nominal in nature and are made up of two categories (rate of use and variety of use) and the impact variables which are also ordinal in nature.

Finally, the chapter concludes by describing the expected outcomes and limitations of the quantitative study respectively.

7

Quantitative Data Analysis

"Men are only as good as their technical development allows them to be."

George Orwell

American nuclear physicist, 1904-1967

7.1 Chapter Overview

This chapter investigates the diffusion of broadband in households of South Africa quantitatively. It first provides a description of the demographic profiles of the survey respondents. This is followed by a description of the usage profiles of the adopters of broadband. A description of the reliability and validity tests conducted to assess the internal consistency of the survey instrument is then provided which subsequently looks at the validity and the reliability of the data collected.

The chapter then focuses on testing each of the proposed hypotheses for this research study with various quantitative analysis techniques. The findings relating to broadband adoption, usage and impact are then presented and the chapter ends with a short discussion of the results obtained.

7.2 Respondent's Profile

A profile of the respondents is presented in Table 15 below. Of the 177 valid responses 42.4% of the respondents belonged to the 18-25 years age group. This forms the largest category. The lowest category was that of 31 years and older at 26.5%, however, the 26-30 years age group was not far above this figure at 31.1%.

All respondents possessed educational qualifications with the highest percentage of the respondents with a Matric Exemption or High School Diploma at 38%. Following this were those respondents with an Honours Degree at 30% and an Undergraduate Degree or Technikon Diploma at 25%. The lowest category was those respondents with a Masters or PhD degree at 7%.

The occupational category with the highest response rate was Technicians & Associate Professionals at 43.5%. This was followed by Professionals with a 34.5% response. The Clerks and Administrative Workers formed the third largest category at 14.7% with the Legislators category at 7.3%.

The responses for the household income categories were spread almost evenly. The majority of the respondents occurred at the < R5000 and R10 000-R20 000 categories both at 28.2%. This was followed by the R5000-R10 000 category at 24.4%. The largest income group was represented by 19.2%.

Of the 177 respondents, 155 (87.6%) had Internet access at home and 22 (12.4%) did not. Among the 155 that had Internet access at home, only one respondent had a dialup connection while the rest had a broadband connection. It should be noted that of the 154 respondents that did have a broadband connection, 32 respondents had more than one type of broadband connection in their household.

	Categories	Frequency	Percentage
Age	18-25	75	42.4%
	26-30	55	31.1%
	31+	47	26.5%
	Total	**177**	**100.0%**
Education	Matric Ex./High School Diploma	67	38%
	Degree/Technikon Diploma	44	25%

	Honours Degree (Postgraduate)	53	30%
	Masters and PhD (Postgraduate research)	13	7%
	Total	**177**	**100.0%**
Occupation	Legislators, Senior Officials, Directors, Managers & Owner Managers	13	7.3%
	Professionals	61	34.5%
	Technicians & Associate Professionals	77	43.5%
	Clerks & Administrative Workers, Service & Sales Workers, Skilled Agricultural & Fishery Workers, Skilled Workers, Craft & Related Trades, Plant & Machine Operators & Assemblers, Labourers & Elementary Occupations	26	14.7%
	Total	**177**	**100.0%**
Income	< R5000	50	28.2%
	R5000 – R10 000	43	24.4%
	R10 001 – R20 000	50	28.2%
	R20 001 +	34	19.2%
	Total	**177**	**100.0%**

Internet Access as Home	Yes	155	87.6%
	No	22	12.4%
	Total	**177**	**100.00%**
Type of Internet Access at Home	Dial-up	1	0.6%
	WiFi	8	4.5%
	WiMAX	3	1.7%
	Broadband with DSL/ADSL	113	63.8%
	Mobile 3G/HSDPA	57	32.2%
	Other	5	2.8%
	Total	**187**	**105.7%**

Table 15: Profile of survey respondents

The next section provides a brief overview of the usage attributes of consumers that have adopted broadband.

7.3 Usage profile of Adopters

A profile of the adopter respondents is illustrated by Figure 11, 12 and 13 below.

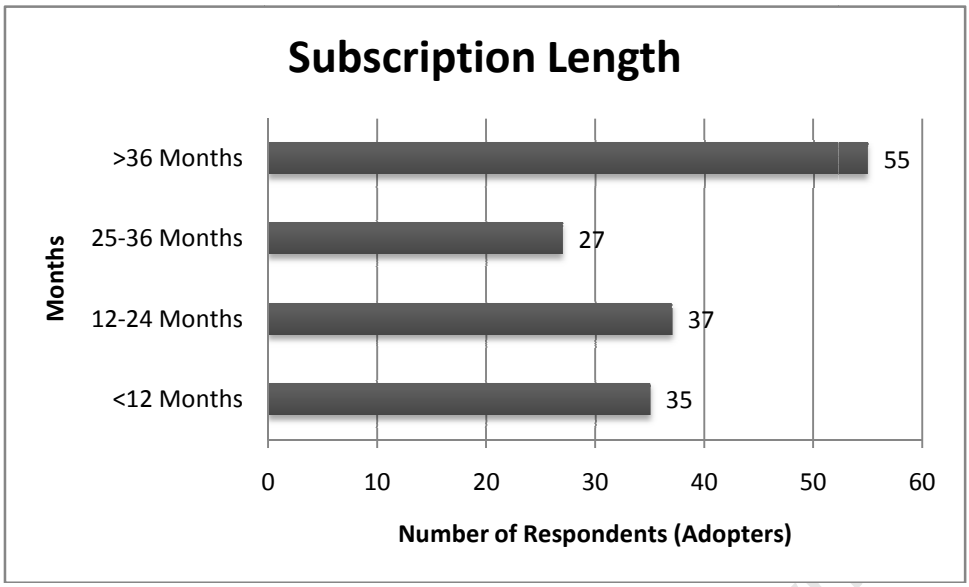

Figure 11: Length of broadband subscription

Of the 154 adopter respondents, 55 adopters had broadband subscriptions for more than 3 years (36 months). This forms the largest category and is followed by 37 adopters who had broadband subscriptions for between 1 to 2 years. This was almost evenly spread with the 35 adopters having broadband subscriptions for less than a year. The least category was the 27 respondents that had broadband subscriptions for between 2 to 3 years.

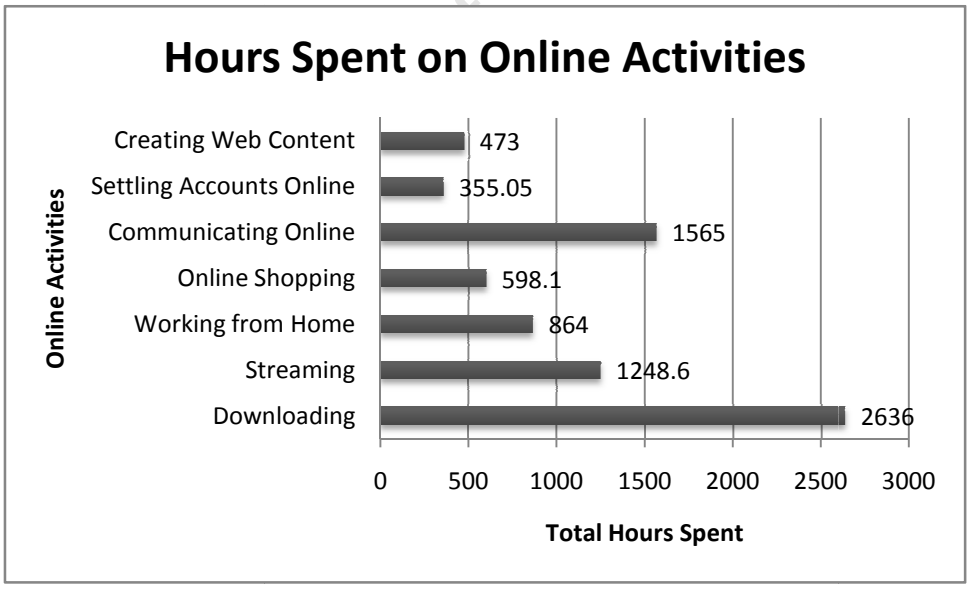

Figure 12: Hours spent on online activities by broadband consumers

Figure 12 above shows that amongst the 154 adopters, consumers mostly used their broadband connection for downloading files, music and videos. This was followed by time spent communicating online. The third largest category was time spent streaming video or music online. This was followed by time spent working from home, online shopping, creating web content and settling accounts online.

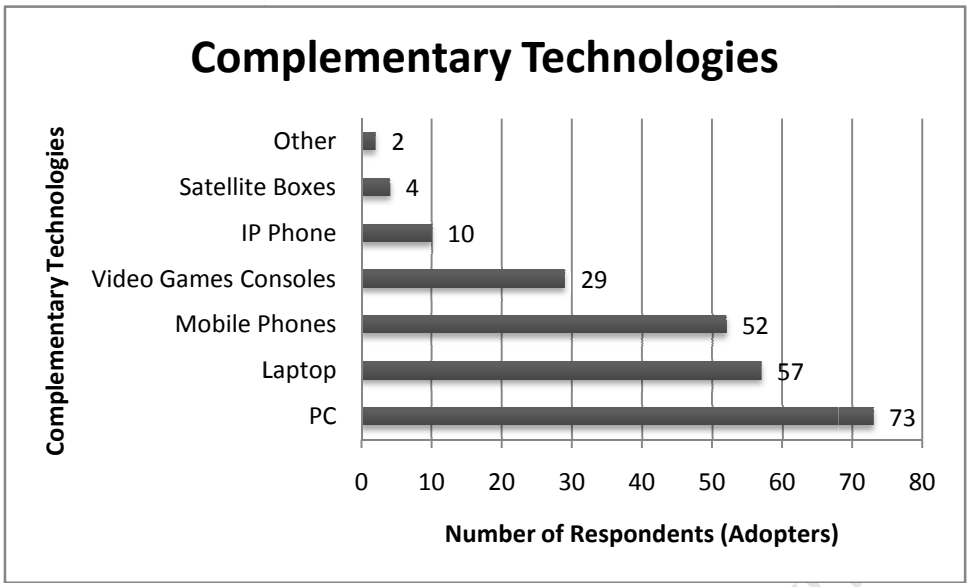

Figure 13: Complementary technologies used by broadband consumers

It should be noted that each respondent may have more than one technology accessing their broadband connection. From the total of 154 respondents, the largest category was consumers who had personal computers accessing their broadband connection. The second largest category was consumers with laptops accessing their broadband connection. It was expected that these technologies would form part of the largest responses as either a PC or laptop is required to effectively setup an ADSL or Wireless/WiFi connection. These are followed by mobile phones, video games consoles and IP phones. The smallest category were those consumers with satellite boxes and other (which where PDA's as mentioned in the questionnaires).

The next section provides a description of the reliability and factor analysis to assess the internal consistency of the survey instrument.

7.4 Instrument Validation

Hinton et al. (2004) suggested four cut-off points for reliability, which include excellent reliability (0.90 and above), high reliability (0.70-0.90), moderate reliability (0.50-0.70) and low reliability (0.50 and below).

According to Bradley (1994), when interpreting alpha coefficients the nature of the items should be examined. Very high alpha coefficients of 0.9 or greater may indicate that the items are duplicated showing redundancy and that the scale could be shortened (Bradley, 1994). For small scale items an alpha coefficient of 0.5 would be sufficient, but would be inadequate for a ten scale item or more. For these reasons, studies generally aim for internal consistency coefficients in the region of 0.7 to 0.8 for a scale of ten items or more (Bradley, 1994).

Together with the Alpha coefficients, item-total correlations with sum scale, item means and standard deviations was assessed and those that showed low correlations

with the sum scale extreme means, and zero or nearly zero variances were adjusted or eliminated.

Confirmatory factor analysis was chosen as it is used to test and confirm a hypothesized factor structure and is used as a validity procedure in measurement research (Suhr, 1999). The following steps were used to carry out the factor analysis to determine the discriminant and convergent validity of the survey instrument:

1. Eigenvalues of or above 1
2. Loadings of at least 0.40
3. Items load on posited constructs
4. Items that do no load properly are dropped

7.4.1 Reliability Test and Factor Loadings

Using the criteria set out above initial factor loadings was determined. Using Statistica, this was conducted utilising the Principal Component Analysis for the extraction of items and Varimax Normalisation as the rotation method. To determine which items to remove from the scale a reliability test was considered for each construct together with the factor analysis. Keeping an item was based on having high loadings and high alpha or high loadings and moderate alpha. Removing an item was the result of having low loadings and moderate alpha or low loadings and low alpha.

Table 16 below provides a summary of the constructs and single items that were extracted from the initial survey instrument to be included in the final instrument.

Code	Constructs/Single Items	Initial Items	Final Items	Final Alpha	Related Hypothesis
Initial Adoption					
RA	Relative Advantage	RA1, RA2, RA3, RA4, RA5, RA6	RA1, RA2, RA3, RA5, RA6	0.71	H_{3a}
HO	Hedonic Outcomes	HO1, HO2, HO3, HO4, HO5	HO1, HO2, HO3	0.72	H_{3b}
UO	Utilitarian Outcomes	UO1, UO2, UO3, UO4,	UO1, UO3,	0.78	H_{3c}

Code	Constructs/Single Items	Initial Items	Final Items	Final Alpha	Related Hypothesis
		UO5, UO6, UO7, UO8	UO4, UO5		
SEC	Security	SEC1, SEC2, SEC3, SEC4	SEC1, SEC2, SEC4	0.70	H_{3d}
TC	Technology Comfort	TC1, TC2, TC3, TC4, TC5, TC6, TC7, TC8	TC4, TC5, TC6,	0.73	H_{3e}
LOY	Loyalty	LOY1, LOY2	LOY1, LOY2	0.60	H_{3f}
RK	Requisite Knowledge	RK1, RK2, RK3, RK4, RK5, RK6	RK1, RK2, RK6	0.74	H_{4a}
SK	Skills (Single Item)	SK1, SK2	SK1	N/A	H_{4b}
N	Needs	N1, N2, N3, N4, N5, N6	N1, N2	0.70	H_{4c}
C	Cost	C1, C2, C3, C4	C1, C3, C4	0.70	H_{4d}
BC	Broadband Content (Single Item)	BC1, BC2	BC2	N/A	H_{4e}
INF	Infrastructure	INF1, INF2	INF1, INF2	0.60	H_{4f}
PC	Personal Computer (Single Item)	PC1, PC2, PC3	PC3	N/A	H_{4g}
SN	Subjective Norms	SN1, SN2, SN3	SN1, SN2, SN3	0.83	H_{5a}
Sustained Adoption					
HSC	Household Communication	HSC1, HSC2	HSC1, HSC2	0.83	H_{6a}
HSC	Competition for Limited	HSC3	HSC3	N/A	H_{6b}

Code	Constructs/Single Items	Initial Items	Final Items	Final Alpha	Related Hypothesis
	Resources (Single Item)				
HSC	Prior Experience with Technology in the Family (Single Item)	HSC4	HSC4	N/A	H_{6c}
TD	Technology Sophistication	TD1, TD2	TD1, TD2	0.60	H_{6d}
TD	Complementary Technologies (Single Item)	TD3	TD3	N/A	H_{6e}
PD	Use Innovativeness (Single Item)	PD1	PD1	N/A	H_{6f}
PD	Frustration	PD2, PD3	PD2, PD3	0.89	H_{6g}
PD	Skills (Single Item)	PD4	PD4	N/A	H_{6h}
ED	External Communication (Single Item)	ED1	ED1	N/A	H_{6i}
ED	External Technology Access (Single Item)	ED2	ED2	N/A	H_{6j}
ED	Family Exposure to Target Media (Single Item)	ED3	ED3	N/A	H_{6k}
SQ	Service Quality	SQ1, SQ2	SQ1, SQ2	0.82	H_{6l}
Impact - Lifestyle and Satisfaction					
LIF	Communication (Single Item)	LIF1	LIF1	N/A	H_{7a}
LIF	Life Activities (Single Item)	LIF2	LIF2	N/A	H_{7b}

Code	Constructs/Single Items	Initial Items	Final Items	Final Alpha	Related Hypothesis
LIF	Costs (Single Item)	LIF3	LIF3	N/A	H_{7c}
LIF	Work Activities (Single Item)	LIF4	LIF4	N/A	H_{7d}
SAT	Satisfaction	SAT1, SAT2	SAT1, SAT2	0.60	H_{7e}
Impact - Interest in Future Technologies					
FT	Interest in Future Technologies (Single Items)	FT1, FT2, FT3, FT4, FT5, FT6	FT1, FT2, FT3, FT4, FT5, FT6	N/A	H_{7f}

Table 16: Summary of Constructs and Single Items for the Final Survey Instrument

A detailed explanation of how these were obtained is provided below.

Initial Adoption

Eigen Values

As mentioned above a factor analysis was conducted. Figure 66 in Appendix F illustrates the Eigenvalues and explains the total variance for the extracted components for the initial adoption phase. The results illustrate that all constructs have an Eigenvalue greater than 1.

Figure 66 shows that all components loaded. The final rotated component matrix for Initial Adoption is presented in Figure 67 in Appendix F with a detailed explanation on how the final results were obtained is explained.

Sustained Adoption

Eigen Values

Figure 14 below illustrates the Eigenvalues and explains the total variance for the extracted components for the sustained adoption phase. The results represented suggest that all constructs have an Eigenvalue greater than 1. Figure 14 shows that all components loaded.

The final rotated component matrix for Sustained Adoption is presented in Figure 15 below. A detailed explanation on how the final results were obtained is explained in Appendix G.

Value	Eigenvalues (Sustained Adoption) Extraction: Principal components			
	Eigenvalue	% Total variance	Cumulative Eigenvalue	Cumulative %
1	5.116260	30.09565	5.11626	30.09565
2	2.650798	15.59293	7.76706	45.68858
3	1.986339	11.68435	9.75340	57.37293
4	1.386682	8.15695	11.14008	65.52988
5	1.103440	6.49082	12.24352	72.02070

Figure 14: Eigenvalues greater than 1 for all factors of Sustained Adoption

Variable	Factor Loadings (Varimax normalized) (Sustained Adopti Extraction: Principal components (Marked loadings are >.400000)				
	(HSC)	(TD)	(PD)	(ED)	(SQ)
HSC1	0.833793	-0.053588	0.178128	-0.076796	-0.024425
HSC2	0.829496	-0.072294	0.061773	-0.018066	-0.094062
HSC3	0.686285	0.192821	0.197132	0.100440	-0.128208
HSC4	0.734829	0.168851	-0.037794	0.196553	0.183775
TD1	0.191177	0.489906	0.403101	0.353348	0.018323
TD2	0.018050	0.953655	0.050466	-0.017636	0.097187
TD4	0.224331	0.278150	0.759367	0.237597	0.004155
TD5	0.350111	0.319876	0.364328	0.482867	0.096578
PD1	0.202655	0.349976	0.405256	0.522201	0.083242
PD2	0.120098	0.003781	0.894292	-0.002513	0.200316
PD3	-0.007820	-0.047669	0.735193	0.014001	0.487994
PD4	-0.118743	0.011531	0.318376	0.568068	0.575129
ED1	0.018050	0.953655	0.050466	-0.017636	0.097187
ED2	-0.119839	-0.000717	0.039085	0.762390	0.084515
ED3	0.386482	-0.141949	-0.082212	0.588503	0.142786
SQ1	0.010904	0.119745	0.127159	-0.012845	0.892697
SQ2	-0.033017	0.114914	0.181019	0.319400	0.824436
Expl.Var	2.838931	2.484997	2.615878	2.095388	2.208326
Prp.Totl	0.166996	0.146176	0.153875	0.123258	0.129902

Figure 15: Factor Loadings (Varimax Normalised) for Sustained Adoption items

Impact

Lifestyle and Satisfaction

A factor analysis and reliability test was not performed for the Lifestyle items as they were single items.

When performing the factor analysis for Satisfaction only 1 factor was extracted using the principle components method. A Varimax Normalized rotation was not used as the solution had only one factor so the factor scores will be the same whether a rotation was requested or not. All items had an Eigenvalue of more than 1 as illustrated below.

Value	Eigenvalues (Impact_Original) Extraction: Principal components			
	Eigenvalue	% Total variance	Cumulative Eigenvalue	Cumulative %
1	1.393092	69.65460	1.393092	69.65460

Figure 16: Eigenvalues greater than 1 for Satisfaction

Items SAT1 and SAT2 also loaded highly on component 1 with coefficients 0.83 respectively.

Variable	Factor Loadings (Unrotated) (Impact_Original) Extraction: Principal components (Marked loadings are >.400000)
	Factor 1
SAT1	0.834593
SAT2	0.834593
Expl.Var	1.393092
Prp.Totl	0.696546

Figure 17: Factor Loadings (Unrotated) for Satisfaction

The Cronbach Alpha for items SAT1 and SAT2 yields an alpha of 0.60. Due to having moderate alpha and high loadings, both items were kept.

Interest in Future Technologies

A factor analysis and reliability test was not performed as all the Interest in Future Technologies items are single items.

7.5 Descriptive Statistics

Using the data collected from the distribution of the final survey instrument, the following descriptive statistics were performed.

7.5.1 Actual Adoption

Figure 18 below illustrates the number of respondents that have subscribed to broadband. It represents the technologies that consumers use to access their broadband subscription.

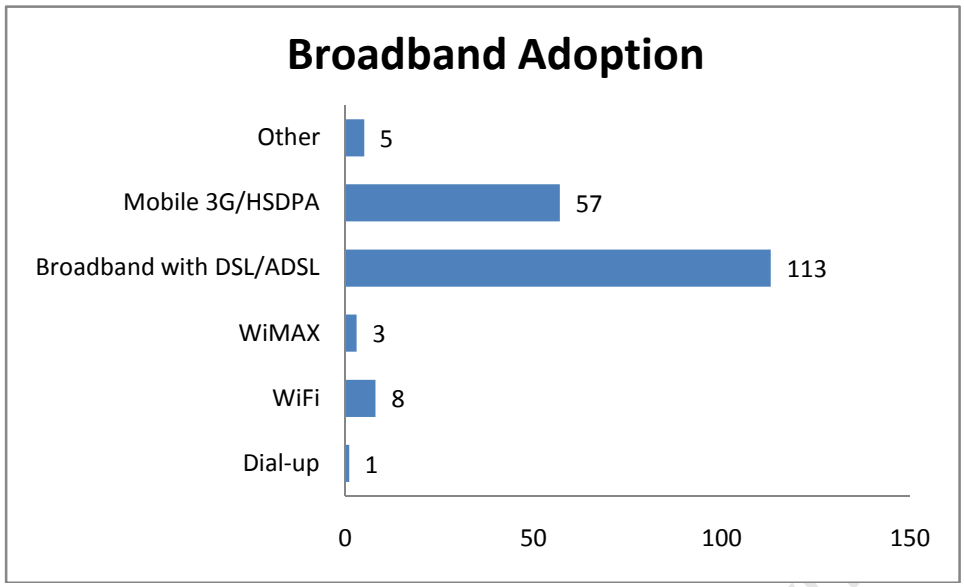

Figure 18: Adoption of Broadband Technologies

Out of the 177 respondents surveyed, 155 had Internet access at home and 22 respondents had not subscribed to the technology. Among the 155 that had Internet access at home, only one respondent had a dialup connection while the rest had a broadband connection. Therefore, 154 respondents had adopted a broadband technology which represents 87% of the total sample population. Broadband with ADSL and Mobile 3G/HSDPA appeared to be the preferred technology of choice. Most respondents had more than 1 type of broadband technology in the household.

7.5.2 Broadband Adoption Factors

Table 17 below presents the means and standard deviations of aggregate measures for the items.

Rank	**Construct/Items**	NI	**N**	Descriptive	
				Mean	***SD***
1	Technology Comfort	3	177	6.7	0.7
2	IT Skills	1	177	6.7	0.9
3	Relative Advantage	5	177	6.5	1.0
4	Utilitarian Outcomes	6	177	6.4	1.0
5	Needs	2	177	6.4	1.2
6	Requisite Knowledge	3	177	6.3	1.1
7	Infrastructure	2	177	6.0	1.6

8	Broadband Content	1	177	5.9	1.4
9	Hedonic Outcomes	3	177	5.8	1.6
10	Cost	3	177	5.4	1.8
11	Security	3	177	4.5	1.8
12	Personal Computer	1	177	4.4	2.7
13	Loyalty	2	177	4.2	2.0
14	**Subjective Norms**	**3**	**177**	**3.2**	**2.1**

Table 17: Summary of Descriptive Statistics for Broadband Adoption

With reference to the Likert scale, where 1 represents strongly disagree and 7 represents strongly agree, the respondents showed a strong agreement for technology comfort, IT skills and relative advantage with aggregate scores greater than 6.5, see Table 17. The majority of the constructs such as utilitarian outcomes, needs, requisite knowledge, infrastructure, broadband content and hedonic outcomes, showed a medium to strong agreement with aggregate scores between 5.5 and 6.5. A weak agreement (between 4.5 and 5.5) with high variance was obtained for cost and security. Respondents appeared to be neutral with regards to the PC and loyalty with aggregate scores between ranging 4.0 and 4.5.

Respondents showed a weak disagreement with subjective norms with a mean score of 3.20 and a standard deviation of 2.1 which shows a high variance in responses (Table 17).

7.5.3 Use Diffusion Patterns

By utilising usage rate and variety of use, four possible types of use diffusion patterns were identified (Shih and Venkatesh, 2002). South African consumers were classified as either low, experimental, specialised or intense users.

Data gathered in the form of number of hours per week spent performing various online activities from South African consumers were grouped into the use diffusion patterns topology, as illustrated in Figure 19.

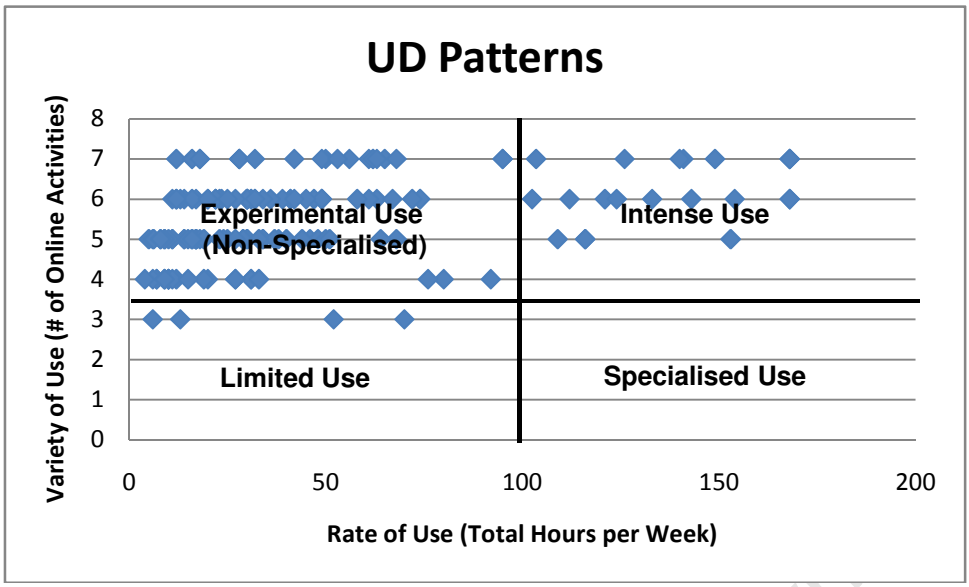

Figure 19: Use Diffusion Patterns of South African Broadband Adopters

Figure 19 shows that South African broadband users are classified as experimental, intense or limited users, with emphasis on being experimental users. It is interesting to note why South African broadband users fell into these categories as broadband was relatively new at the time this research study took place. Moreover, there was also a low Internet penetration rate in South Africa.

One reason for users falling mostly within the experimental category is that broadband was a relatively new technology at the time, hence users may have been experimenting with the various online activities that could be performed with the technology. Reasons for users falling within the other categories can be attributed to the different variables that came into play, affecting the usage behaviour of broadband consumers. This will be explained further in the forthcoming chapters.

7.5.4 Sustained Adoption

Table 18 presents the means and standard deviations of aggregate measures for the items.

Rank	**Construct/Items**	NI	**N**	Descriptive	
				Mean	***SD***
1	Service Quality	2	154	6.23	1.4
2	Skills	2	154	6.20	1.4
3	International Communication	1	154	6.06	1.6
4	Technology Dimension	4	154	5.90	1.5
5	Use Innovativeness	1	154	5.90	1.4

6	Frustration	1	154	5.90	1.4
7	External Technology Access	1	154	5.44	2.0
8	Competition for Limited Recourses	1	154	5.38	1.9
9	Prior Experience with Technology in the Family	1	154	5.30	1.7
11	Family Exposure to Target Media	1	154	4.30	2.0
10	Household Communication	2	154	4.23	2.2

Table 18: Summary of Descriptive Statistics for Sustained Adoption

Respondents showed a medium agreement with a majority of the constructs such as service quality, skills, international communication, technology dimension, use innovativeness and frustration with aggregate scores between 5.5 and 6.5. Weak agreements with a high variance in responses were shown for constructs external technology access, competition for limited resources and prior experience with technology.

Respondents appeared to be neutral with regards to the family exposure to target media and household communication with aggregate scores between ranging 4.0 and 4.5 and high variances of responses (Table 18).

7.5.5 **Impact**

Table 19 and Table 20 present the means and standard deviations of aggregate measures for the items respectively.

Rank	**Construct/Items**	NI	**N**	Descriptive	
				Mean	***SD***
1	Work Activities	1	154	5.84	1.4
2	Communication	1	154	5.75	1.5
3	Satisfaction	2	154	5.67	1.5
4	Costs	1	154	5.30	1.7
5	Life Activities	1	154	4.89	1.8

Table 19: Summary of Descriptive Statistics for Impact (Lifestyle & Satisfaction)

Respondents seemed to have a medium agreement lifestyle and satisfaction factors, namely work activities, communication and satisfaction of the impact phase with

aggregate scores ranging between 5.5 and 6.5 (Table 19). Respondents showed weak agreement for the cost and life activities factors with aggregate scores ranging between 4.5 and 5.5.

Rank	**Construct/Items**	NI	**N**	Descriptive	
				Mean	***SD***
1	Higher speed lines	1	154	3.97	0.2
2	Unlimited bandwidth no shaping	1	154	3.95	0.3
3	Paradigm shift from traditional TV to IPTV	1	154	3.57	0.8
4	High speed wireless	1	154	3.56	0.8
5	Voice over IP	1	154	3.37	0.9
6	Interactive online communication systems	1	154	3.23	1.0

Table 20: Summary of Descriptive Statistics for Impact (Interest in Future Technologies)

With reference to the scale with aggregate scores greater than 3.5, in future technologies such as higher speed lines, unlimited bandwidth with no shaping, paradigm shift from traditional to IPTV and high speed wireless connections, see Table 20. Respondents were somewhat interested, with aggregate scores between 2.5 and 3.5, in future technologies such as VoIP and interactive online communication systems.

7.6 Hypothesis and Model Testing

This section focuses on validating the model through the testing of the proposed hypotheses.

As mentioned in Section 6.7, the confidence interval (CI) was dropped to 90%. Therefore, when testing the hypothesis (significance test), a significance level of 0.1 (90% CI) was used. Furthermore, unless otherwise stated, a one-tailed test was used due to each instance of the hypotheses having one direction (Keller, 2005).

The tests were justified in section 6.8 and are displayed in Table 21 below with their relevant sections and hypotheses tested.

Hypotheses	Description	Test Used	Section
H_1	There will be demographic differences between adopters and non-adopters of broadband	Mann-Whitney Test	7.6.1
H_2	Overall demographics will have a an influence on the consumer's Perceived Behavioural Control	Spearman's Rho	7.6.2
H_3	Overall attitudinal factors positively influence broadband adoption	Logistic Regression	7.6.3
H_4	Overall PBC factors will have an influence on broadband adoption		
H_5	Overall subjective norms will have a positive influence on broadband adoption		
H_6	Overall determinants of use diffusion influence a consumer's use diffusion patterns	Spearman's Rho	7.6.4
H_7	The greater a users' rate and variety of use, the greater the impact broadband will have on the consumers life.	Spearman's Rho	7.6.5

Table 21: Hypotheses with the relevant data analysis tests

7.6.1 The Difference between Broadband Adopters and Non-Adopters

For each of the hypotheses tested a frequency count was performed together with the respective medians of the adopters and non-adopters for each demographic factor. These, combined with the results of the Mann-Whitney Test, attempted to determine if there were strong differences between the adopters and non-adopters for each demographic factor. A one-tailed test was used as this was standard when running the test in SPSS. The findings are represented below.

H_{1a}: Adopters of broadband will have a younger age distribution than non-adopters of broadband.

Table 22 illustrates that the broadband adoption percentage varied little with age when comparing the different age categories.

The Mann-Whitney test confirmed that there was no significant difference between the two median ages and as a result there are no significant differences (Z = -0.299, p

= 0.765) between the ages of adopters and non-adopters of broadband. This can be verified by both samples having the same medians.

Age Categories	Non-adopters	Adopters	Adoption Percentage
	Frequency	Frequency	
18-25	10	66	**87%**
26-30	8	46	**85%**
31+	5	42	**89%**
Total	**23**	**154**	

Variable	Adopters (*N*-154) Median (IQR)	Non-Adopter (*N*=23) Median (IQR)	Z statistic	*P* value
Age	2.00 (2.00)	2.00 (1.00)	-.299	**0.765**

Table 22: Age as a determinant of broadband adopters and non-adopters

H_{1b}: ***Adopters of broadband will have a higher annual household income than non-adopters.***

Table 23 illustrates that the broadband adoption percentage varied little with annual household income.

When comparing the medians between the two samples, the results show that the medians are exactly the same. Therefore, there appears to be no difference between the income categories of adopters and non-adopters of broadband. This was also confirmed by the Mann-Whitney test (Z = -0.562, p = 0.574).

Income Categories	Non-adopters	Adopters	Adoption Percentage
	Frequency	Frequency	
< R5000	9	41	**82%**
R5000 – R10 000	3	40	**93%**
R10 001 – R20 000	7	44	**86%**
R20 001+	4	29	**88%**

Total	23	154		
Variable	**Adopters (*N*-154) Median (IQR)**	**Non-Adopter (*N*=23) Median (IQR)**	***Z* statistic**	***P* value**
Income	2.00 (2.00)	2.00 (2.00)	-.562	**0.574**

Table 23: Annual Household Income as a determinant of broadband adopters and non-adopters

H_{1c}: ***Adopters of broadband will have higher education levels than non-adopters of broadband.***

Table 24 illustrates that the broadband adoption percentage increased with an increase in education levels. Higher percentages of adopters belonged to the Postgraduate and Postgraduate Research categories. This can be verified by the difference in medians between the two samples.

The Mann-Whitney test confirmed that the differences between the education levels of adopters and non-adopters was significant (Z = -1.920, p = 0.055).

Education Categories	**Non-adopters**	**Adopters**	**Broadband Percentage**
	Frequency	**Frequency**	
Matric Ex./High School Diploma	12	56	**82%**
Degree/Technikon Diploma	7	36	**84%**
Honours Degree (Postgraduate)	3	50	**94%**
Master/PhD (Postgraduate research)	1	12	**92%**
Total	**23**	**154**	

Variable	**Adopters (*N*-154) Median (IQR)**	**Non-Adopter (*N*=23) Median (IQR)**	***Z* statistic**	***P* value**
Education	2.00 (2.00)	1.00 (1.00)	-1.920	**0.055**

Table 24: Education as a determinant of broadband adopters and non-adopters

H_{1d}: ***Adopters of broadband will belong to a higher occupation category than non-adopters.***

Table 25 illustrates that the broadband adoption percentage varied little with occupation levels.

The Mann-Whitney test confirmed that there was no significant difference between the two median ages and as a result there are no significant differences (Z = -0.226, p = 0.821) between the occupation levels of adopters and non-adopters of broadband. This can be verified by both samples having the same medians.

Occupation Categories	Non-adopters	Adopters	Broadband Percentage
	Frequency	Frequency	
Legislators, Senior Officials...	2	11	**85%**
Professionals	7	54	**88%**
Technicians & Associated Professionals	7	46	**87%**
Clerks & Administrative Workers...	7	43	**86%**
Total	**23**	**154**	

Variable	Adopters (*N*-154) Median (IQR)	Non-Adopter (*N*=23) Median (IQR)	*Z* statistic	*P* value
Occupation	3.00 (2.00)	3.00 (2.00)	-0.226	0.821

Table 25: Occupation as a determinant of broadband adopters and non-adopters

7.6.2 Demographic Influence on Perceived Behavioural Control

A Spearman's Rho ($\mathbf{r_s}$) test was performed in order to determine if there were any relationships between a consumers Perceived Behavioural Control (PBC) and demographic variables.

The test was performed with PBC as the dependant variables and demographics as the independent variables. Both samples of adopters and non-adopters were combined as, although non-adopters did not subscribe to broadband, their perceptions of broadband were tested. The findings from the qualitative study suggest that skills, knowledge and cost are the variables most likely affected by the demographics of the respondents. The findings are represented below. It should be noted that * or ^{o} represent respondent outliers for each box plots.

H2a: The older the consumer, the higher the skills in using broadband.

The hypothesis states that as age increases, its effect on skills also increases. Therefore, the older the consumer the more skills the consumer would have in using broadband technology and broadband thereof.

Figure 20 and Table 26 illustrates the results of the frequency and $\mathbf{r_s}$ test performed respectively to determine whether a relationship exists between the age of the consumer and their skill levels.

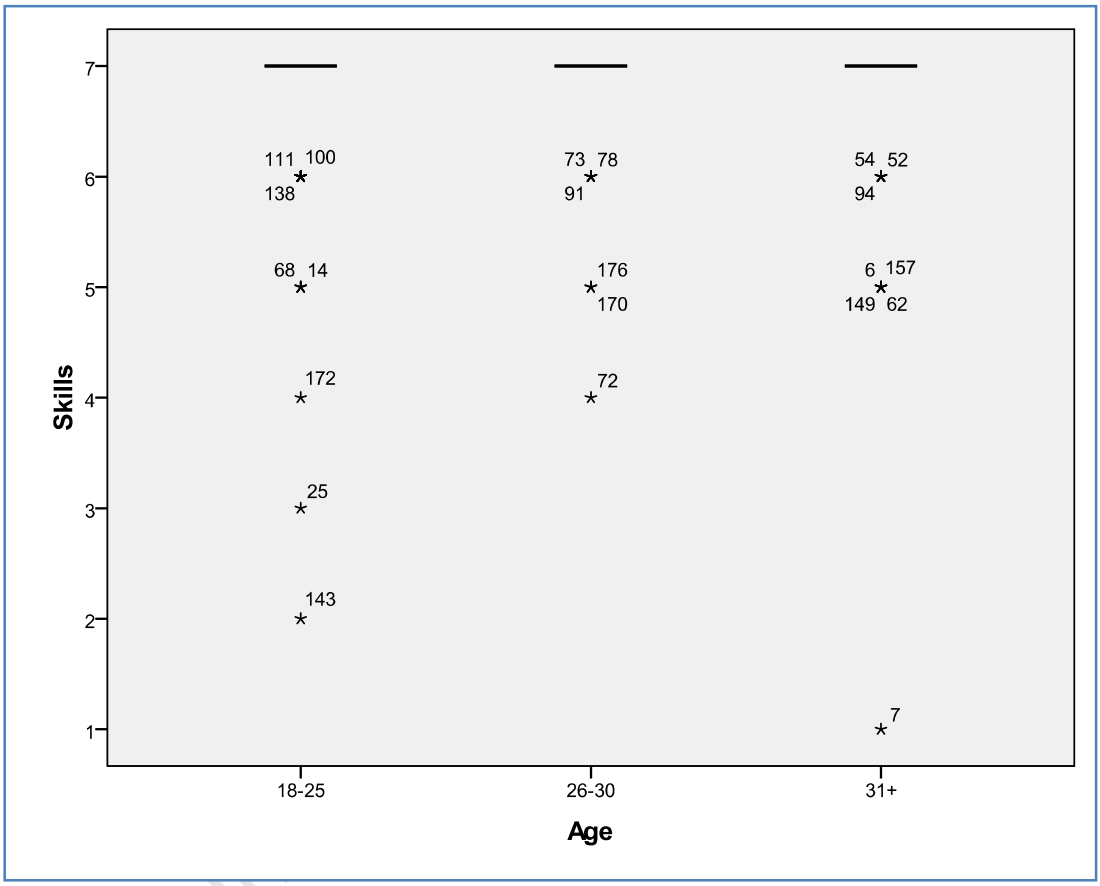

Figure 20: Association between Age and Skill Level

			Age	SK1
Spearman's rho	Age	Correlation Coefficient	1.000	.014
		Sig. (1-tailed)	.	.427
		N	177	177
	SK1	Correlation Coefficient	.014	1.000
		Sig. (1-tailed)	.427	.
		N	177	177

Table 26: Spearman's Rho (r_S) test to determine relationship between Age and Skill levels

A majority of the respondents strongly agreed (median = 7) with having the necessary skills to use broadband appeared to be spread among all age groups as represented by the median for each age category. It should be noted that the largest number of these respondents belonged to the 18-25 years category and this might give the sense that those of a younger age tend to have a higher skills level in using the Internet. However, this age group formed the largest of the survey responses and therefore the median of each category was taken into account. Having no 1st and 3rd inter quartiles ranges meant that all respondents in each age category strongly believed that they had the necessary skills in using broadband.

The $\mathbf{r_s}$ test confirmed that there was no significant ($p > 0.1$) relationship between age groups and skill levels. From the findings presented, it cannot be concluded that at an older age, the skill levels in using broadband are higher. Therefore, the hypothesis is rejected.

H2b: The higher the level of the consumer's education, the higher the consumer's skills in using broadband.

The hypothesis states that the higher the level of a consumers education, the higher its effect on a consumer's skill level. Therefore, the more qualified the consumer the more skills the consumer would have in using broadband technology and broadband thereof.

Figure 21 and Table 27 below illustrates the results of the frequency and $\mathbf{r_s}$ test performed respectively to determine whether a relationship exists between education levels of the consumer and their skill levels.

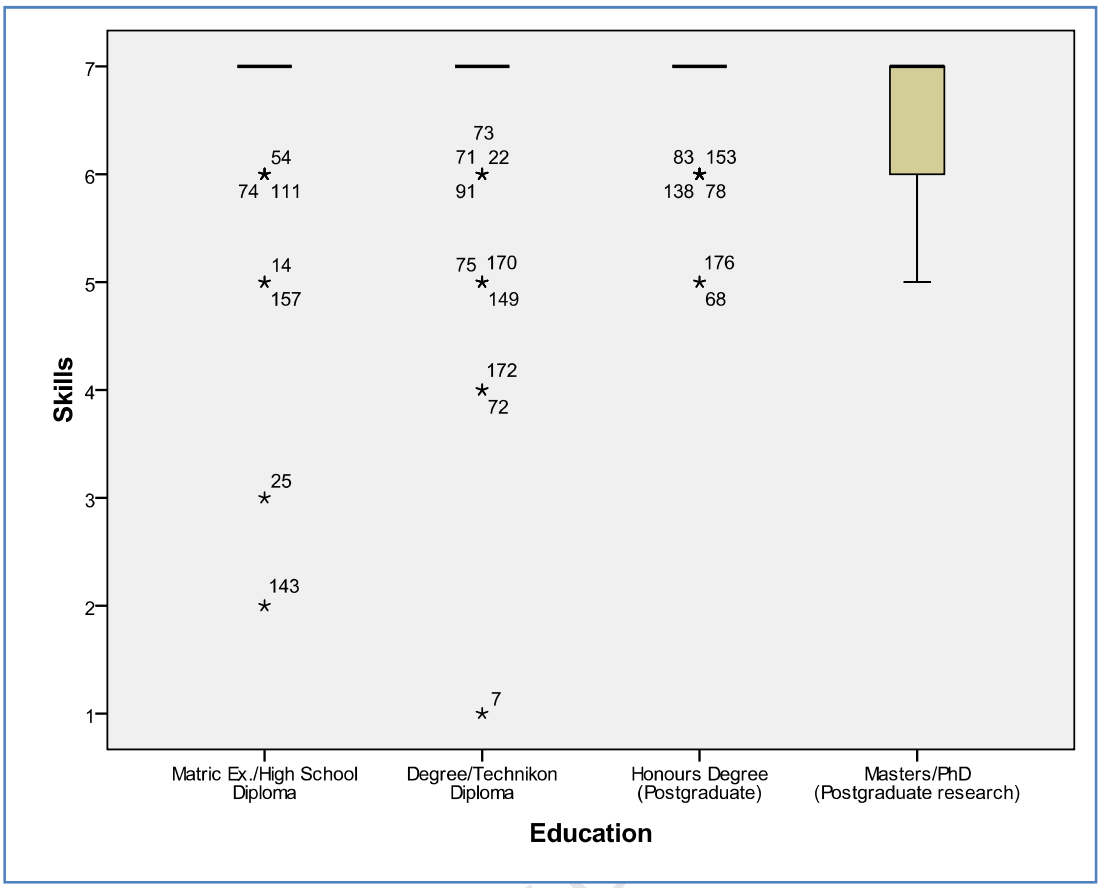

Figure 21: Association between Education and Skill Levels

			Education	SK1
Spearman's rho	Education	Correlation Coefficient	1.000	-.092
		Sig. (1-tailed)	.	.111
		N	177	177
	SK1	Correlation Coefficient	-.092	1.000
		Sig. (1-tailed)	.111	.
		N	177	177

Table 27: Spearman's Rho (r_S) test to determine relationship between Education and Skill levels

A majority of the consumers that strongly agreed (median = 7) with having the necessary skills to use broadband seemed to be spread amongst all education categories. Having no 1st and 3rd inter quartile ranges meant that all respondents in the Matric/High School Diploma, Degree/Technikon Diploma and Honours (Postgraduate) Degree categories strongly believed that they had the necessary skills in using broadband. It should be noted that for the Masters/PhD category, that a quarter of the respondents in this category agreed (> 5) that they had the necessary skills to use broadband.

The $\mathbf{r_s}$ test validated that the significance level was greater than 0.1. However, this was not at a large extent. As such, the relationship between the education levels of consumers and their skills in using broadband was "somewhat" significant. Therefore, the hypothesis will be accepted.

H2c: The higher the level of the consumer's occupation, the higher the consumer's skills in using broadband.

The hypothesis states that the higher the level of a consumer's occupation in terms of job experience in the industry, its effect on skills increases. Therefore, the more industry experience the consumer has, the more skills the consumer would have in using broadband technology and broadband thereof.

Figure 22 and Table 28 below illustrates the results of the frequency and $\mathbf{r_s}$ test performed respectively to determine whether a relationship exists between the occupation level of the consumer and their skill levels.

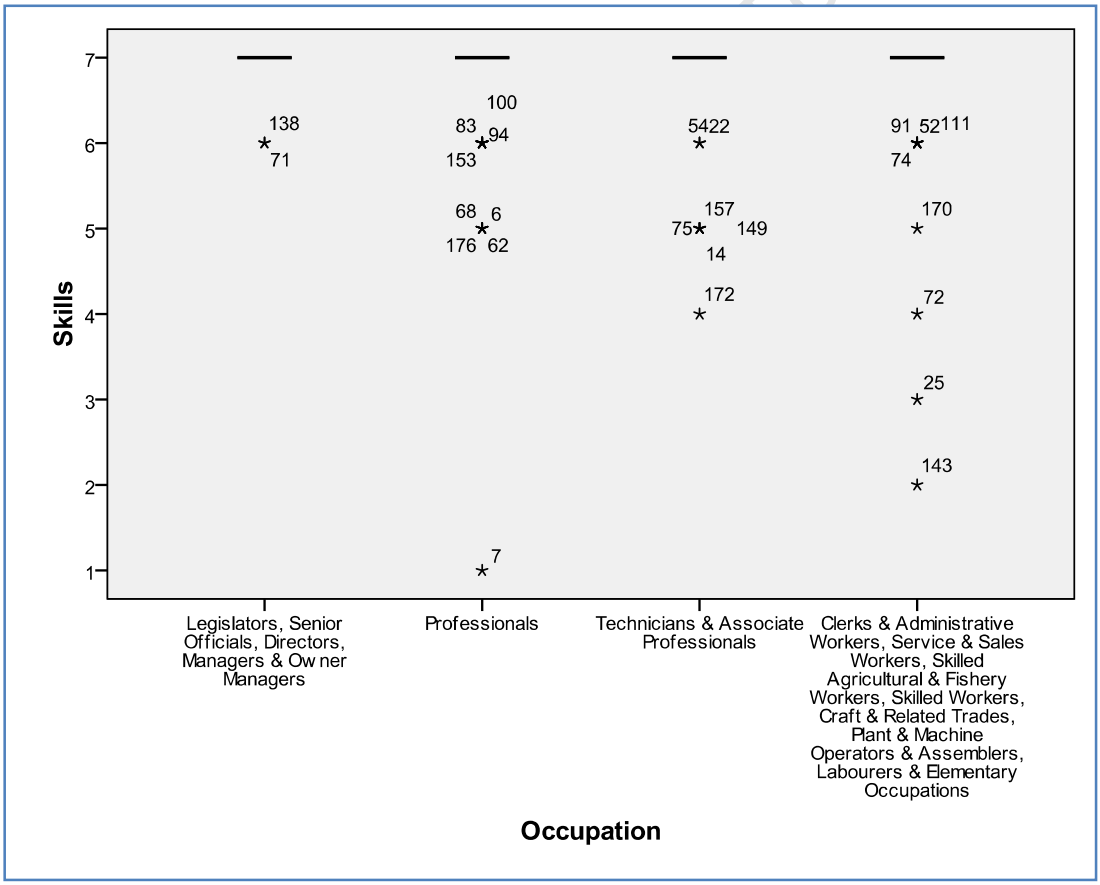

Figure 22: Association between Occupation and Skill Levels (* represent respondent outliers)

			Occupation	SK1
Spearman's rho	Occupation	Correlation Coefficient	1.000	.013
		Sig. (1-tailed)	.	.432
		N	177	177
	SK1	Correlation Coefficient	.013	1.000
		Sig. (1-tailed)	.432	.
		N	177	177

Table 28: Spearman's Rho (r_S) test to determine relationship between Occupation and Skill levels

A majority of the respondents that felt strongly about having the necessary skill levels to use broadband seemed to be evenly spread among all occupation categories, as illustrated by each category having a median of 7. It should be noted that students were added as part of the lower occupation levels of Clerks & Administrative Workers etc. If this category were to be separated, this may impact on the results obtained.

The $\mathbf{r_s}$ test validated that there is no significant ($p > 0.1$) relationship between the occupation of consumers and their skills in using broadband. Therefore it cannot be concluded that the higher the occupation levels of consumers, the higher the skills in using broadband. Therefore, the hypothesis will be rejected.

H2d: The higher the level of the consumer's occupation, the greater the consumer's knowledge about broadband.

The hypothesis states that the higher the level of a consumers occupation, its effect on a consumers knowledge about broadband increases. Therefore, the more industry experience the consumer has, the more knowledge the consumer would have about broadband technology and broadband thereof.

Figure 23 and Table 29 below illustrates the results of the frequency and $\mathbf{r_s}$ test performed respectively to determine whether a relationship exists between the occupation level of the consumer and their knowledge levels.

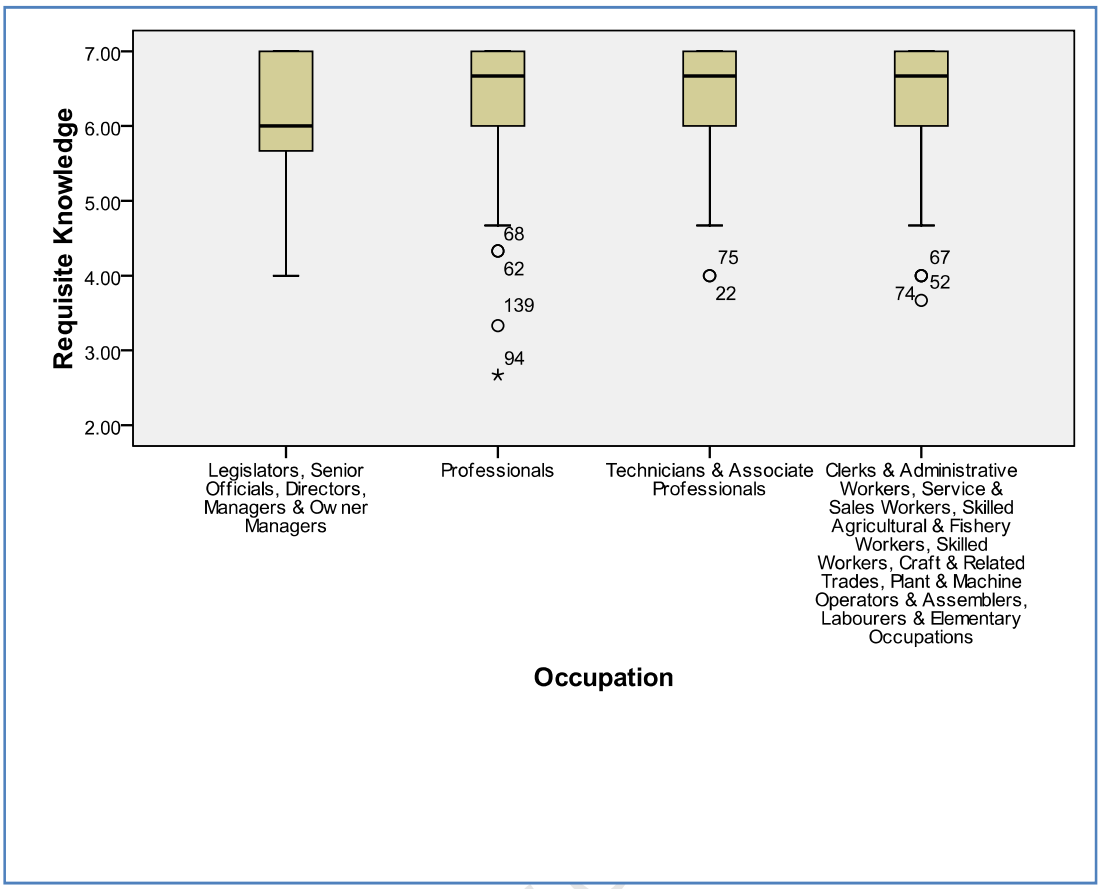

Figure 23: Association between Occupation and Knowledge

			Occupation	RK_Average
Spearman's rho	Occupation	Correlation Coefficient	1.000	.001
		Sig. (1-tailed)	.	.494
		N	177	177
	RK_Average	Correlation Coefficient	.001	1.000
		Sig. (1-tailed)	.494	.
		N	177	177

Table 29: Spearman's Rho (r_s) test to determine relationship between Occupation and Requisite Knowledge

A majority of the respondents that felt strongly (median > 6) about having the necessary knowledge regarding using broadband seemed to be evenly spread among the lower occupation levels of Professionals, Associate Professionals and Clerks. Professionals also make up higher levels of occupation as this category can consist of those job positions of senior and managerial positions. Respondents that held top job positions agreed (median = 6) that they had the necessary knowledge levels. It should be noted, however, that the majority of respondents in this category that fell into the 3rd inter quartile range strongly agreed (> 6) that they had the necessary knowledge regarding broadband technologies.

The $\mathbf{r_s}$ test validated that there is no significant ($p > 0.1$) relationship between the occupation of consumers and their knowledge about broadband. Therefore, it cannot be concluded that the higher the occupation levels of consumers, the higher the knowledge about broadband. The hypothesis is, therefore, rejected.

H2e: The higher the level of the consumer's monthly income, the more affordable broadband will be for the consumer.

The hypothesis states that the higher the level of a consumer's income, the cost of obtaining a broadband connection decreases. Therefore, the more monthly income the consumer has at their disposal, the more affordable broadband will be for the consumer.

Figure 24 and Table 30 below illustrates the results of the frequency and rs test performed to determine whether a relationship exists between the income disposal level of the consumer and cost of a broadband subscription.

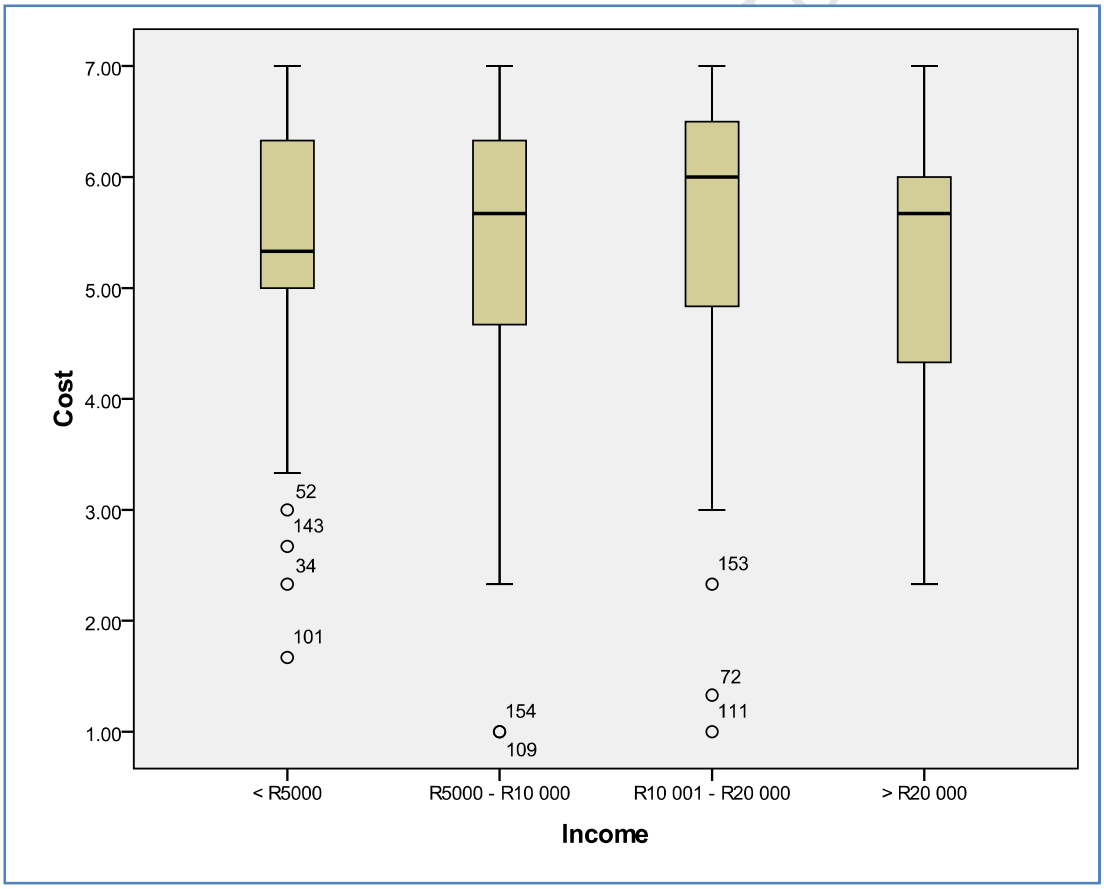

Figure 24: Association between Income and Cost

			Income	C_Average
Spearman's rho	Income	Correlation Coefficient	1.000	.010
		Sig. (1-tailed)	.	.448
		N	177	177
	C_Average	Correlation Coefficient	.010	1.000
		Sig. (1-tailed)	.448	.
		N	177	177

Table 30: Spearman's Rho (r_S) test to determine relationship between Income and Cost

A majority of the respondents that agreed strongly (median = 6) about having a high enough income to subscribe to broadband fell into the R10 001-R20 000 income category. However, it appeared that respondents from all categories also felt strongly (median > 5) about having a high enough income to purchase a broadband subscription.

The $\mathbf{r_s}$ test validated that there was no significant ($p > 0.1$) relationship between the monthly income disposal of consumers and the affordability of broadband. Therefore, the hypothesis will be rejected.

7.6.3 Initial Adoption Factors will have an Influence on Broadband Adoption

A logistic regression was performed in order to determine if any of the broadband factors (Attitude, Subjective Norms and PBC) predicted broadband adoption. The logistic regression test was selected, firstly, due to normality assumption of the data not being satisfied and therefore a nonparametric regression test was deemed appropriate. Secondly, the dependent variable, broadband adoption, is categorical in nature and is represented by a Yes and No.

The test was performed with the broadband adoption as the dependant variable and Attitude, Subjective Norms and PBC variables as the independent variables. Broadband adoption was represented by a 1 for Yes if the respondent had adopted broadband and 0 for No if the respondent had not adopted broadband.

Table 31 below illustrates the omnibus test performed as part of the logistic regression. The test is interpreted as a test of the capability of all predictors in the model jointly to predict the response (dependent) variable (Garson, 2010). A finding of significance corresponds to the research conclusion that there is adequate fit of the data to the model and that at least one of the predictors is significantly related to the response variable (Garson, 2010).

A total of 177 cases was analysed and the full model was considered to be significantly reliable (> 0.1) as depicted in Table 31 below.

Omnibus Tests of Model Coefficients				
		Chi-square	df	Sig.
Step 1	Step	127.225	14	.000
	Block	127.225	14	.000
	Model	127.225	14	.000

Table 31: Logistic Regression - Omnibus Tests of Model Coefficients

Table 32 below depicts that the model accounted for between 51.3% and 68.4% of the variance in broadband adoption.

Model Summary			
Step	-2 Log likelihood	Cox & Snell R Square	Nagelkerke R Square
1	118.149[a]	.513	.684

Table 32: Logistic Regression - Model Summary

Table 33 depicts that 99.4% of the adopters were successfully predicted, however, 0% of the predictions for the non-adopters were accurate. Overall, 86.4% of the predictions were accurate.

Classification Table[a]					
			Predicted		
	Observed		Adopter		
			No	Yes	Percentage Correct
Step 1	Adopter	No	0	23	.0
		Yes	1	153	99.4
	Overall Percentage				86.4

a. The cut value is .500

Table 33: Logistic Regression - Classification Table

Table 34 illustrates the coefficients, Wald statistics, associated degrees of freedom and probability values for each of the predictor variables. The results show that only those consumers with a PC or having a suitable PC reliably predicted broadband adoption (significance < 0.1).

It should be noted that although all the other independent variables were not significantly reliable in predicting broadband adoption, the hedonic outcomes, technology comfort, skills and cost constructs significance level were not to a great extent higher than the cut-off point (0.1). Therefore, these constructs were deemed as "somewhat" significantly reliable in predicting broadband adoption.

For each of the constructs that predicted broadband adoption, the results show that technology comfort had a larger part (Exp(B) = 2.254) in explaining actual adoption. This was followed by skills in using the PC and the Internet (Exp(B) = 1.545), cost (Exp(B) = .736), Hedonic Outcomes (Exp(B) = .712) and having a suitable PC to access broadband (Exp(B) = .684) respectively.

The hypotheses for those constructs that predicted broadband will be discussed while all other hypothesis will be rejected.

Variables in the Equation							
Rank	**Step 1[a]**	**B**	**S.E.**	**Wald**	**df**	**Sig.**	**Exp(B)**
1	**Personal Computer**	-.380	.130	8.464	1	.004	.684
2	**Hedonic Outcomes**	-.340	.260	1.705	1	.112	.712
3	**Technology Comfort**	.813	.513	2.506	1	.113	2.254
4	**Cost**	-.306	.232	1.737	1	.118	.736
5	**Skills**	.435	.279	2.429	1	.119	1.545
6	**Requisite Knowledge**	.248	.323	.589	1	.443	1.281
7	**Needs**	-.233	.352	.437	1	.508	.793
8	**Infrastructure**	.125	.207	.361	1	.548	1.133
9	**Subjective Norms**	.078	.138	.319	1	.572	1.081
10	**Security**	.099	.179	.302	1	.583	1.104
11	**Loyalty**	-.046	.150	.094	1	.759	.955
12	**Relative Advantage**	-.098	.381	.066	1	.797	.907
13	**Utilitarian Outcomes**	-.211	.517	.167	1	.683	.810
14	**Broadband Content**	-.017	.208	.007	1	.935	.983
a. Variable(s) entered on step 1: RA_Average, HO_Average, UO_Average, SEC_Average, TC_Average, LOY_Average, RK_Average, SK1, N_Average, C_Average, BC2, INF_Average, PC3, SN_Average.							

Table 34: Logistic Regression - Variables in Equation

H_{3b}: ***The greater the perceived entertainment (hedonic outcomes) potential of using broadband, the more likely that broadband will be adopted.***

The hypothesis states that the more a consumer believes that broadband is able to provide them with enjoyment in terms of listening to music, watching and download

movies and play online games the more likely the consumer would subscribe to broadband.

The results from the logistic regression states that the odds of adopting broadband compared to not adopting the technology decreased by a factor of 0.712 if the consumer did not perceive an entertainment value that broadband offers. Therefore, the probability of a consumer obtaining a broadband subscription if they did not perceive an entertainment value is low. The hypothesis was therefore accepted.

H_{3e}: ***The greater the technology comfort provided by broadband the more likely its adoption.***

The hypothesis states that the more a consumer believes that broadband is able to provide them with comfort in terms of having high speed Internet access, learning new technologies and offering more control over their lives, the more likely the consumer would subscribe to broadband.

The results from the logistic regression states that the odds of adopting broadband as compared to not adopting the technology increased by a factor of 2.254 if the consumer perceived comfort by using the technology. Therefore, the probability of a consumer obtaining a broadband subscription if they did perceive comfort provided by broadband is high. The hypothesis was therefore accepted.

H_{4b}: ***The less the skills in using the PC and the Internet, the less likely that broadband will be adopted.***

The hypothesis states that if a consumer does not have the required skills in using the PC and Internet, they would be less likely to obtain a broadband subscription.

The results from the logistic regression states that the odds of adopting broadband compared to not adopting the technology increased by a factor of 1.545 if the consumer has the required computer literacy skills for using broadband. Therefore, the probability of a consumer obtaining a broadband subscription if they do have the necessary skills is high. The hypothesis was therefore accepted.

H_{4d}: ***The greater the perceived monthly cost of broadband access, the less likely that it will be adopted.***

The hypothesis now states that if a consumer has a low income level or the costs of subscribing to broadband were high, they would be less likely to obtain a broadband subscription.

The results from the logistic regression states that the odds of adopting broadband compared to not adopting the technology decreased by a factor of 0.736 if the

consumer has a low income level or the costs of subscribing to broadband were high. Therefore, the probability of a consumer obtaining a broadband subscription if they had low income levels or felt that the costs were too high is low. The hypothesis was therefore accepted.

H_{4g}: ***A lack of owning a PC or having a good enough PC will inhibit broadband adoption***

As mentioned in Section 7.4 the PC3 item was kept in order to ensure the reliability of scale. The hypothesis was changed in order to accurately reflect this. The hypothesis now states that if a consumer has no PC or the consumers PC do not meet the minimum requirements for the ability to have high speed access to Internet, they would be less likely to obtain a broadband subscription.

The results from the logistic regression states that the odds of adopting broadband compared to not adopting the technology decreased by a factor of 0.695 if the consumer does not have a suitable PC compared to having a suitable PC to access the Internet. Therefore, the probability of a consumer obtaining a broadband subscription if they do not have a PC or their PC does not meet the minimum requirements is low. The hypothesis was therefore accepted.

7.6.4 Sustained Adoption

The Spearman's Rho ($\mathbf{r_s}$) test was performed in order to determine if there were any relationships between a consumers use diffusion (UD) determinants and their use diffusion (UD) patterns (rate of use and variety of use). The test uses nominal (categorical) as well as ordinal level data and was performed with the UD patterns as the dependant variables and UD determinants as the independent variables. The aim was to determine whether UD determinants are able to predict the UD patterns of consumers.

The rate of use was calculated by counting the amount of hours that consumers had used their broadband connection on average. These were then grouped into four categories in multiples of 56 hours per week in order to accommodate for the many hours that the consumers spend online per week. It should be noted that those respondents that used their subscription for more than 168 hours per week was due to their connection being always on and they had performed many different online activities concurrently. As a result the total hour for each respondent was an accumulation of the hours spent for each activity unless otherwise stated.

The variety of use was calculated by counting the amount of technologies and online activities that consumers used with their broadband subscription. The findings are represented below.

H_{6a}: ***Higher intensity of household communication with other users about broadband leads to a higher variety of use (intense and experimental use).***

The hypothesis states that the higher the level of household communication between consumers, the higher the number of technologies that those consumers will use to access their broadband subscription. In other words, the more consumers enquire with each other about the different technologies that can access broadband, the more consumers will use these technologies with broadband to perform various online activities as well as experiment with these technologies.

Figure 25 and Table 35 below illustrates the results of the frequency and $\mathbf{r_s}$ test performed respectively to determine whether a relationship exists between the household communication and a consumers UD pattern (Variety of Use).

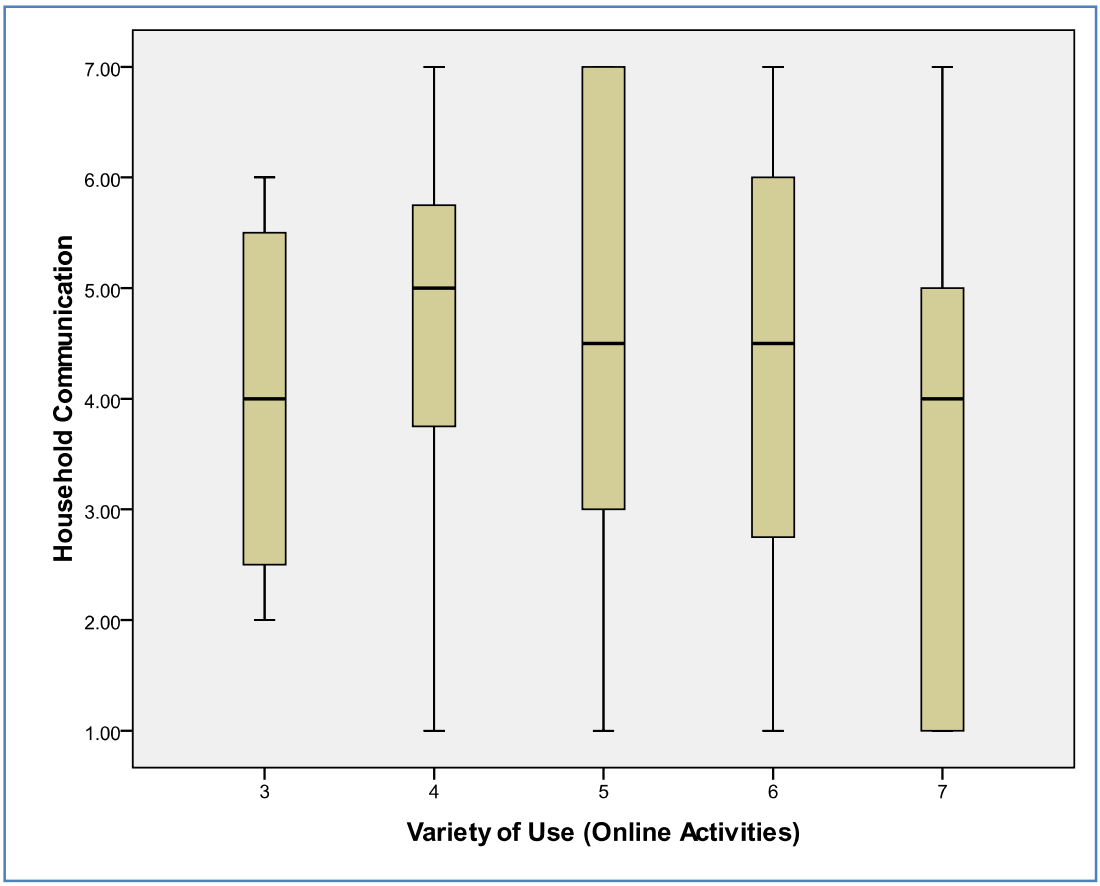

Figure 25: Association between Household Communication and Variety of Use

			HSC_1_2_Average	Number_of_Tech
Spearman's rho	HSC_1_2_Average	Correlation Coefficient	1.000	.124
		Sig. (1-tailed)	.	.063
		N	154	154
	Number_of_Tech	Correlation Coefficient	.124	1.000
		Sig. (1-tailed)	.063	.
		N	154	154

Table 35: Spearman's Rho (r_s) test to determine association between Household Communication and Variety of Use

A majority of the respondents that weakly agreed (median =5) with consulting with other members of the family appeared to performed 4 online activities with their broadband subscription. Moreover, those respondents that were neutral (median =4) appeared to perform 5-7 online activities.

The $\mathbf{r_s}$ test validated that there is a significant ($p < 0.1$) but weak relationship between the household communication of consumers and the variety of use with their broadband subscription. The hypothesis is accepted.

H_{6b}: *Greater competition for limited resources within the household leads to a lower rate of use (specialised use).*

The hypothesis states that the higher the competition between family members for limited technologies that access their broadband subscription, the lower the amount of time that those consumers will spend using their broadband subscription. If the household has only one PC accessing the broadband subscription then the rate of use of the subscription service per household member will be low and the consumer would only be able to perform fewer online activities at a time.

Figure 26 and Table 36 below illustrates the results of the frequency and $\mathbf{r_s}$ test performed respectively to determine whether a relationship exists between the household communication and a consumers UD pattern (Variety of Use).

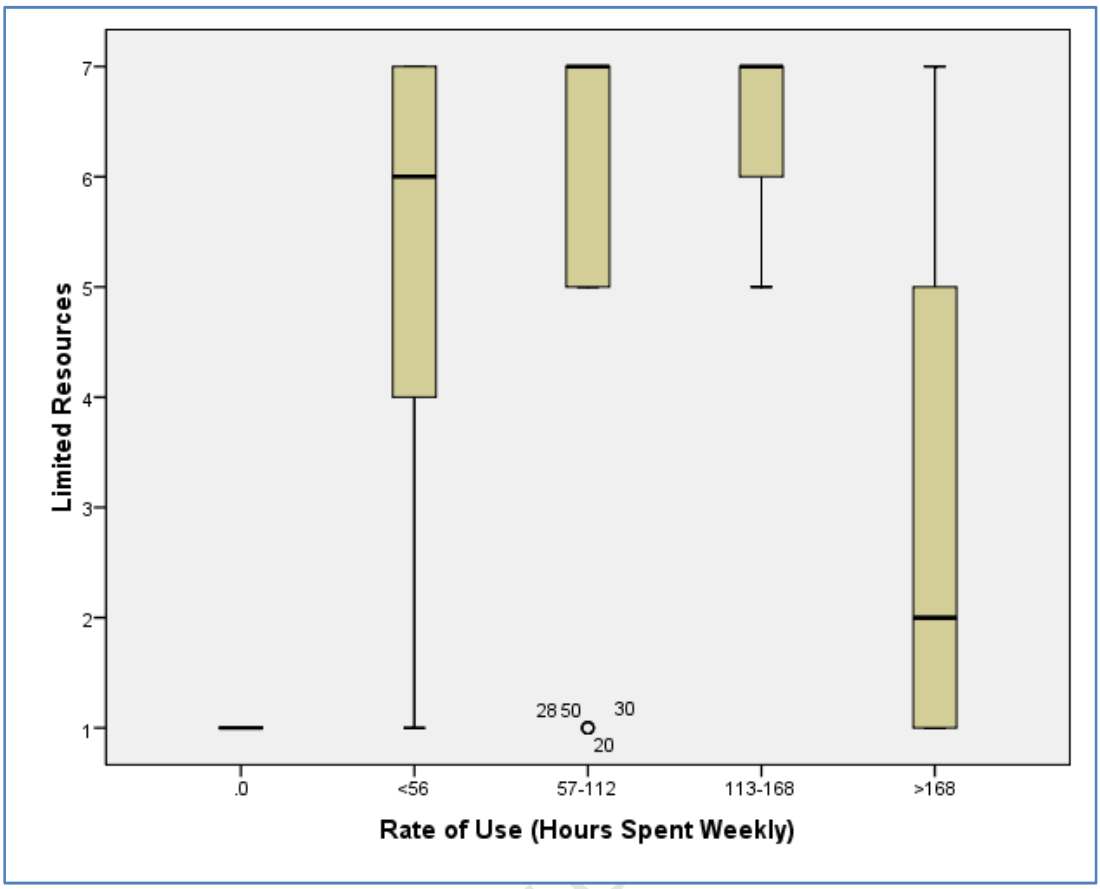

Figure 26: Association between Limited Resources and Rate of Use

			HSC3	Hours_Spent_Weekly
Spearman's rho	HSC3	Correlation Coefficient	1.000	.134*
		Sig. (1-tailed)	.	.049
		N	154	154
	Hours_Spent_Weekly	Correlation Coefficient	.134*	1.000
		Sig. (1-tailed)	.049	.
		N	154	154

Table 36: Spearman's Rho (r_s) test to determine association between Competition for Limited Resources and Rate of Use

The findings suggest that a majority of the respondents that strong agreement (medium = 7) with clashes between family members for resources to access their broadband subscription, made use of their broadband subscription of less than 168hrs per week.

The $\mathbf{r_s}$ test validated that there is a significant ($p < 0.1$) relationship between the competition for limited resources and the rate of use with their broadband subscription. The higher the family clashes for limited resources the lower the rate of use of a consumer's broadband subscription. Therefore, the hypothesis is accepted.

H_{6c}: ***Greater previous experience in the family of using the Internet results in a higher variety and rate of use (intense and experimental user).***

The hypothesis states that the higher the level of previous experience of using the Internet within the family leads to a higher rate of use and the number of technologies that those consumers will use to access their broadband subscription.

Figure 27 with Table 37 and Figure 28 with Table 38 below illustrates the results of the frequency and $\mathbf{r_s}$ test performed to determine whether a relationship exists between a family's previous Internet experience and their UD pattern (Variety and Rate of Use) respectively.

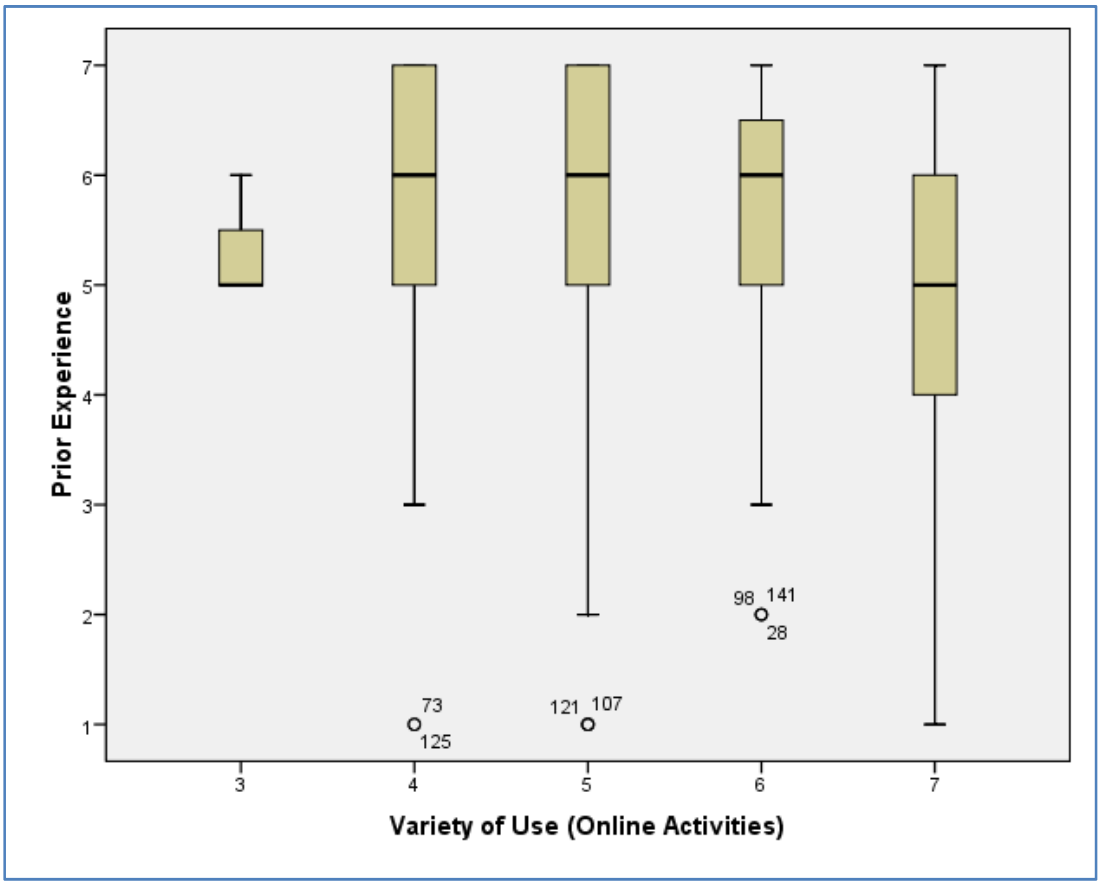

Figure 27: Association between Experience Using the Internet and Variety of Use (*° represent respondent outliers)

			Number_of_Tech	HSC4
Spearman's rho	Number_of_Tech	Correlation Coefficient	1.000	-.002
		Sig. (1-tailed)	.	.492
		N	154	154
	HSC4	Correlation Coefficient	-.002	1.000
		Sig. (1-tailed)	.492	.
		N	154	154

Table 37: Spearman's Rho (r_s) test to determine association between Experience Using the Internet and Variety of Use

The findings suggest that a majority of the respondents who agreed (median = 6) that they had previous experience in the family with using the Internet appeared to perform 4-6 online activities with their broadband subscription. However, the $\mathbf{r_s}$ test validated that the relationship between previous experience with using the Internet and variety of use with a consumer's broadband subscription was not significant ($p > 0.1$) enough to conclude that the higher the experience with using the Internet, the higher the variety of use of broadband.

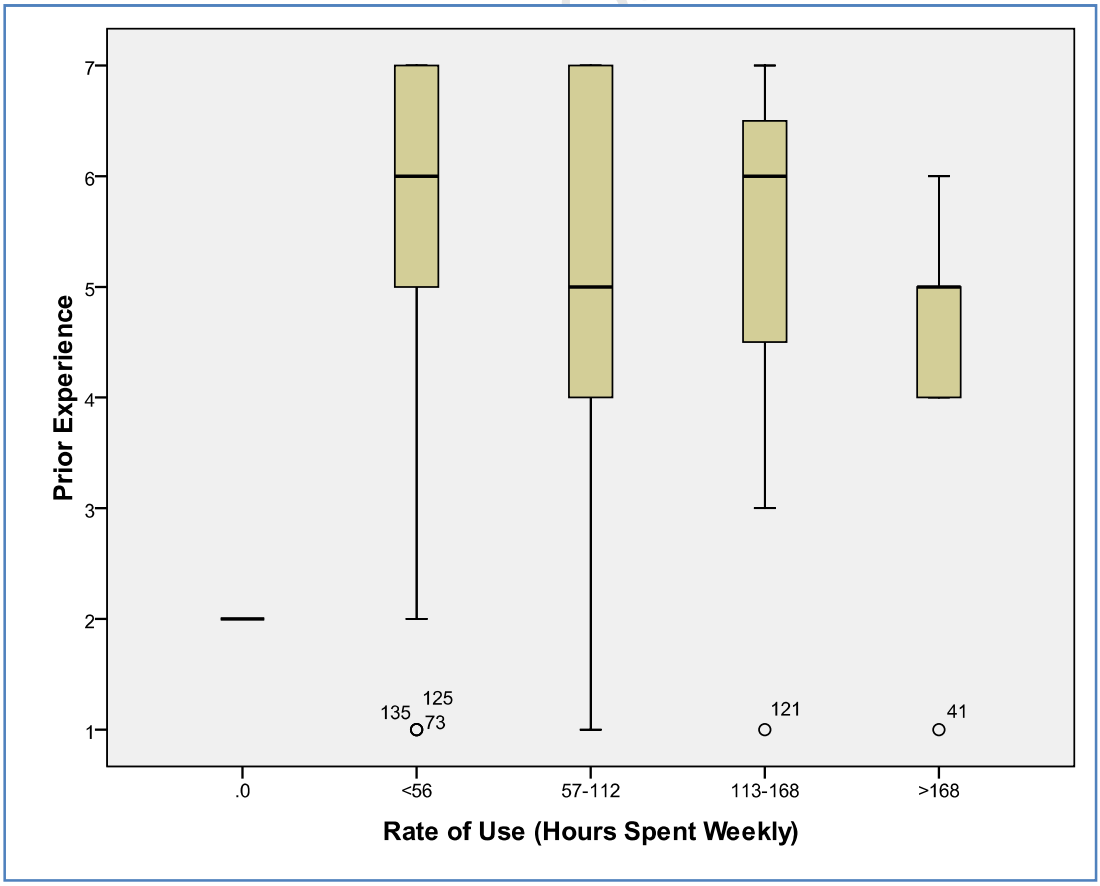

Figure 28: Association between Experience Using the Internet and Rate of Use

			HSC4	Hours_Spent_Weekly
Spearman's rho	HSC4	Correlation Coefficient	1.000	-.032
		Sig. (1-tailed)	.	.345
		N	154	154
	Hours_Spent_Weekly	Correlation Coefficient	-.032	1.000
		Sig. (1-tailed)	.345	.
		N	154	154

Table 38: Spearman's Rho (r_s) test to determine association between Experience Using the Internet and Rate of Use

The findings suggest that the majority of the respondents that agreed (median = 6) that they had previous experience within the family with using the Internet make use of their broadband subscription less than 113-168 hours per week. The variability of the box plot illustrates that the respondents in this category showed more agreement with having prior experience in the family. However, the $\mathbf{r_s}$ test validated that there is no significant ($p > 0.1$) relationship between previous experience with using the Internet and rate of use with a consumer's broadband subscription. Therefore, it cannot be concluded that the higher the experience with using the Internet, the higher the rate of use of broadband.

As there is no significance between both variety and rate of use with experience in using the Internet, the hypothesis is rejected.

H_{6d}: *Greater perceived technology sophistication of broadband leads to higher variety and rate of use (intense, specialized, experimental use).*

The hypothesis states that the higher the consumer perceives broadband to be sophisticated over dial-up, the higher the rate of use and the number of technologies that the consumer will be able to use to access their broadband subscription.

Figure 29 with Table 39 and Figure 30 with Table 40 below illustrates the results of the frequency and $\mathbf{r_s}$ test performed to determine whether a relationship exists between a family's perceived technology sophistication of broadband and their UD patterns (Variety and Rate of Use) respectively.

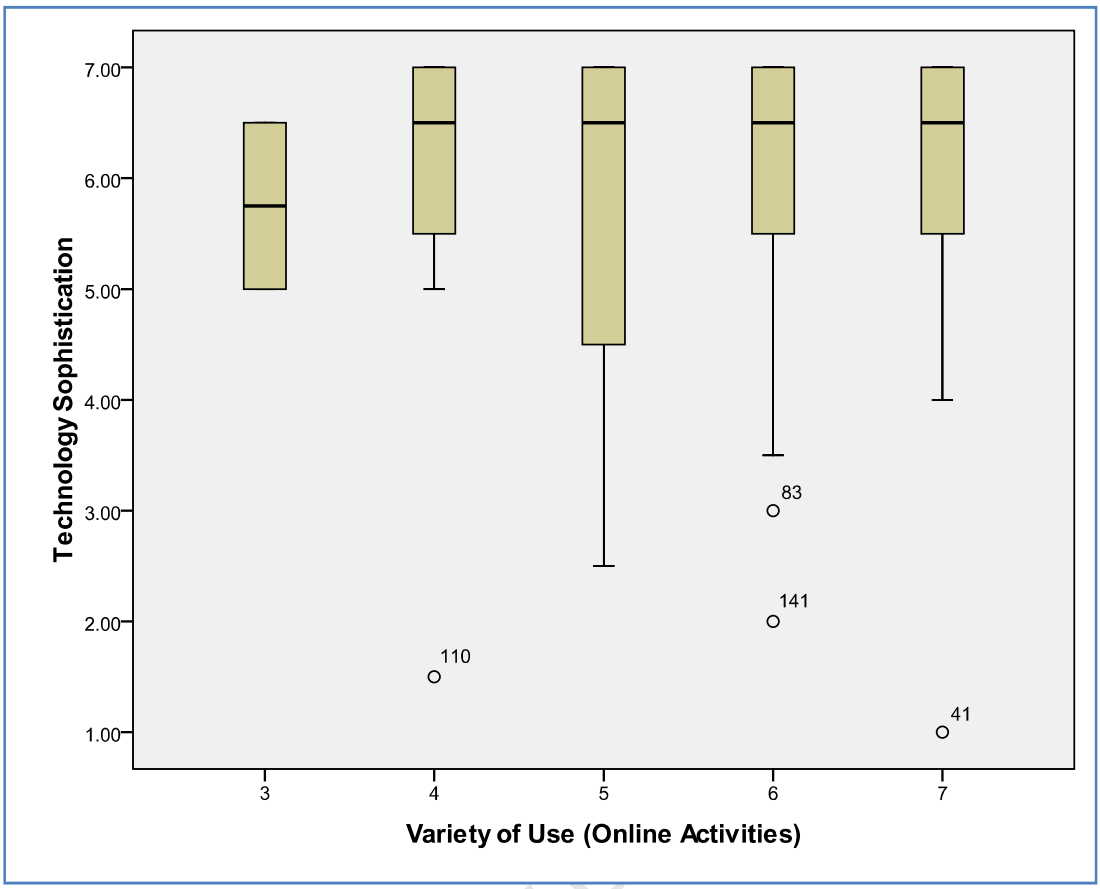

Figure 29: Association between Technology Sophistication and Variety of Use

			Number_of_Tech	TD_1_2_Average
Spearman's rho	Number_of_Tech	Correlation Coefficient	1.000	-.083
		Sig. (1-tailed)	.	.154
		N	154	154
	TD_1_2_Average	Correlation Coefficient	-.083	1.000
		Sig. (1-tailed)	.154	.
		N	154	154

Table 39: Spearman's Rho (r_s) test to determine association between Technology Sophistication and Variety of Use

The findings suggest that the majority of the respondents who believed strongly (median = 6.5) that broadband is more sophisticated than dial-up, appeared to perform between 4-7 online activities their broadband subscription. Respondents that performed 4 online activities appeared to show more agreement with broadband being more sophisticated than dial-up. However, the $\mathbf{r_s}$ test validated that the relationship between consumers perceived technology sophistication of broadband and the variety of use with their broadband subscription was not significant ($p > 0.1$) enough.

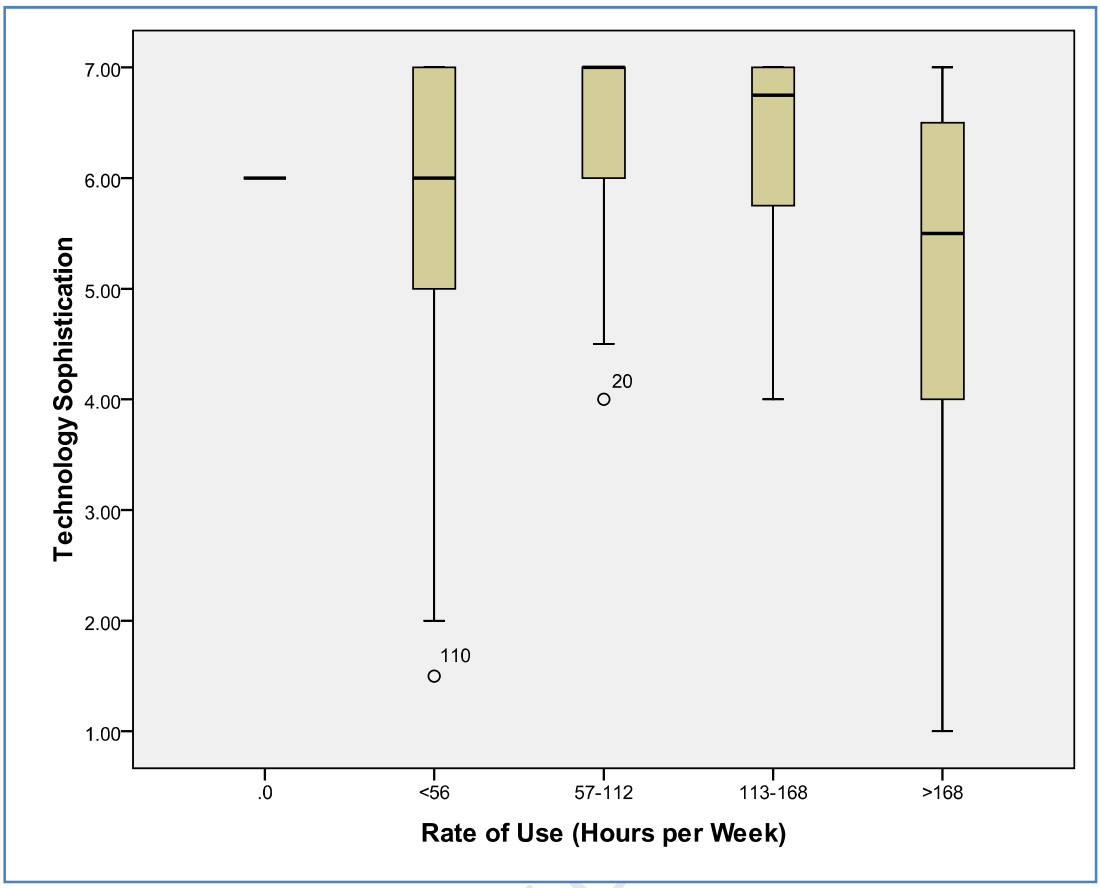

Figure 30: Association between Technology Sophistication and Rate of Use

			Hours_Spent_Weekly	TD_1_2_Average
Spearman's rho	Hours_Spent_Weekly	Correlation Coefficient	1.000	.145*
		Sig. (1-tailed)	.	.036
		N	154	154
	TD_1_2_Average	Correlation Coefficient	.145*	1.000
		Sig. (1-tailed)	.036	.
		N	154	154

Table 40: Spearman's Rho (r_s) test to determine association between Technology Sophistication and Rate of Use

The findings suggest that the majority of the respondents who believed strongly (median = 7) that broadband is more sophisticated than dial-up, appeared to make use of their broadband subscription for between 57-112 hours per week. However, Figure 30 illustrates that as rate of use increases, technology sophistication decreases. The $\mathbf{r_s}$ test validated that the relationship between consumers perceived technology sophistication of broadband and the consumers' rate of use with their broadband subscription was significant ($p < 0.1$) however the relationship was positive. Since both tests reflect the relationship differently it cannot be concluded that the higher

the perceived technology sophistication of broadband, the higher the rate of use of broadband. Therefore, the hypothesis is rejected.

H_{6e}: ***The greater the complementary technologies that access the broadband service the higher the variety and rate of use (intense, specialized, experimental use).***

The hypothesis states that the greater the number of technologies that consumers have available to make use of their broadband subscription, the higher the number of online activities that consumers will be able to perform as well as the higher the amount of time that consumers will spend online performing these activities.

In order to determine if there was a relationship between complementary technologies and variety and rate of use, an association between the number of technologies in a consumers household and the number of hours that a consumer spent using their broadband subscription was performed.

Figure 31 and Table 41 below illustrates the results of the frequency and $\mathbf{r_s}$ test performed to determine whether a relationship exists between a consumers complimentary technologies and their UD patterns (Variety and Rate of Use) respectively.

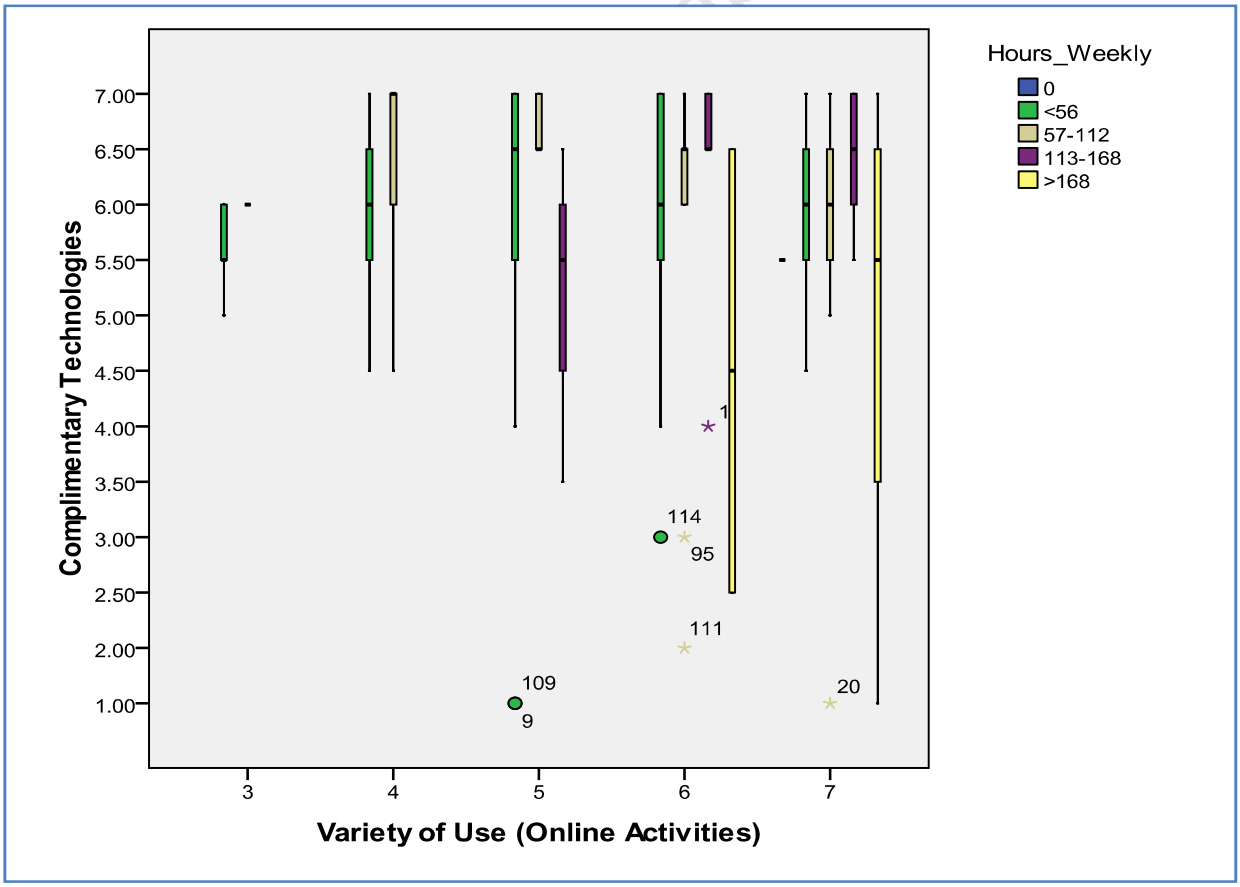

Figure 31: Association between complimentary technologies and variety and rate of use

			Hours_Spent_Weekly	Number_of_Tech
Spearman's rho	Hours_Spent_Weekly	Correlation Coefficient	1.000	-.139*
		Sig. (1-tailed)	.	.042
		N	154	154
	Number_of_Tech	Correlation Coefficient	-.139*	1.000
		Sig. (1-tailed)	.042	.
		N	154	154

Table 41: Spearman's Rho (r_s) test to determine association between Complimentary Technologies and Variety and Rate of Use

The findings suggest that a majority of consumers (median = 6.5 as representing by the *purple* box plot) that made use of their broadband subscription between 113-168 hours per week performed 7 online activities with their broadband.

The $\mathbf{r_s}$ test validated that the relationship between consumers having complementary technologies and their variety and rate of use with their broadband subscription was significant ($p < 0.1$). Therefore, the hypothesis is accepted.

H_{6f}: *Higher use innovativeness within broadband users results in higher variety of use (intense and experimental use).*

The hypothesis states that if a consumer perceives that they are innovative by performing various activities online, then the higher the amount of technologies that access their broadband connection would be used in order to achieve this.

Figure 32 and Table 42 below illustrates the results of the frequency and $\mathbf{r_s}$ test performed respectively to determine whether a relationship exists between a consumer's use innovativeness within broadband and their UD pattern (Variety of Use).

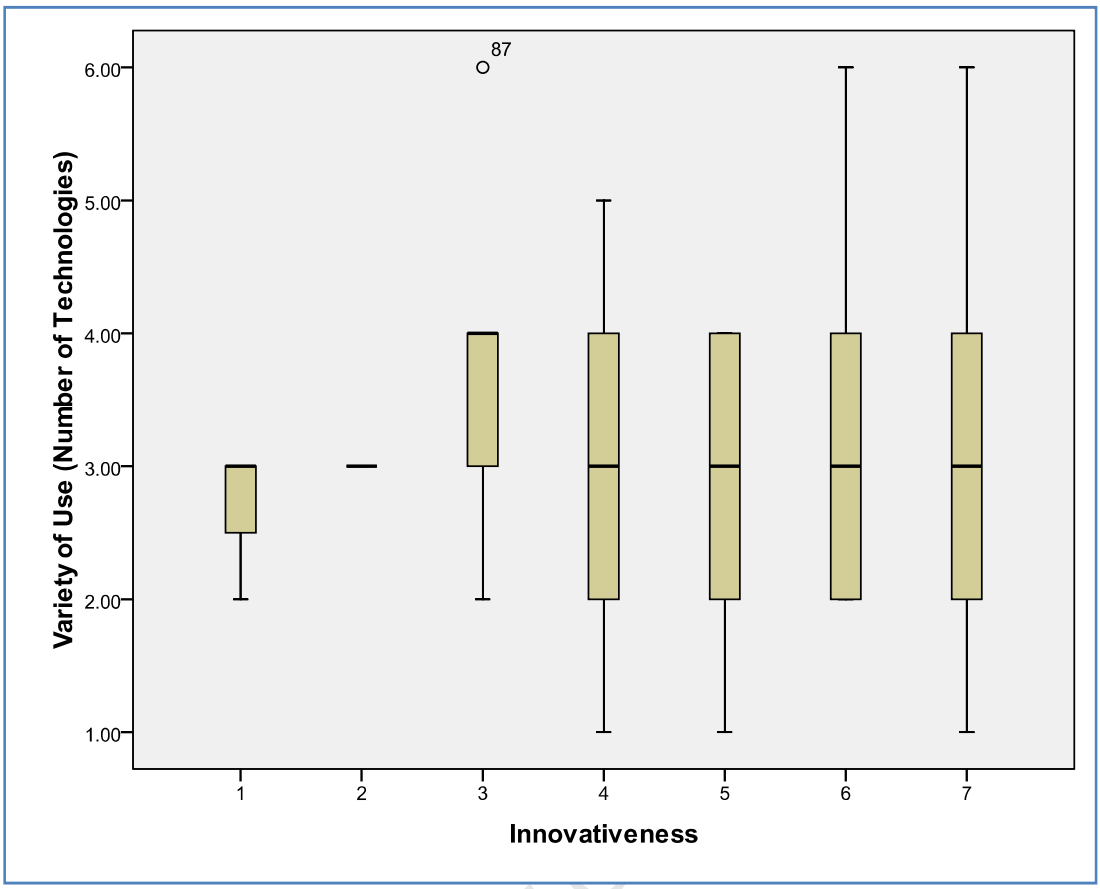

Figure 32: Association between Use Innovativeness and Variety of Use

			PD1	Number_of_Tech
Spearman's rho	PD1	Correlation Coefficient	1.000	.088
		Sig. (1-tailed)	.	.138
		N	154	154
	Number_of_Tech	Correlation Coefficient	.088	1.000
		Sig. (1-tailed)	.138	.
		N	154	154

Table 42: Spearman's Rho (r_s) test to determine association between Use Innovativeness and Variety of Use

The findings suggest that the majority of the respondents, who felt neutral to strongly (4-7) that they are more innovative when using their broadband subscription, appeared to have 2-4 technologies accessing their broadband subscription. However, the $\mathbf{r_s}$ test validated that the relationship between consumers perceived use innovativeness of broadband and the variety of use with their broadband subscription was not significant ($p > 0.1$) enough. Therefore, it cannot be concluded that the higher the perceived technology sophistication of broadband, the higher the variety of use of broadband. The hypothesis is rejected.

H_{6g}: *Higher frustration with the technology leads to lower variety and lower rate of use (low use).*

The hypothesis states that the higher the frustration of the consumer with using their broadband subscription, particularly with regards to the ease of use and cost/speed ratio of the subscription, the lower the amount of time spent online and lower the number of technologies that the consumer will use to access their broadband subscription to perform various online activities.

Figure 33 with Table 43 and Figure 34 with Table 44 below illustrates the results of the frequency and r_s test performed to determine whether a relationship exists between a consumer's level of frustration with using their broadband subscription and their UD patterns (Variety of Use and Rate of Use) respectively.

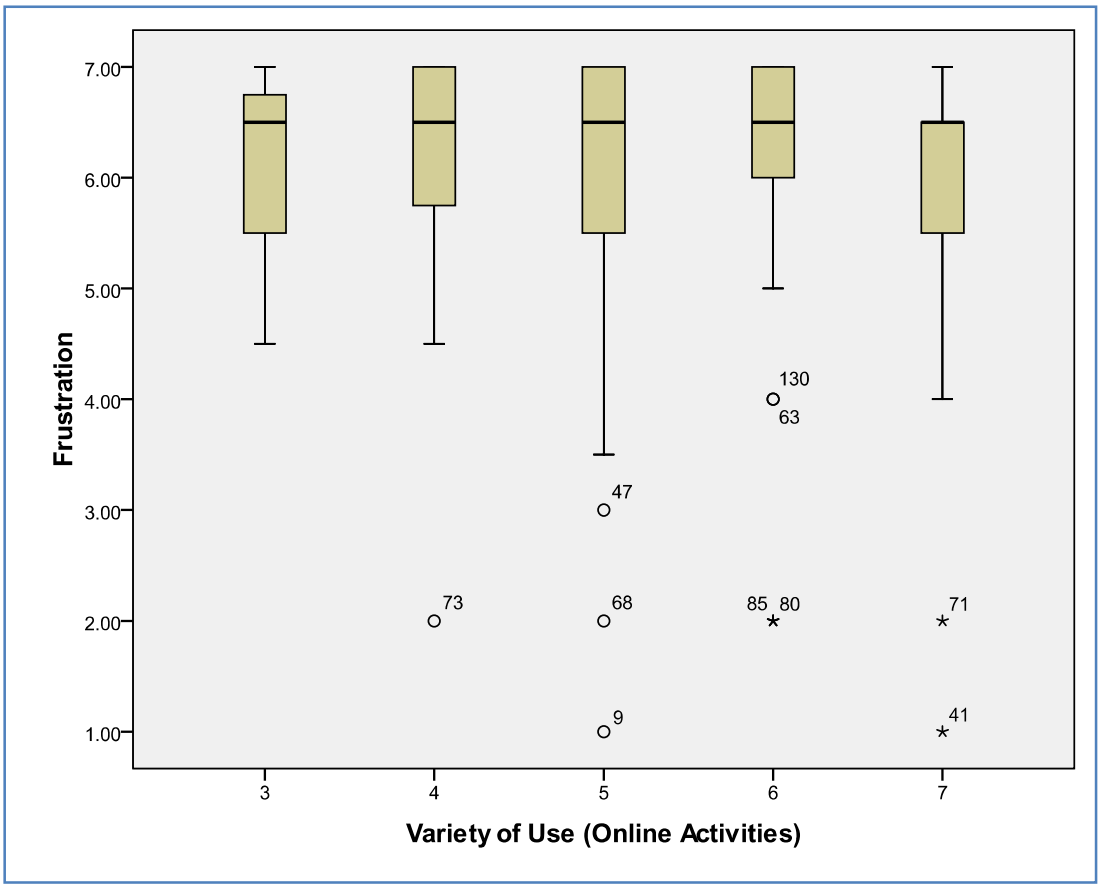

Figure 33: Association between Frustration with Broadband and Variety of Use

			Number_of_Tech	PD_2_3_Average
Spearman's rho	Number_of_Tech	Correlation Coefficient	1.000	.053
		Sig. (1-tailed)	.	.256
		N	154	154
	PD_2_3_Average	Correlation Coefficient	.053	1.000
		Sig. (1-tailed)	.256	.
		N	154	154

Table 43: Spearman's Rho (r_s) test to determine association between Frustration with Broadband and Variety of Use

The findings suggest that a majority of the respondents that were strongly (median = 6) frustrated with their broadband subscription appeared to perform a variety of tasks (3-7) using their broadband subscription. However, those respondents that showed more agreement with being frustrated appeared to perform around 4 online activities as opposed to those that performed 7 online activities. The $\mathbf{r_s}$ test validated that there is no significant ($p > 0.1$) relationship between the consumers frustration with using their broadband subscription and the variety of use of their broadband subscription.

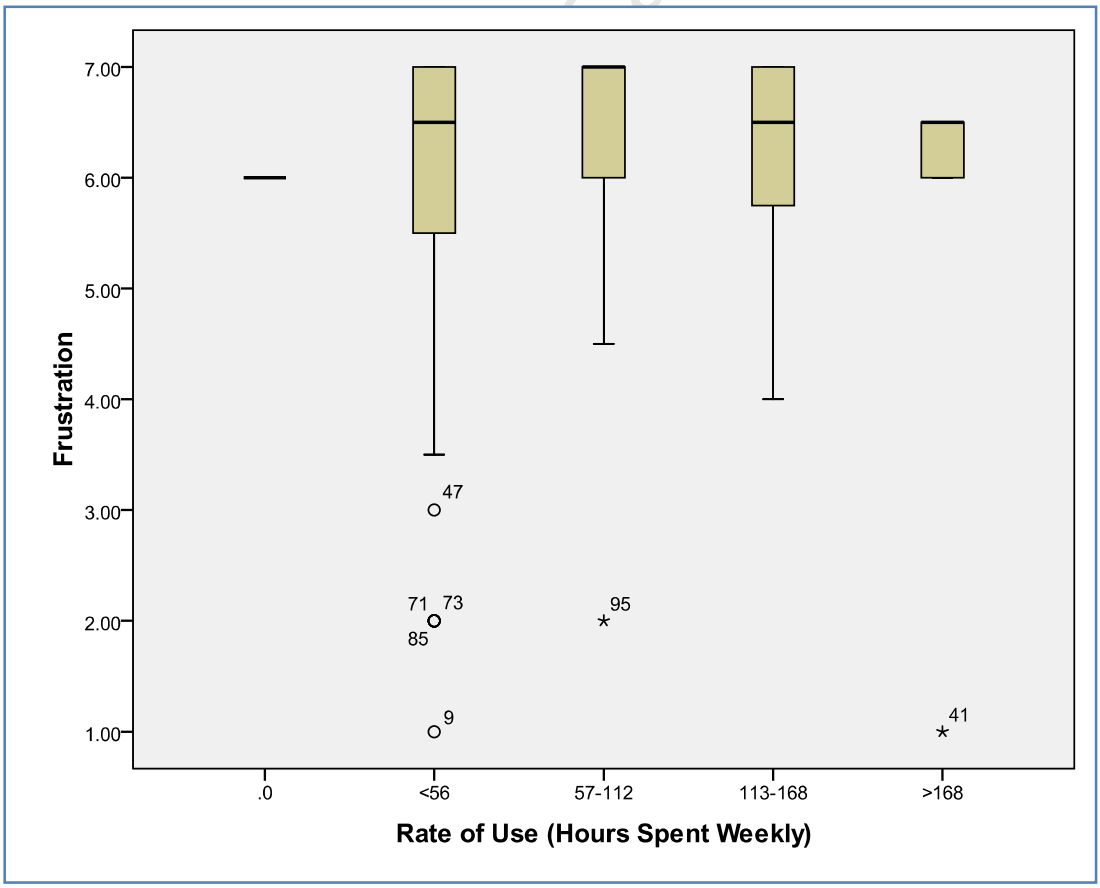

Figure 34: Association between Frustration with Broadband and Rate of Use

			PD_2_3_Average	Hours_Spent_Weekly
Spearman's rho	PD_2_3_Average	Correlation Coefficient	1.000	.126
		Sig. (1-tailed)	.	.060
		N	154	154
	Hours_Spent_Weekly	Correlation Coefficient	.126	1.000
		Sig. (1-tailed)	.060	.
		N	154	154

Table 44: Spearman's Rho (r_s) test to determine association between Frustration with Broadband and Rate of Use

The findings suggest that a majority of the respondents that were strongly (median = 7) frustrated with their broadband subscription, spend 57-112 hours per week using their broadband subscription. The $\mathbf{r_s}$ test validated that the relationship between the consumer's frustration with using their broadband subscription and the rate of use of their broadband subscription was not significant ($p < 0.1$) enough.

Since there is a significant relationship between rate use and frustration of broadband but not that of variety of use, the hypothesis was partially accepted on the basis that a higher the frustration of broadband leads to a lower rate of use.

H_{6h}: *Higher skills of users lead to higher variety of use (intense and experimental use).*

The hypothesis states that the higher the skill levels of the consumer with using their broadband subscription the higher the number of technologies that the consumer will use to access their broadband subscription for various online activities.

Figure 35 and Table 45 below illustrates the results of the frequency and $\mathbf{r_s}$ test performed respectively to determine whether a relationship exists between a consumer's skill levels with using their broadband subscription and their UD pattern (Variety of Use).

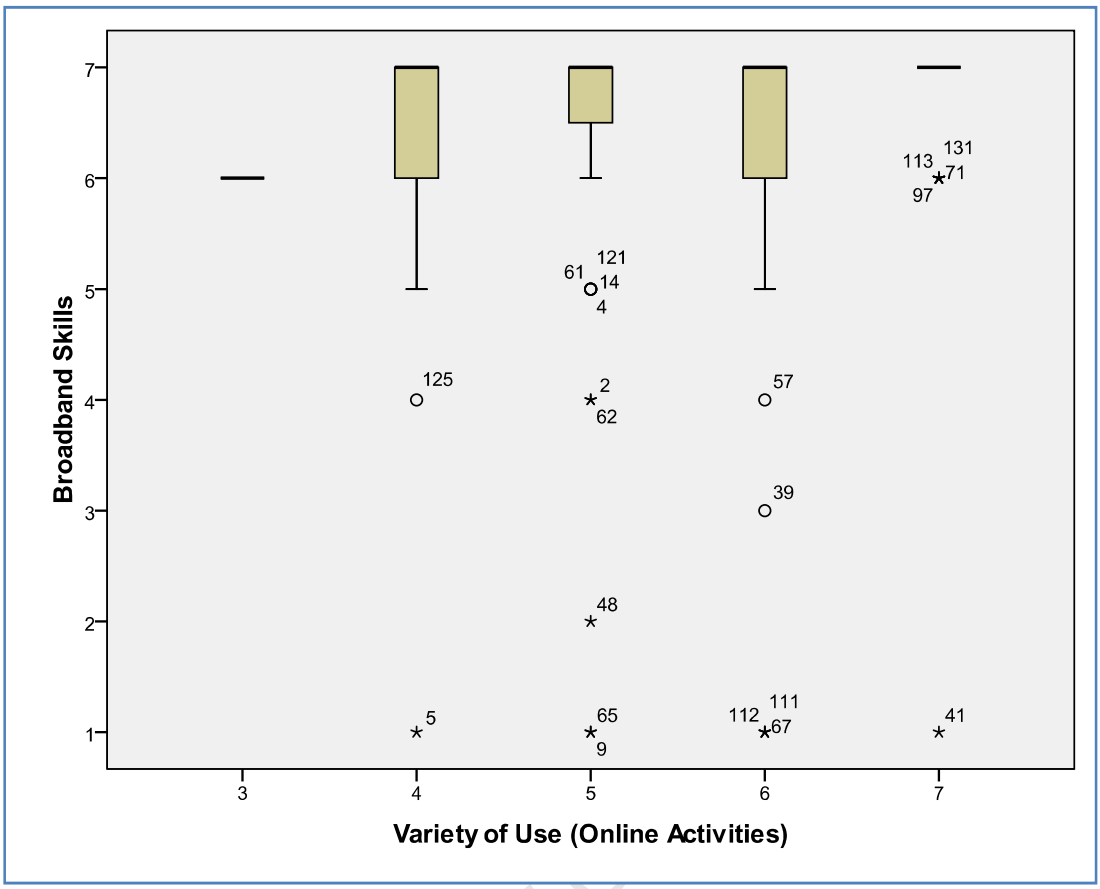

Figure 35: Association between Skills of Users and Variety of Use

			PD4	Number_of_Tech
Spearman's rho	PD4	Correlation Coefficient	1.000	-.029
		Sig. (1-tailed)	.	.360
		N	154	154
	Number_of_Tech	Correlation Coefficient	-.029	1.000
		Sig. (1-tailed)	.360	.
		N	154	154

Table 45: Spearman's Rho (r_s) test to determine association between Skills of users and Variety of Use

The findings suggest that a majority of the respondents strongly believed (median = 7) that they had the necessary skills to use their broadband subscription performed between 4-6 online activities using their broadband subscription. However, the $\mathbf{r_s}$ test validated that the relationship between the consumers skill levels with using their broadband subscription and the rate of use of their broadband subscription was not significant (> 0.1) enough. Therefore, the hypothesis is rejected.

H_{6i}: ***Higher levels of international communication with family and friends leads to an increase in variety of use (intense and experimental use).***

The hypothesis states that the higher the level of external communication performed by a consumer using their broadband subscription, particularly with family residing overseas, the higher the number of technologies that the consumer will use to access their broadband subscription.

Figure 36 and Table 46 below illustrates the results of the frequency and rs test performed to determine whether a relationship exists between a consumer's level of international communication with family and friends using their broadband subscription and their UD pattern (Variety of Use).

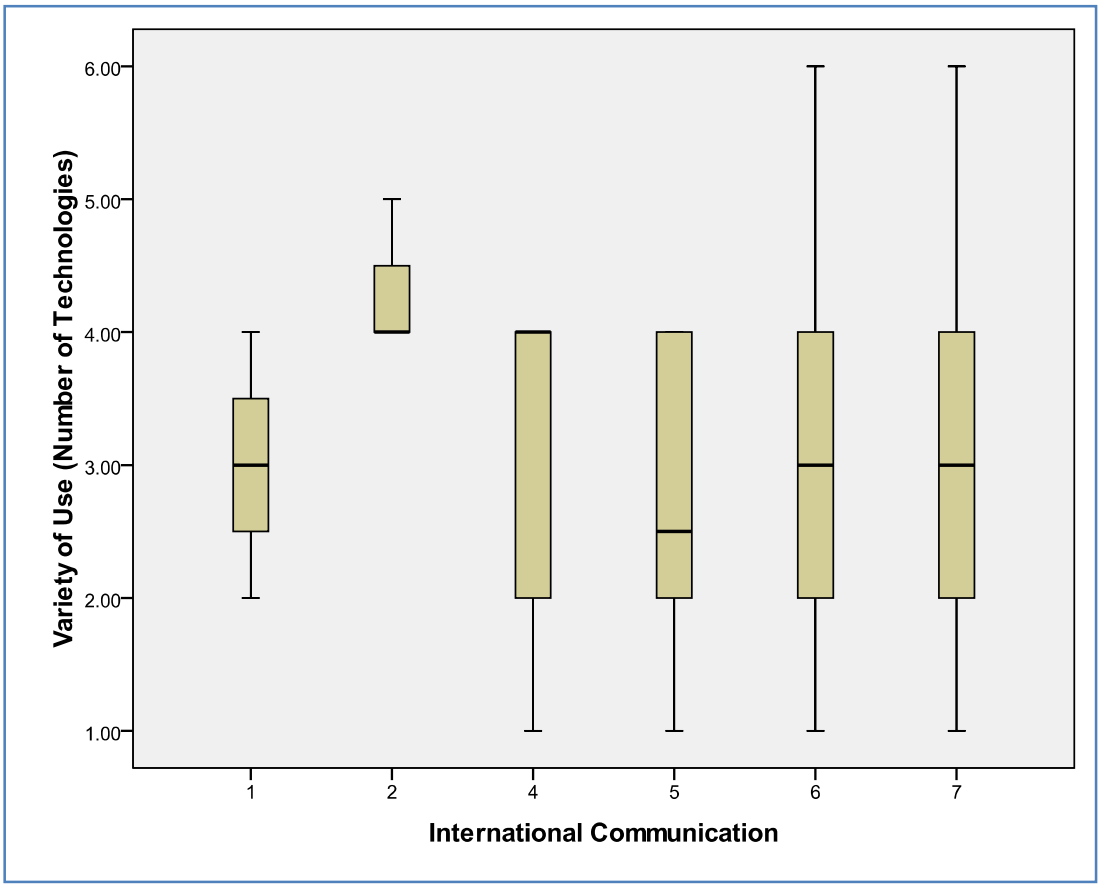

Figure 36: Association between International Communication and Variety of Use

			Number_of_Tech	ED1
Spearman's rho	Number_of_Tech	Correlation Coefficient	1.000	-.049
		Sig. (1-tailed)	.	.275
		N	154	154
	ED1	Correlation Coefficient	-.049	1.000
		Sig. (1-tailed)	.275	.
		N	154	154

Table 46: Spearman's Rho (r_s) test to determine association between International Communication and Variety of Use

The findings suggest that a majority of the respondents that communicated with family and friends overseas regularly (6-7) appeared to have between 1 and 6 (median = 3) technologies accessing different online services provided by their broadband subscription. The $\mathbf{r_s}$ test validated that the relationship between the consumers international communication levels using their broadband subscription and the variety of use with their broadband subscription was not significant ($p > 0.1$). Therefore, the hypothesis is rejected.

H_{6j}: ***Greater usage of broadband Internet connection outside the home environment leads to a higher variety of use but lower rate of use in the home (experimental use).***

The hypothesis states that the more a consumer accesses a broadband Internet connection outside the household, particularly connections at the work place or university, the higher the number of broadband technologies that the consumer will make use of but results in a lower rate of use with regards to their home broadband subscription.

Figure 37 with Table 47 and Figure 38 with Table 48 below illustrates the results of the frequency and $\mathbf{r_s}$ test performed to determine whether a relationship exists between a consumer's level of access to broadband Internet connections outside the home environment and their UD patterns (Variety of Use and Rate of Use) respectively.

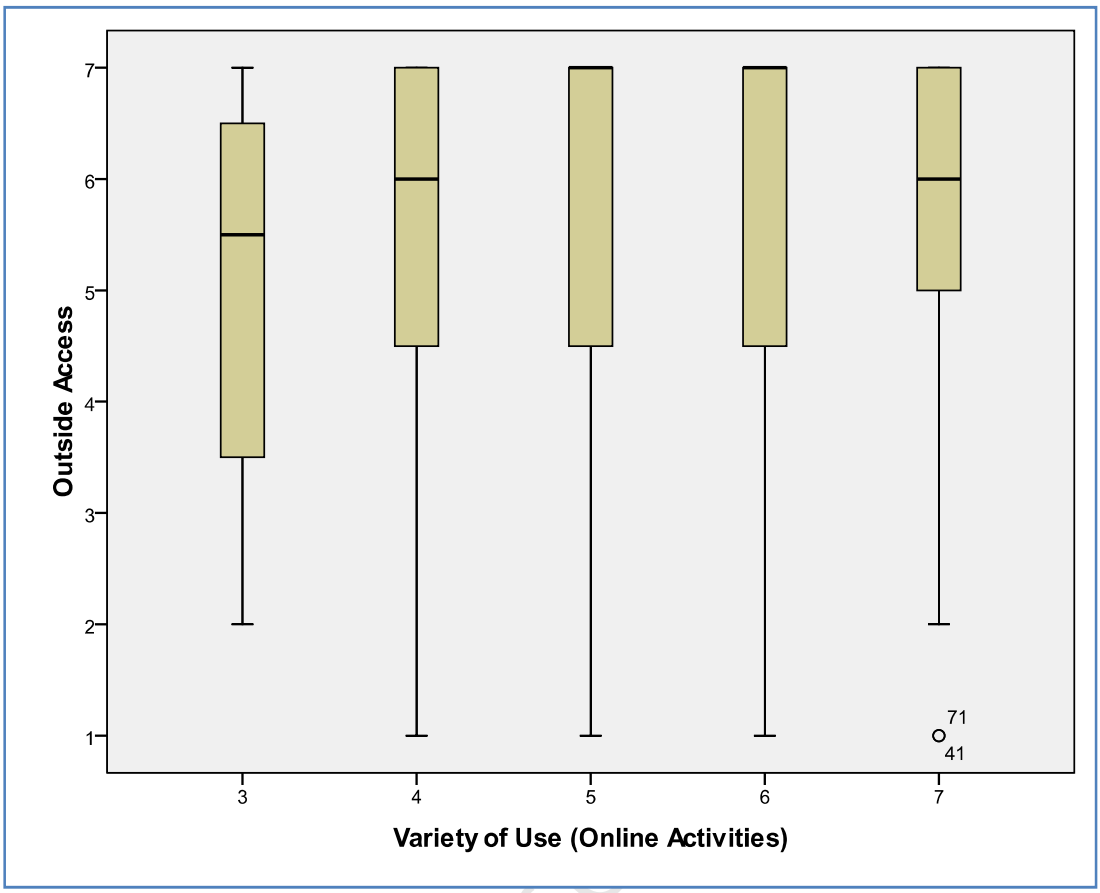

Figure 37: Association between Outside Access and Variety of Use

			Number_of_Tech	ED2
Spearman's rho	Number_of_Tech	Correlation Coefficient	1.000	-.004
		Sig. (1-tailed)	.	.478
		N	154	154
	ED2	Correlation Coefficient	-.004	1.000
		Sig. (1-tailed)	.478	.
		N	154	154

Table 47: Spearman's Rho (r_s) test to determine association between Outside Access and Variety of Use

The findings suggest that a majority of the respondents that strongly agreed (median = 7) to accessing technologies outside the household appeared to perform 5-6 online activities using broadband connections outside their households. However, the $\mathbf{r_s}$ test validated that the relationship between the outside broadband Internet access and the variety of use of their broadband subscription was not significant (> 0.1).

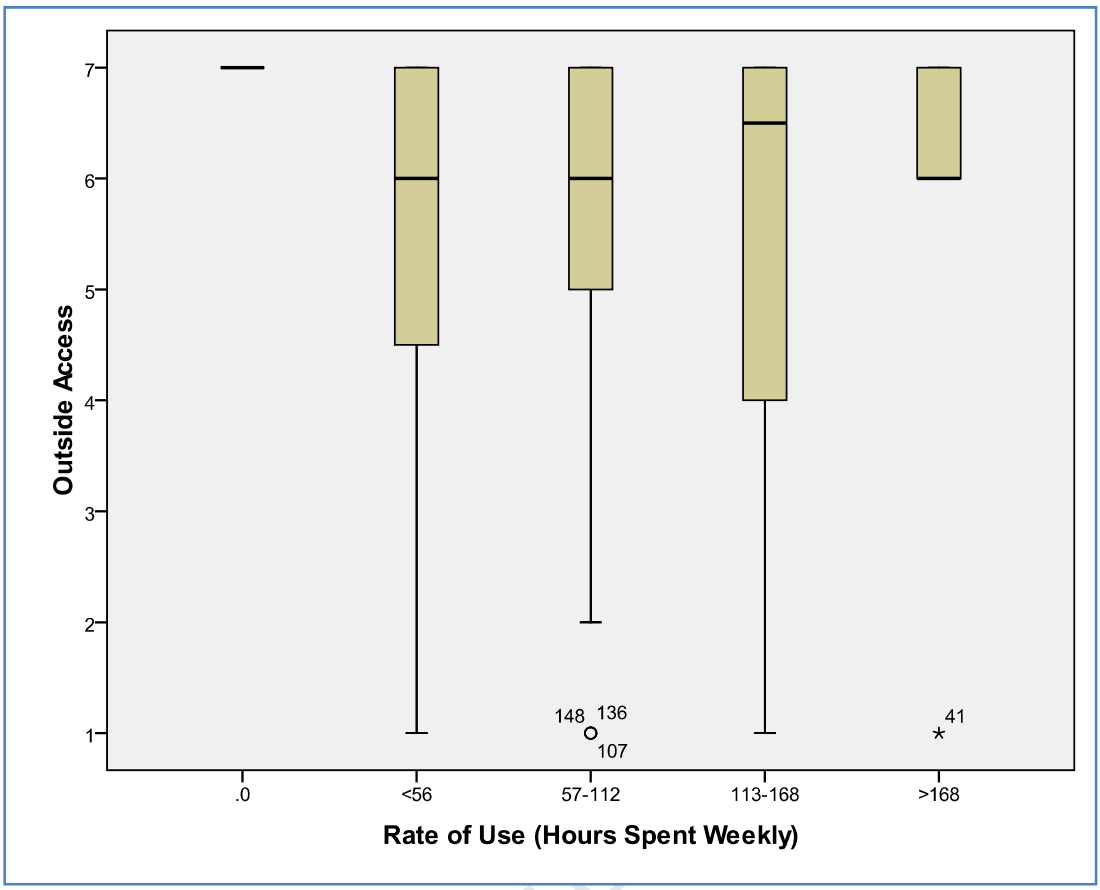

Figure 38: Association between Outside Access and Rate of Use

			ED2	Hours_Spent_Weekly
Spearman's rho	ED2	Correlation Coefficient	1.000	-.008
		Sig. (1-tailed)	.	.461
		N	154	154
	Hours_Spent_Weekly	Correlation Coefficient	-.008	1.000
		Sig. (1-tailed)	.461	.
		N	154	154

Table 48: Spearman's Rho (r_s) test to determine association between Outside Access and Rate of Use

The findings suggest that a majority of the respondents that strongly agreed (median = 6. 5) to accessing technologies outside the household appeared to make use of their broadband subscription of between 113-168 hours per week. This suggests that even though users made use of broadband connections outside their households, they still spent a lot of time using their home broadband connection. The $\mathbf{r_s}$ test validated that the relationship between the outside broadband Internet access and the rate of use of their broadband subscription was not significant (> 0.1) enough.

Since there is no significant relationship between variety use and rate of use with consumers accessing broadband Internet connections outside the home environment, the hypothesis is rejected.

H_{6k}: ***Increased family exposure to target media leads to an increase in variety of use and rate of use of broadband services (intense, specialized, experimental use).***

The hypothesis states that the more a family member is exposed the media (such as adverts) about the benefits of broadband or the greater media makes consumers aware of broadband, the more technologies that a consumer will use to access online services via their broadband subscription. This will also result in the consumer spending more time online increasing their rate of use.

Figure 39 with Table 49 and Figure 40 with Table 50 below illustrates the results of the frequency and rs test performed to determine whether a relationship exists between a consumer's level of exposure to target media and their UD patterns (Variety of Use and Rate of Use) respectively.

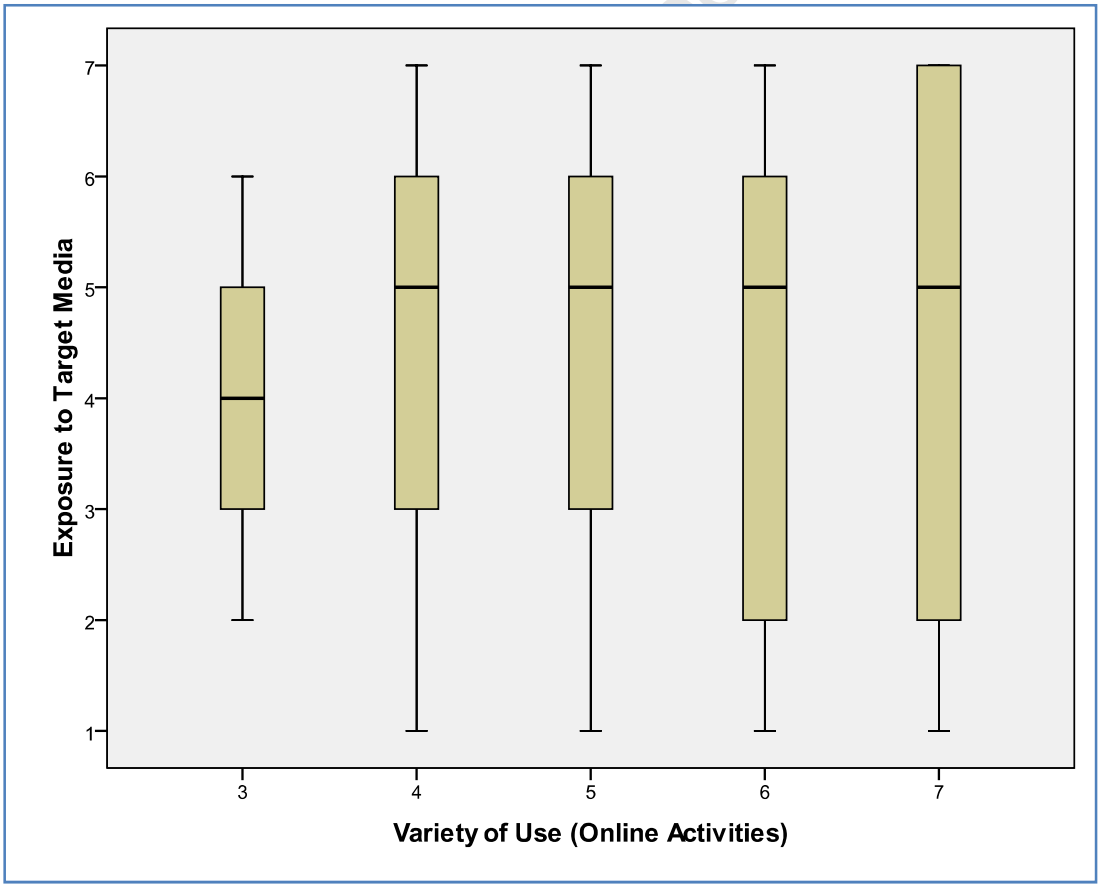

Figure 39: Association between Exposure to Target Media and Variety of Use

			ED3	Number_of_Tech
Spearman's rho	ED3	Correlation Coefficient	1.000	-.001
		Sig. (1-tailed)	.	.493
		N	154	154
	Number_of_Tech	Correlation Coefficient	-.001	1.000
		Sig. (1-tailed)	.493	.
		N	154	154

Table 49: Spearman's Rho (r_s) test to determine association between Exposure to Target Media and Variety of Use

The findings suggest that a majority of the respondents that showed weak agreement (median = 5) with being influenced by target media performed between 4-7 activities online accessing different online services in their home. The $\mathbf{r_s}$ test validated that the relationship between a family member's exposure to target media and the variety of use of their broadband subscription was not significant (> 0.1).

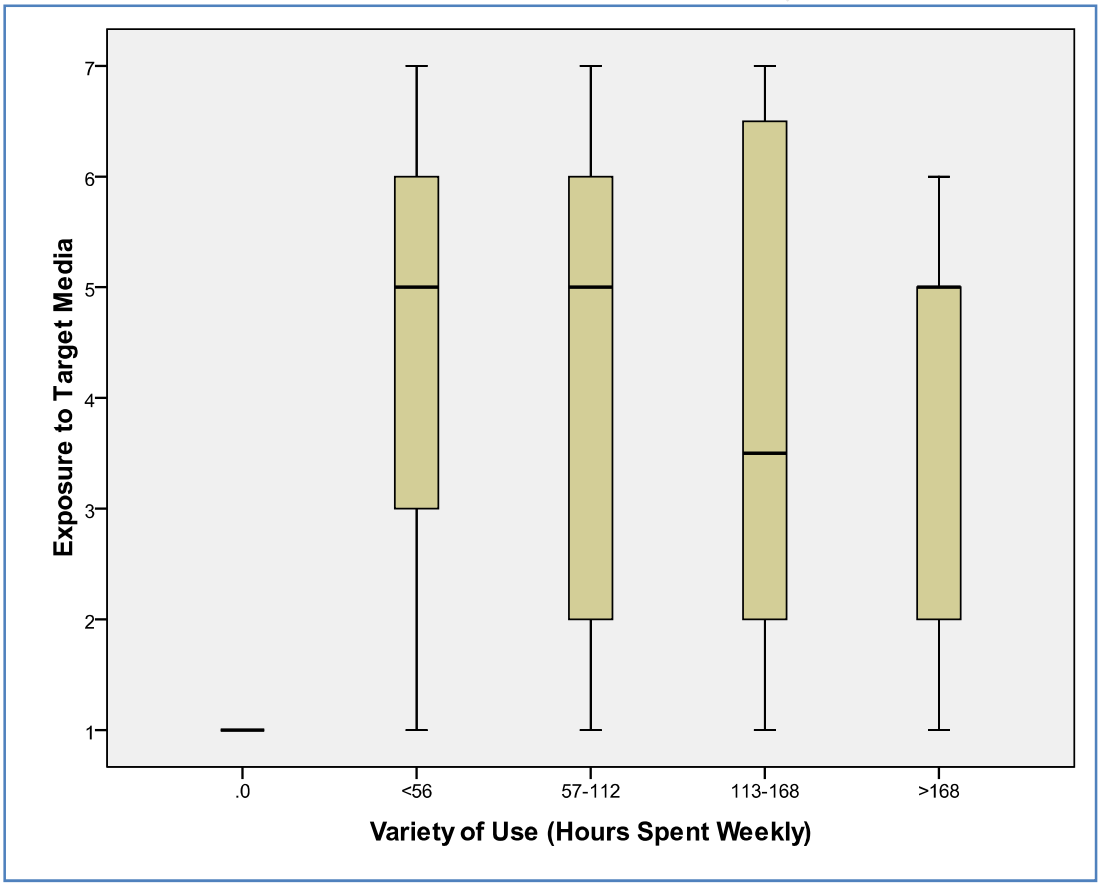

Figure 40: Association between Exposure to Target Media and Rate of Use

			ED3	Hours_Spent_Weekly
Spearman's rho	ED3	Correlation Coefficient	1.000	-.036
		Sig. (1-tailed)	.	.329
		N	154	154
	Hours_Spent_Weekly	Correlation Coefficient	-.036	1.000
		Sig. (1-tailed)	.329	.
		N	154	154

Table 50: Spearman's Rho (r_s) test to determine association between Exposure to Target Media and Rate of Use

The findings suggest that a majority of the respondents that showed weak agreement (median = 5) with being influenced by target media make use of their broadband subscription < 112 hours per week. The $\mathbf{r_s}$ test validated that the relationship between a family member's exposure to target media and the rate of use of their broadband subscription was not significant (> 0.1).

Since there is no significant relationship between variety use and rate of use with exposure to target media, the hypothesis is rejected.

H_{61}: ***An increase in the quality of broadband services will increase its rate of use (intense use).***

The hypothesis states that when the quality of broadband services increases, particularly with regards to customer support, security, less downtime and quality of the connections, the amount of time that a consumer will spend using their broadband subscription for online activities increases.

Figure 41 and Table 51 below illustrates the results of the frequency and $\mathbf{r_s}$ test performed to determine whether a relationship exists between a consumer's perception of service quality provided by their service provider and their UD pattern (Rate of Use) respectively.

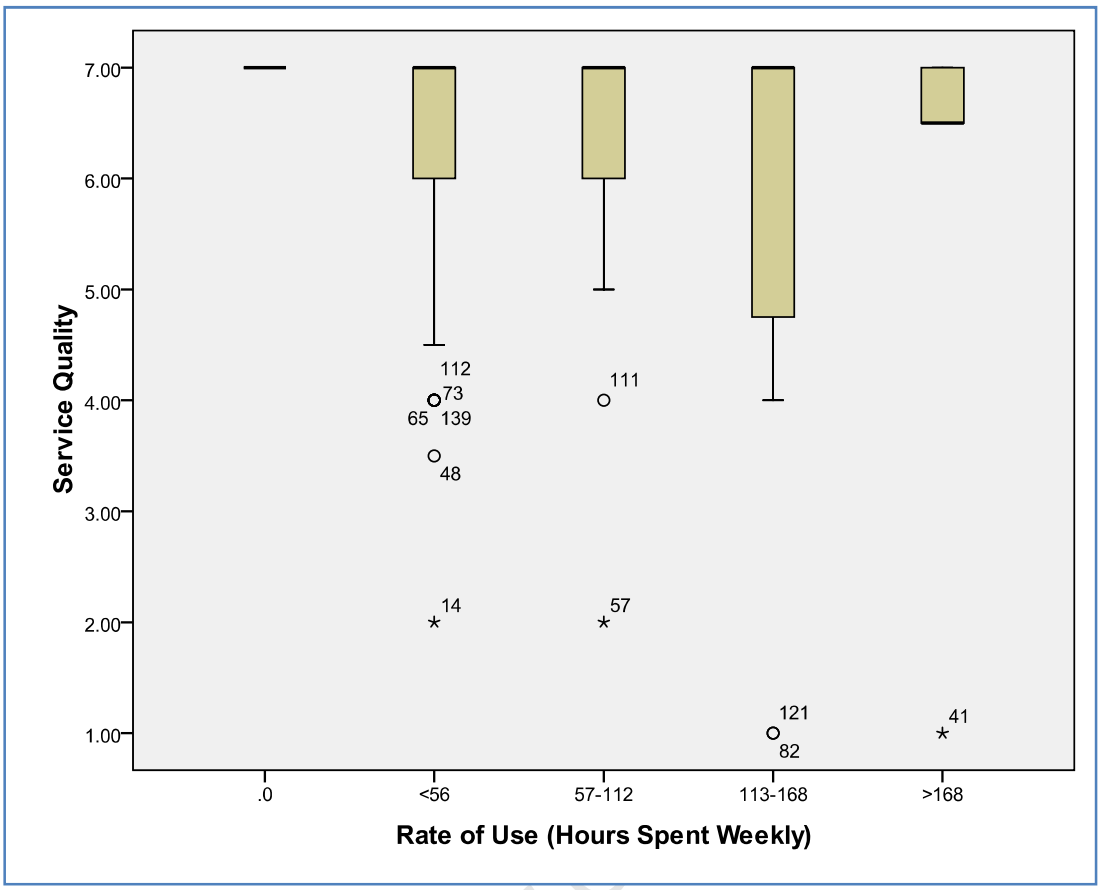

Figure 41: Association between Service Quality and Rate of Use

			SQ_Average	Hours_Spent_Weekly
Spearman's rho	SQ_Average	Correlation Coefficient	1.000	.029
		Sig. (1-tailed)	.	.359
		N	154	154
	Hours_Spent_Weekly	Correlation Coefficient	.029	1.000
		Sig. (1-tailed)	.359	.
		N	154	154

Table 51: Spearman's Rho (r_s) test to determine association between Service Quality and Rate of Use

The findings suggest that a majority of the respondents that were strongly (median = 7) satisfied with the quality of their broadband subscription, make use of their broadband subscription for more than 56 hours per week. However, Figure 41 above illustrates a negative relationship between service quality and rate of use. This suggests that as the service quality decreases the more time that a consumer will spend using their broadband subscription.

The $\mathbf{r_s}$ test validated that there is a significant ($p > 0.1$) relationship between the consumers service quality and the consumers rate of use of their broadband subscription. Therefore, the hypothesis is rejected.

7.6.5 The Impact of Broadband

The $\mathbf{r_s}$ test was performed in order to determine if there were any relationships between consumers use diffusion (UD) patterns (rate of use and variety of use) and the impact that broadband has on their lives. The test uses nominal (categorical) as well as ordinal level data. The test was performed with the UD patterns as the independent variables and the impact of broadband as the dependent variables.

The aim is to determine whether the UD patterns of consumers are able to predict the impact that broadband has on consumers lives. The findings are represented below.

H_{7a}: ***The greater a users' rate and variety of use, the easier it is for users to communicate with distant families.***

The hypothesis states that if a consumer is an intense, specialised and experimental user then it is easier for them to communicate or keep in contact with distance families, particularly those situated overseas. In other words, if the consumer is an intense, specialized and experimental user with broadband, this makes it easier for the consumer to find different ways of communicating online with family located internationally.

Figure 42 with Table 52 and Figure 43 with Table 53 below illustrates the results of the frequency and $\mathbf{r_s}$ test performed to determine whether a relationship exists between a consumer's UD patterns (Variety of Use and Rate of Use) and their perceptions of how much easier broadband has made it is to communicate with family located internationally.

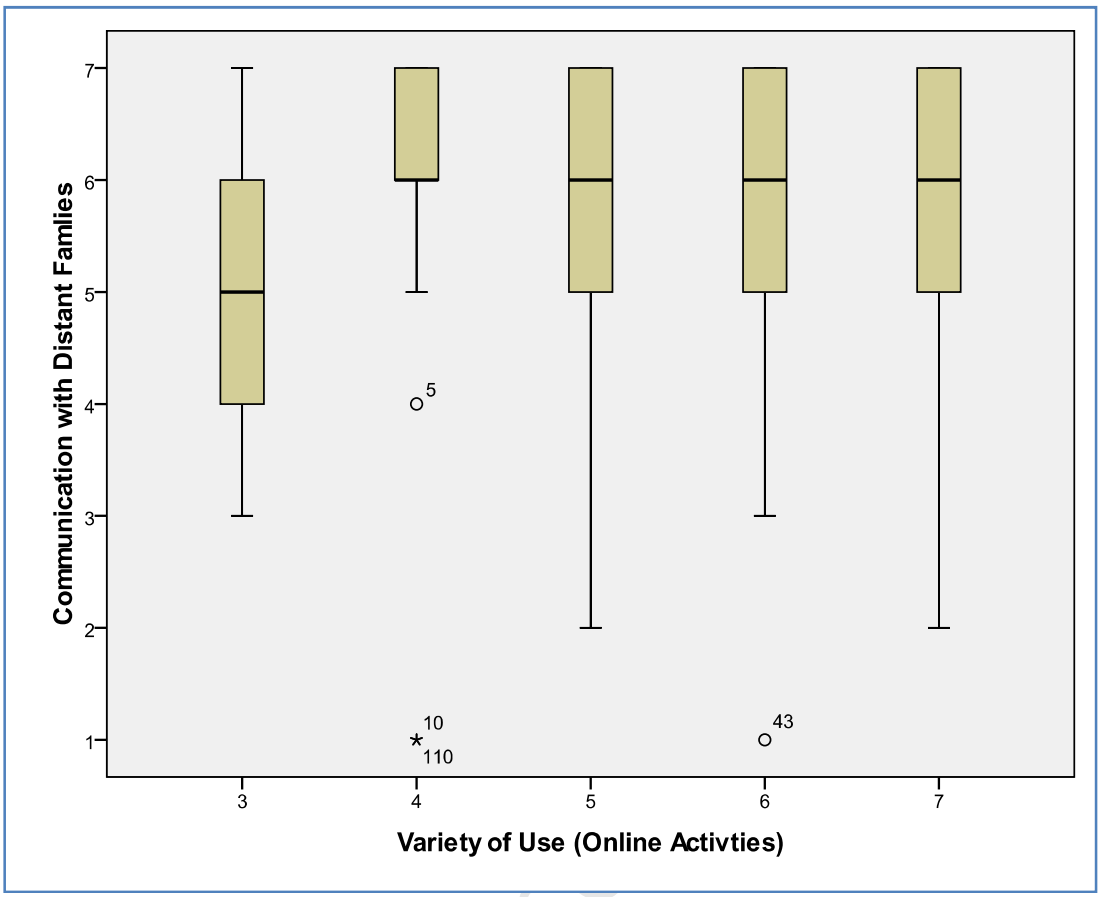

Figure 42: Association between Variety of Use and Communication with Distant Families

			LIF1	Hours_Spent_Weekly
Spearman's rho	LIF1	Correlation Coefficient	1.000	.024
		Sig. (1-tailed)	.	.382
		N	154	154
	Hours_Spent_Weekly	Correlation Coefficient	.024	1.000
		Sig. (1-tailed)	.382	.
		N	154	154

Table 52: Spearman's Rho (r_s) test to determine association between Variety of Use and Communication with Distant Families

The results from Figure 42 suggest that a majority of the respondents that agreed with broadband making it easier (median = 6) to communicate with family located overseas had performed between 4-7 online activities using their broadband subscription. It should be noted that overall strong agreement was shown by respondents who performed 4 online activities. The technologies that accessed their broadband subscription could be IP Phones, PCs or Laptops with specific communication software (e.g. Skype). The respondents appeared to be intense and

experimental users and the $\mathbf{r_s}$ test validated that there is no significant relationship (> 0.1) between a consumers variety of use and communicating with family located internationally.

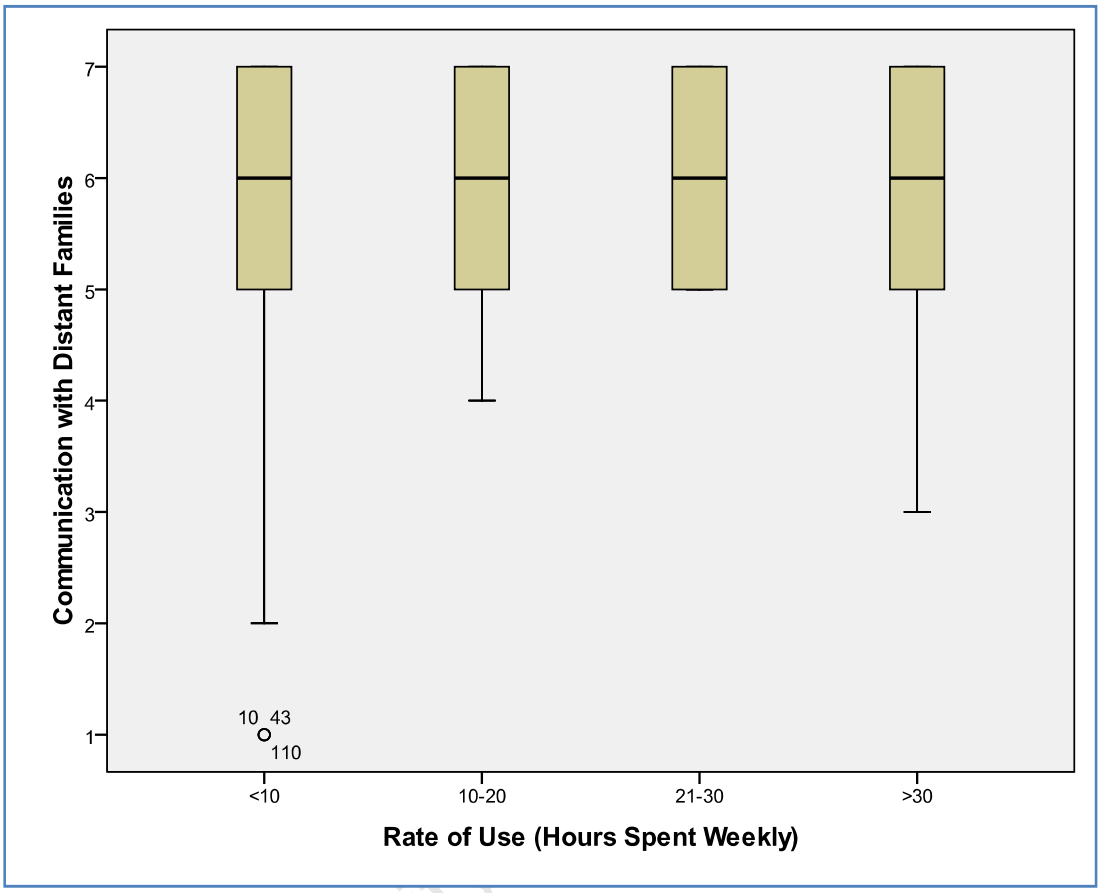

Figure 43: Association between Rate of Use and Communication with Distant Families

			LIF1	Number_of_Tech
Spearman's rho	LIF1	Correlation Coefficient	1.000	.095
		Sig. (1-tailed)	.	.121
		N	154	154
	Number_of_Tech	Correlation Coefficient	.095	1.000
		Sig. (1-tailed)	.121	.
		N	154	154

Table 53: Spearman's Rho (r_s) test to determine association between Rate of Use and Communication with Distant Families

The results from Figure 43 were obtained by looking at the amount of time that consumers spent specifically using their broadband subscription for communicating online. The finding suggest that a majority of the respondents that agreed with broadband making it easier (median = 6) to communicate with family located overseas tend to be spread across the hours per week specifically for communicating

online categories. The $\mathbf{r_s}$ test validated that there was no significant relationship (> 0.1) between a consumers variety of use and communicating with family located internationally.

Since there is no significant relationship between both variety and rate of use and communication with distant families, the hypothesis is rejected.

H_{7b}: ***The greater a users' rate and variety of use, the more a user will be able to commence with other life activities.***

The hypothesis states that if a consumer is an intense, specialised and experimental user then it is easier for them to commence with other life activities. In other words, the more time consumers spend using broadband subscription performing various online activities such as such shopping, banking, work related activities instead of actually physically being at these places, more time will be available to the consumers to perform other life activities such as spending time with the family.

Figure 44 with Table 54 and Figure 45 with Table 55 below illustrates the results of the frequency and $\mathbf{r_s}$ test performed to determine whether a relationship exists between a consumer's UD patterns (Variety of Use and Rate of Use) and their perceptions of how much easier broadband has made it to commence with other life activities.

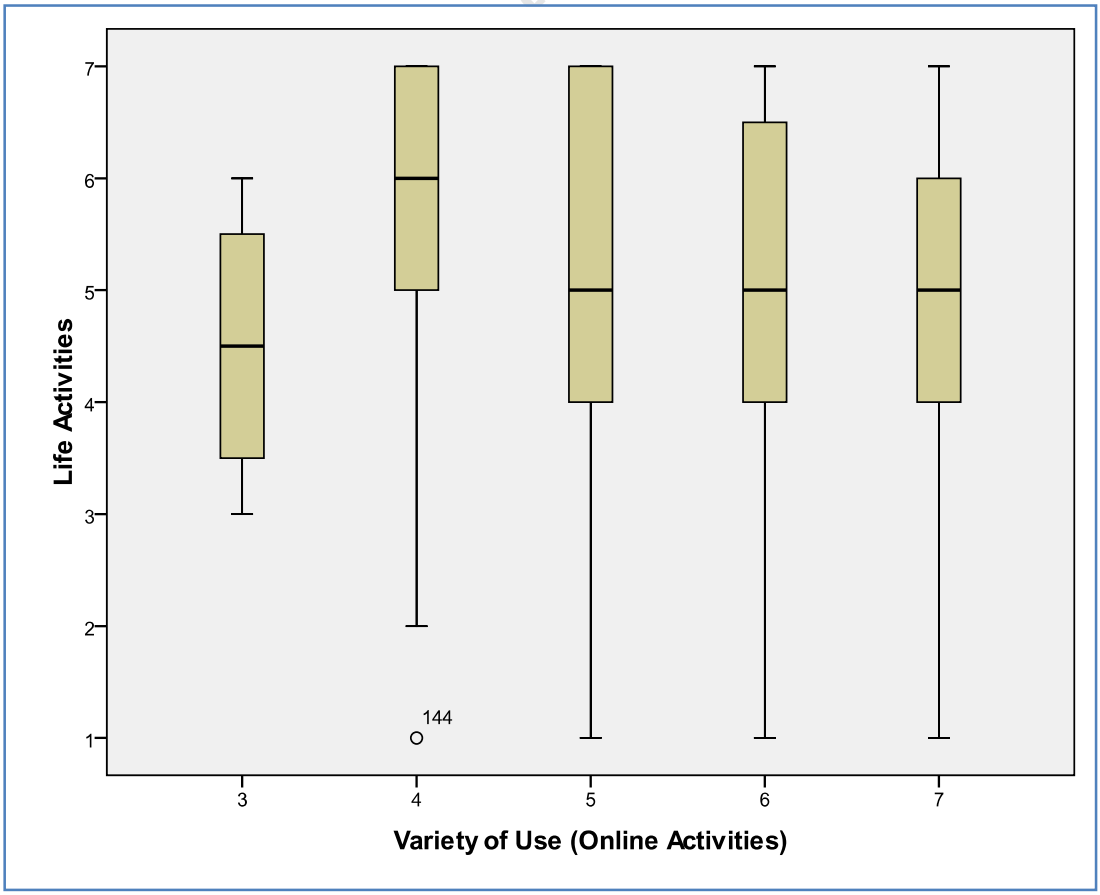

Figure 44: Association between Variety of Use and Life Activities

			LIF2	Number_of_Tech
Spearman's rho	LIF2	Correlation Coefficient	1.000	.120
		Sig. (1-tailed)	.	.069
		N	154	154
	Number_of_Tech	Correlation Coefficient	.120	1.000
		Sig. (1-tailed)	.069	.
		N	154	154

Table 54: Spearman's Rho (r_s) test to determine association between Variety of Use and Life Activities

The findings from Figure 44 suggests that a majority of the respondents showed agreement (median = 6) with broadband making it easier to commence with other life activities had perform around 4 activities online. The $\mathbf{r_s}$ test validated that there is a significant relationship (< 0.1) between a consumer's variety of use and commencing with other life activities.

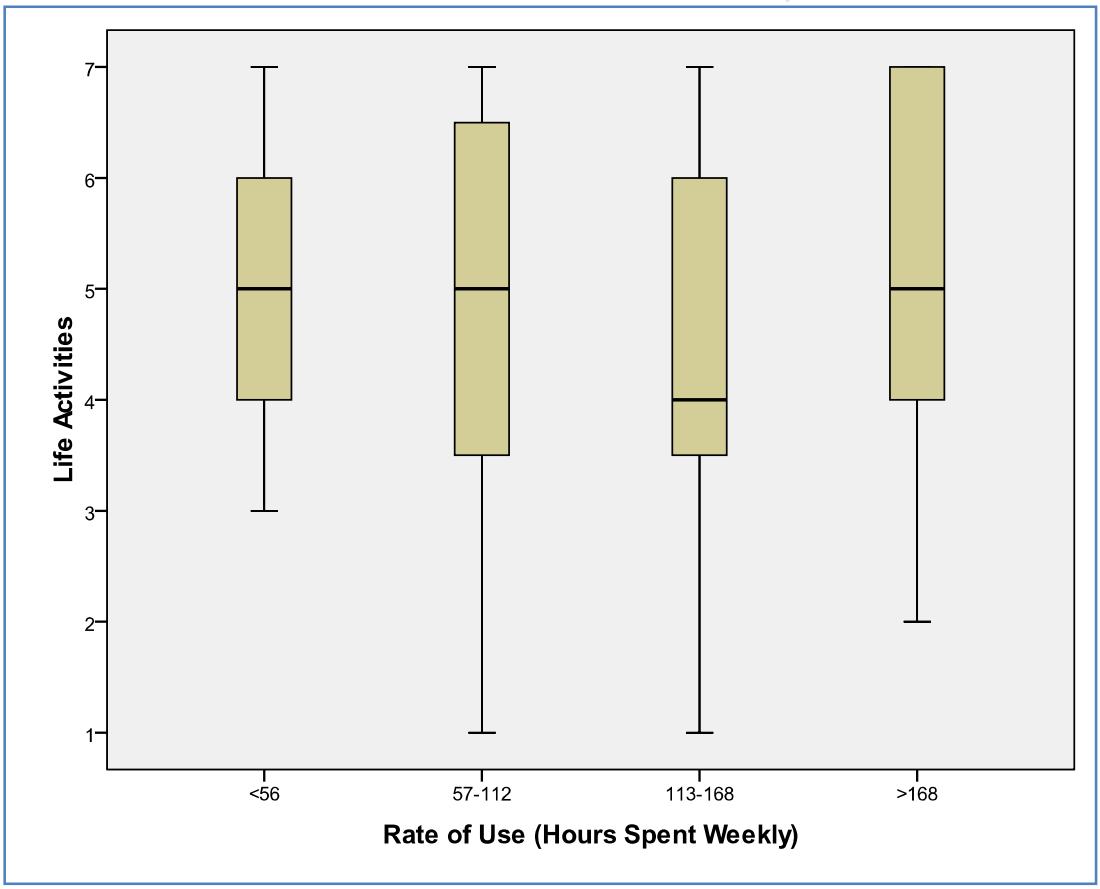

Figure 45: Association between Rate of Use and Life Activities

			LIF2	Hours_Spent_Weekly
Spearman's rho	LIF2	Correlation Coefficient	1.000	.048
		Sig. (1-tailed)	.	.275
		N	154	154
	Hours_Spent_Weekly	Correlation Coefficient	.048	1.000
		Sig. (1-tailed)	.275	.
		N	154	154

Table 55: Spearman's Rho (r_s) test to determine association between Rate of Use and Life Activities

The findings from Figure 45 suggest that a majority of the respondents that showed weak agreement (median = 5) with that broadband making it easier to commence with other life activities tend to make use of their broadband subscription of between more than 168 hours per week. The $\mathbf{r_s}$ test validated that there is no significant relationship (> 0.1) between a consumer's rate of use and commencing with other life activities.

Since variety of use has a significant relationship with consumers being able to commence with other life activities, the hypothesis is partially accepted.

H_{7c}: ***The greater a users rate and variety of use, the more a user will be able to save on costs.***

The hypothesis states that the more time consumers spend using broadband subscription performing various online activities such as such shopping, banking or work related activities instead of actually physically being at these places, the costs that consumers incur are minimised, such as petrol costs.

Figure 46 with Table 56 and Figure 47 with Table 57 below illustrates the results of the frequency and $\mathbf{r_s}$ test performed to determine whether a relationship exists between a consumer's UD patterns (Variety of Use and Rate of Use) and their perceptions of how broadband allows them to be more cost effective.

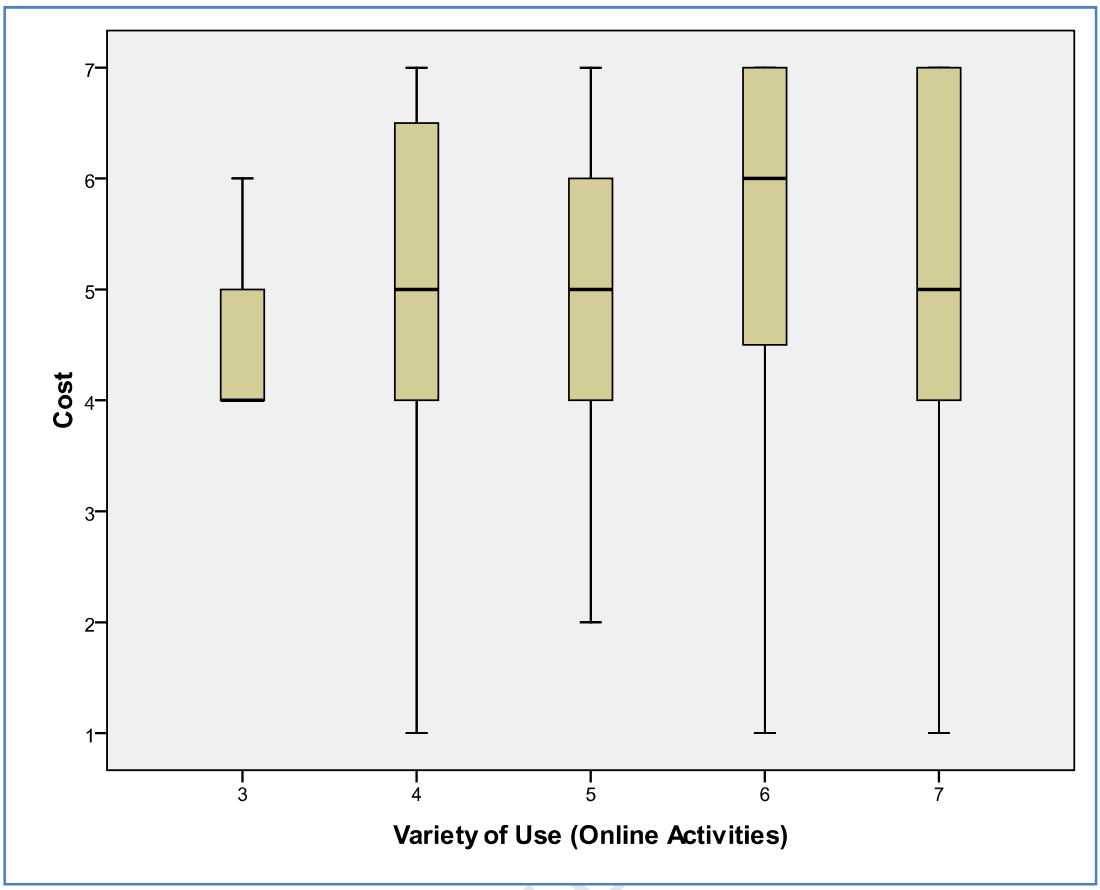

Figure 46: Association between Variety of Use and Cost

			Number_of_Tech	LIF3
Spearman's rho	Number_of_Tech	Correlation Coefficient	1.000	.059
		Sig. (1-tailed)	.	.233
		N	154	154
	LIF3	Correlation Coefficient	.059	1.000
		Sig. (1-tailed)	.233	.
		N	154	154

Table 56: Spearman's Rho (r_s) test to determine association between Variety of Use and Cost

The findings from Figure 46 suggest that those users that agreed (median = 6) with broadband allowing them to be cost effective performed around 6 activities online. The $\mathbf{r_s}$ test validated that there is no significant relationship (> 0.1) between a consumer's variety of use and cost.

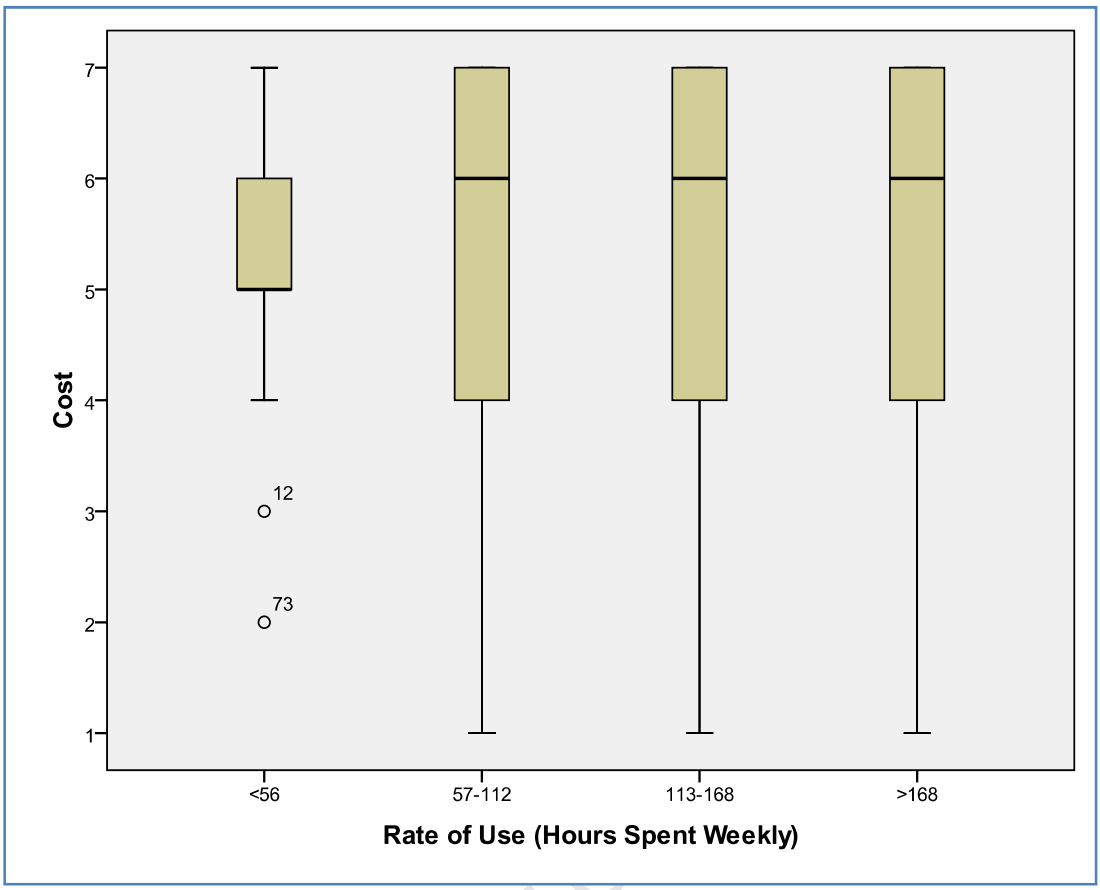

Figure 47: Association between Rate of Use and Cost

			LIF3	Hours_Spent_Weekly
Spearman's rho	LIF3	Correlation Coefficient	1.000	.071
		Sig. (1-tailed)	.	.191
		N	154	154
	Hours_Spent_Weekly	Correlation Coefficient	.071	1.000
		Sig. (1-tailed)	.191	.
		N	154	154

Table 57: Spearman's Rho (r_s) test to determine association between Rate of Use and Cost

The findings from Figure 47 suggest that a majority of the respondents that agreed (median = 6) with broadband allowing them to be cost effective tend to make use of their broadband subscription for > 56 hours per week. However, respondents that used their broadband connection for less than 56 per week appeared to show more agreement with saving on costs. As such, the $\mathbf{r_s}$ test validated that there is no significant relationship (> 0.1) between a consumer's rate of use and cost. Therefore, it cannot be concluded that the higher the experience with using the Internet, the higher the variety of use of broadband.

Since there is no significant relationship between both variety and rate of use and cost of using broadband, the hypothesis was rejected.

H_{7d}: ***The greater a users rate and variety of use, the easier a user will be able to perform work related activities at home.***

The hypothesis states that if a consumer is an intense, specialised and experimental user then it is easier for the user to perform work related activities at home. In other words, the more time consumers spend using their broadband subscription and making use of different technologies to access their broadband subscription for online activities, the easier it is for the consumer to perform work related activities at home.

Figure 48 with Table 58 and Figure 49 with Table 59 below illustrates the results of the frequency and $\mathbf{r_s}$ test performed to determine whether a relationship exists between a consumer's UD patterns (Variety of Use and Rate of Use) and whether broadband has made it easier for them to perform work related activities at home.

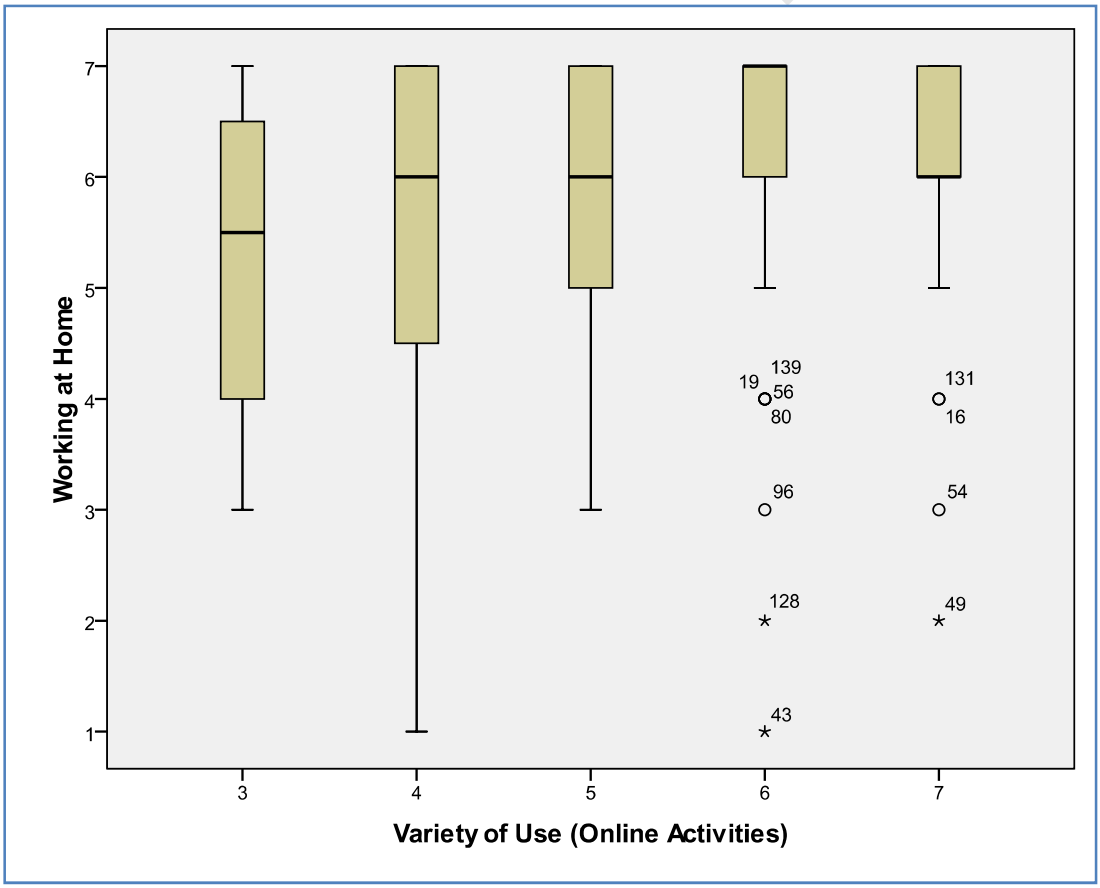

Figure 48: Association between Variety of Use and Working at Home

			LIF4	Number_of_Tech
Spearman's rho	LIF4	Correlation Coefficient	1.000	.057
		Sig. (1-tailed)	.	.242
		N	154	154
	Number_of_Tech	Correlation Coefficient	.057	1.000
		Sig. (1-tailed)	.242	.
		N	154	154

Table 58: Spearman's Rho (r_s) test to determine association between Variety of Use and Working at Home

The findings from Figure 48 suggest that a majority of the respondents that strongly (median = 7) believed that broadband had made it easier to perform work related activities at home performed around 6 activities online using their broadband subscription. The $\mathbf{r_s}$ test validated that there is no significant relationship (> 0.1) between a consumer's variety of use and performing work related activities at home.

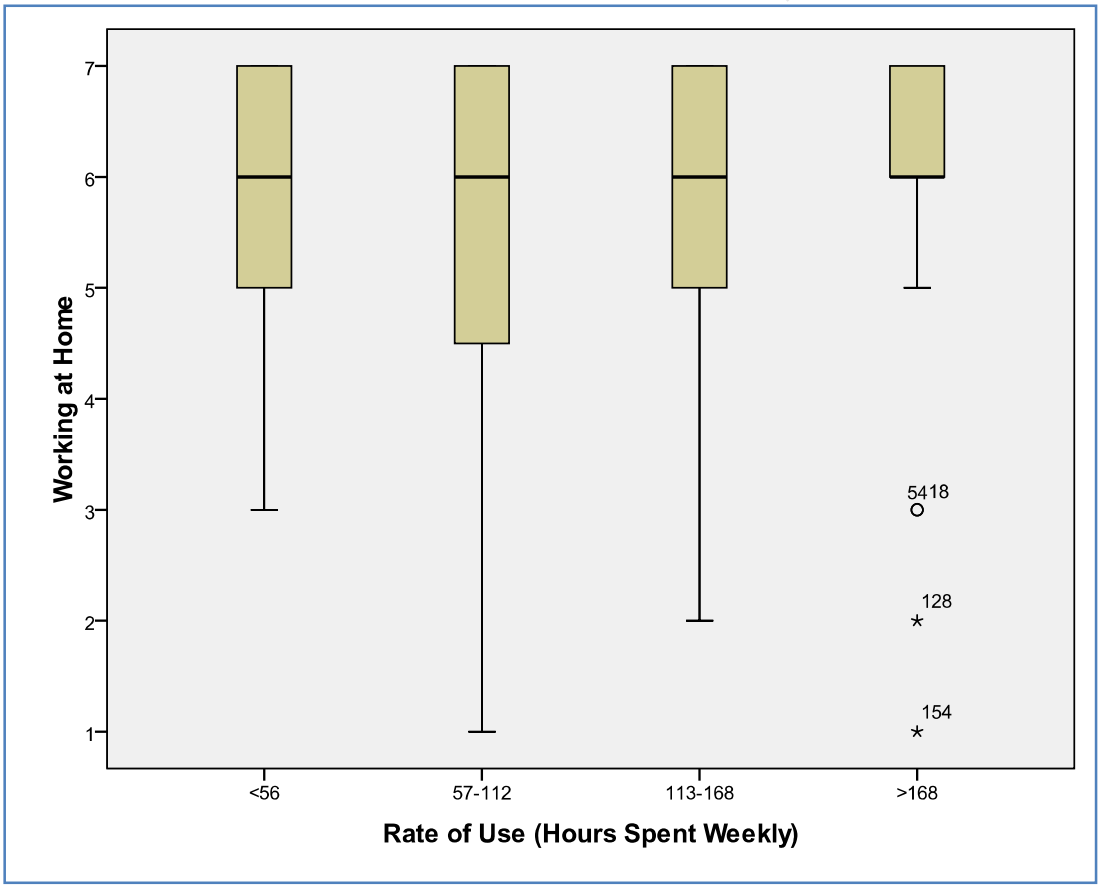

Figure 49: Association between Rate of Use and Working at Home

			LIF4	Hours_Spent_Weekly
Spearman's rho	LIF4	Correlation Coefficient	1.000	.166*
		Sig. (1-tailed)	.	.020
		N	154	154
	Hours_Spent_Weekly	Correlation Coefficient	.166*	1.000
		Sig. (1-tailed)	.020	.
		N	154	154

Table 59: Spearman's Rho (r_s) test to determine association between Rate of Use and Working at Home

The findings from Figure 49 suggest that a majority of the respondents that agreed (median = 6) with broadband making it easier to perform work related activities at home tend to be spread among the hours spent per week categories. However, respondents that spent more than 168 per week showed more agreement with performing work related activities at home. The $\mathbf{r_s}$ test validated that there is a significant relationship (< 0.1) between a consumer's rate of use and performing work related activities at home.

The hypothesis is therefore partially accepted due to the users having a high rate of use to perform work related activities at home using their broadband subscription.

H_{7e}: *The greater a users' rate and variety of use, the more satisfied a user will be with the technology.*

The hypothesis states that the more time consumers spend using their broadband subscription and making use of different technologies to access their broadband subscription for various online activities, the more satisfaction consumers will obtain from performing these online activities with a broadband subscription.

Figure 50 with Table 60 and Figure 51 with Table 61 below illustrates the results of the frequency and $\mathbf{r_s}$ test performed to determine whether a relationship exists between a consumer's UD patterns (Variety of Use and Rate of Use) and whether consumers obtained satisfaction from using their broadband subscription for various online activities.

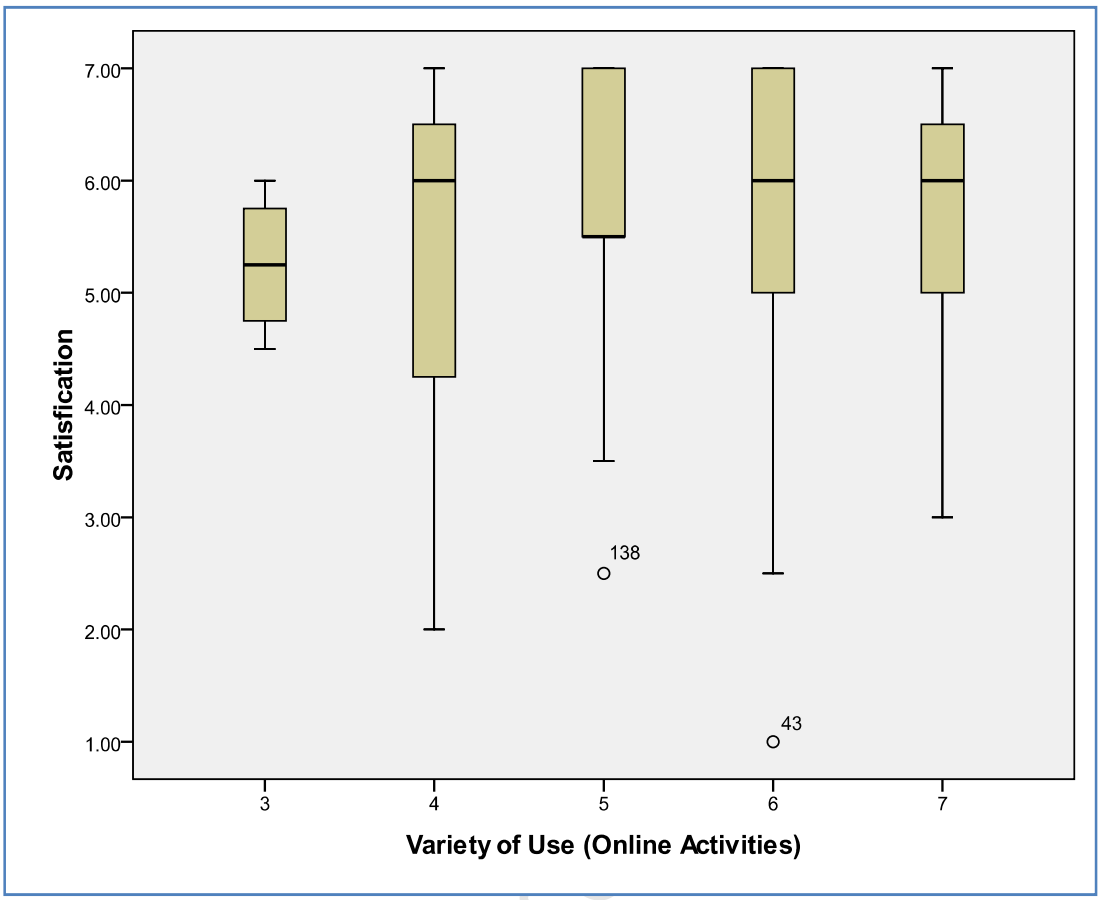

Figure 50: Association between Variety of Use and Satisfaction

			SAT_Average	Number_of_Tech
Spearman's rho	SAT_Average	Correlation Coefficient	1.000	-.008
		Sig. (1-tailed)	.	.461
		N	154	154
	Number_of_Tech	Correlation Coefficient	-.008	1.000
		Sig. (1-tailed)	.461	.
		N	154	154

Table 60: Spearman's Rho (r_s) test to determine association between Variety of Use and Satisfaction

The findings from Figure 50 suggest that a majority of the respondents that agreed (median = 6) with being satisfied with their broadband subscription performed between 6-7 online activities. However, respondents that showed more agreement with being satisfied with their broadband subscription appeared to perform around 6 activities online. The $\mathbf{r_s}$ test validated that there is no significant relationship (> 0.1) between a consumers variety of use and user satisfaction.

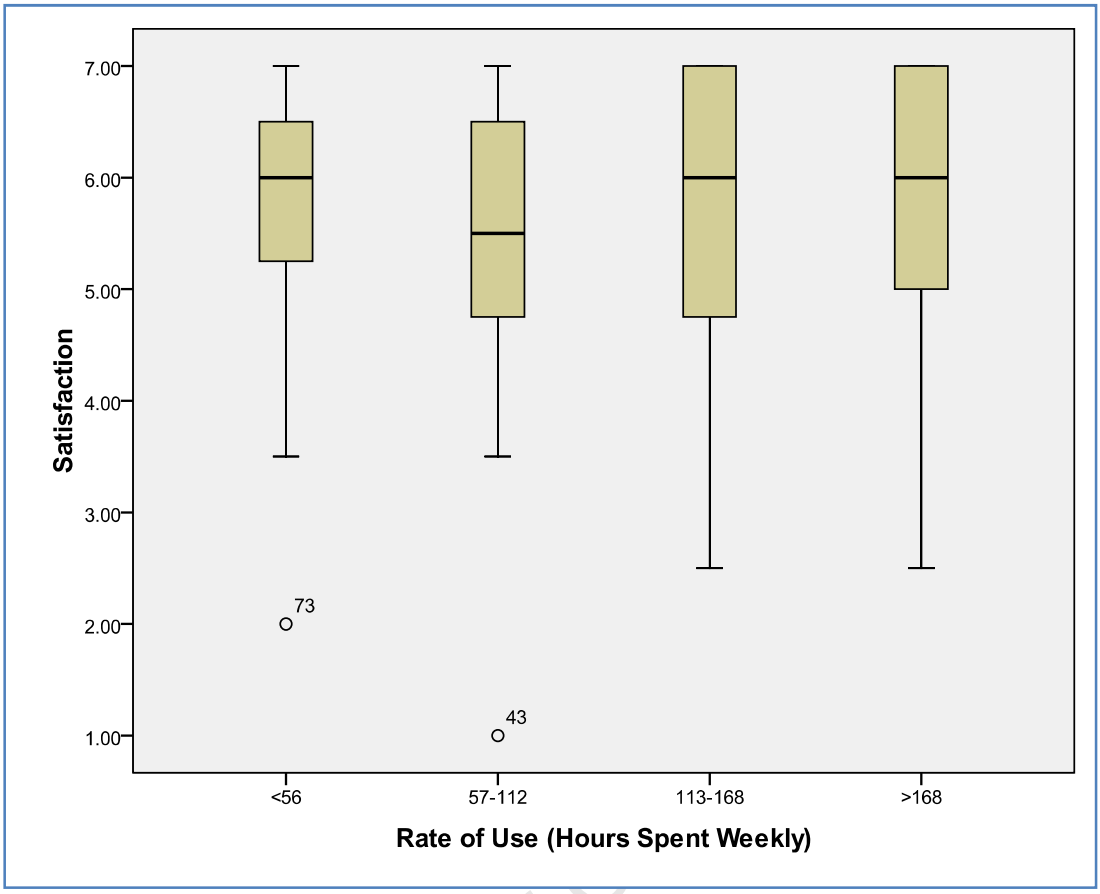

Figure 51: Association between Rate of Use and Satisfaction

			SAT_Average	Hours_Spent_Weekly
Spearman's rho	SAT_Average	Correlation Coefficient	1.000	.112
		Sig. (1-tailed)	.	.082
		N	154	154
	Hours_Spent_Weekly	Correlation Coefficient	.112	1.000
		Sig. (1-tailed)	.082	.
		N	154	154

Table 61: Spearman's Rho (r_s) test to determine association between Rate of Use and Satisfaction

The findings from Figure 51 suggest that a majority of the respondents that agreed (median = 6) with being satisfied with their broadband subscription tend to make use of their broadband subscription for more than 113 hours per week. The $\mathbf{r_s}$ test validated that there is a significant relationship (< 0.1) between a consumer's rate of use and satisfaction.

Since only the relationship between rates of use and a consumer's satisfaction is significant, the hypothesis is partially accepted.

H_{7f}: *The greater a users'rate and variety of use, the higher the level of interest in acquiring futuristic-oriented technologies.*

The hypothesis states that consumers that are intense, specialised or experimental users of broadband will tend to be more interested in acquiring futuristic-oriented technologies. In other words, consumers that are experienced with the technology are always looking for new ways to improve their online activities.

Figure 52 and Table 62 below illustrates the results of the frequency and $\mathbf{r_s}$ test performed to determine if there were any relationship between a consumers UD patterns (rate and variety of use) and their interest in future technologies.

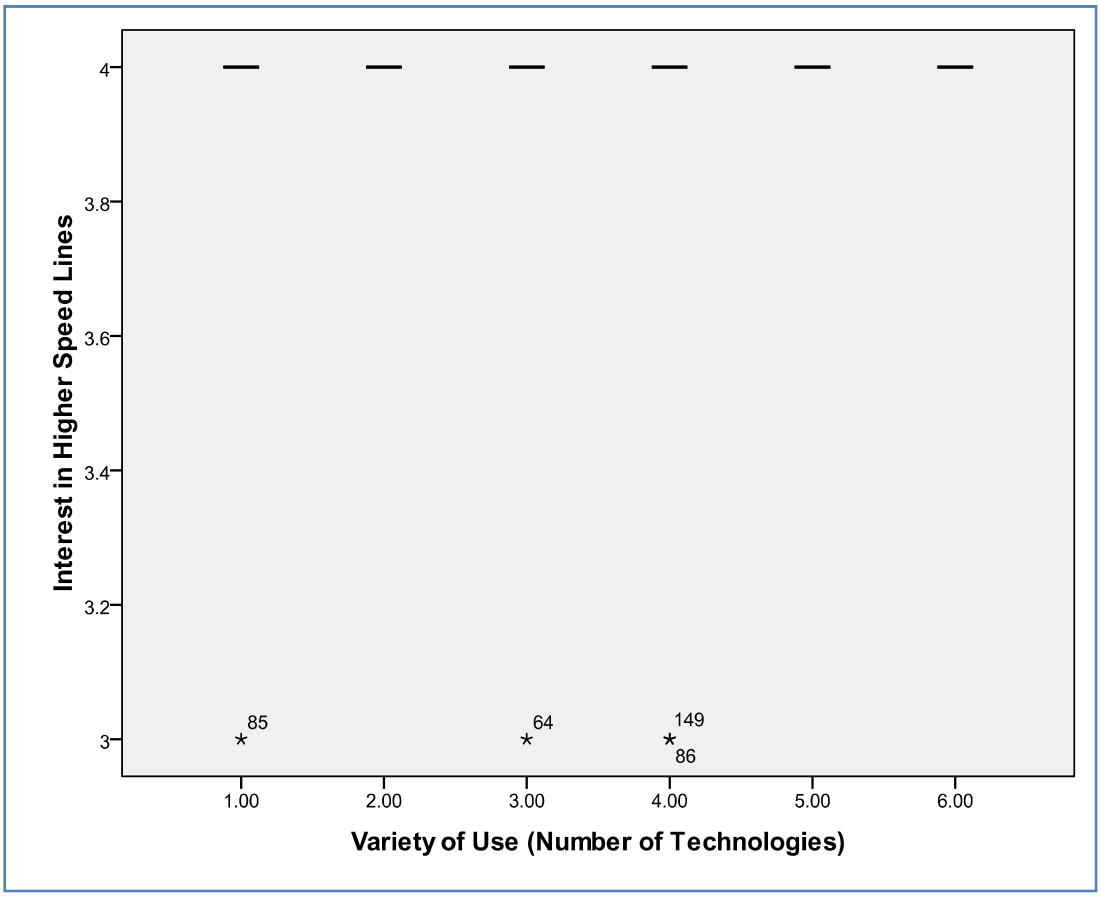

Figure 52: Association between Consumers Interest in Higher Speed Lines and Variety of Use

			FT1	Number_of_Tech
Spearman's rho	FT1	Correlation Coefficient	1.000	-.011
		Sig. (1-tailed)	.	.448
		N	154	154
	Number_of_Tech	Correlation Coefficient	-.011	1.000
		Sig. (1-tailed)	.448	.
		N	154	154

Table 62: Spearman's Rho (r_s) test to determine association between consumers interest in higher speed lines and variety of use

The findings from Figure 52 suggest that a majority of consumers that showed signs of strong interest in higher speed lines capable of 30Mbps and over had between 1-6 technologies accessing their broadband subscription. However, when associating their interest in higher speed lines with variety of use, the relationships were not significant (> 0.1). A possible reason is that the consumers that rated highly on their interest are spread between low and high number of technologies accessing their broadband subscription. Therefore, it cannot be concluded that there is a relationship between interest in higher speed lines and higher variety of use.

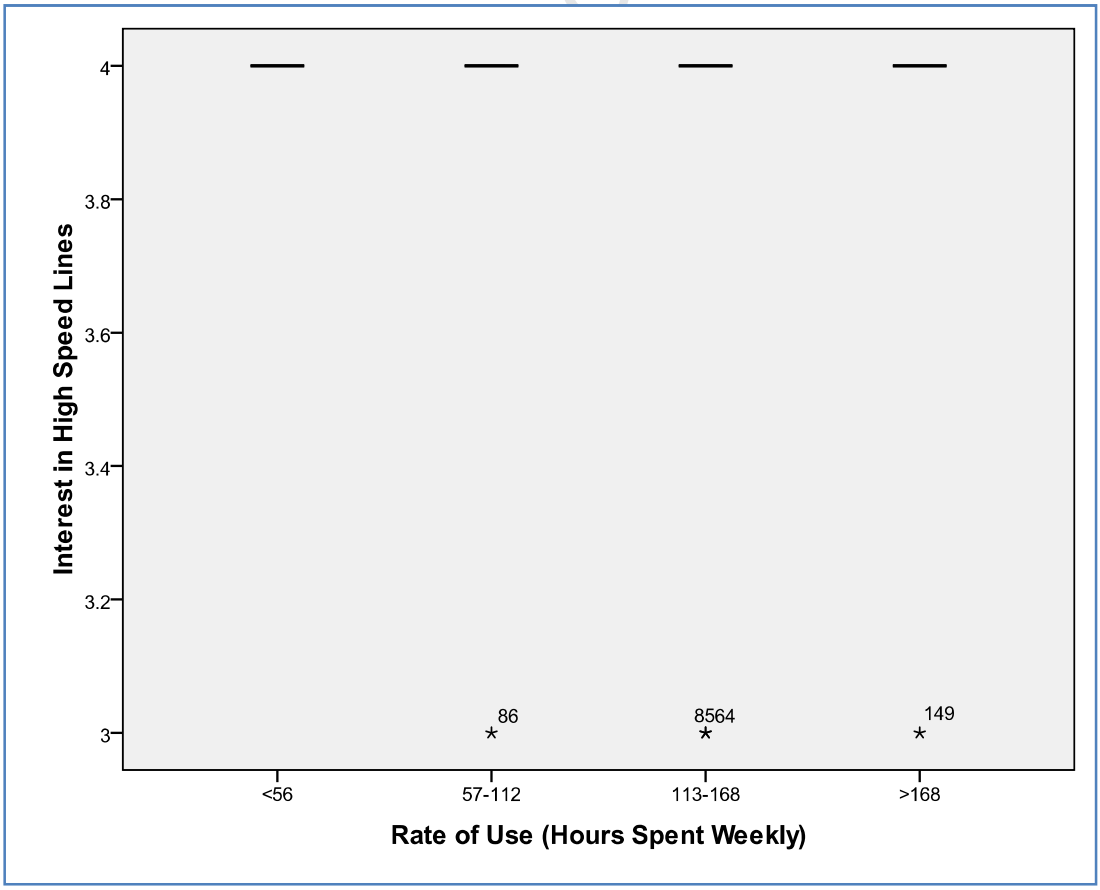

Figure 53: Association between Consumers Interest in Higher Speed Lines and Rate of Use

			FT1	Hours_Spent_Weekly
Spearman's rho	FT1	Correlation Coefficient	1.000	.002
		Sig. (1-tailed)	.	.489
		N	154	154
	Hours_Spent_Weekly	Correlation Coefficient	.002	1.000
		Sig. (1-tailed)	.489	.
		N	154	154

Table 63: Spearman's Rho (r_s) test to determine association between Consumers Interest in Higher Speed Lines and Rate of Use

The findings from Figure 53 suggest that a majority of consumers that showed signs of strong interest in higher speed lines capable of 30Mbps seemed to be spread across all rate of use categories. However, when associating their interest in higher speed lines with rate of use, the relationships were not significant (> 0.1) enough. Therefore, it cannot be concluded that there is a relationship between interest in higher speed lines and higher rate of use.

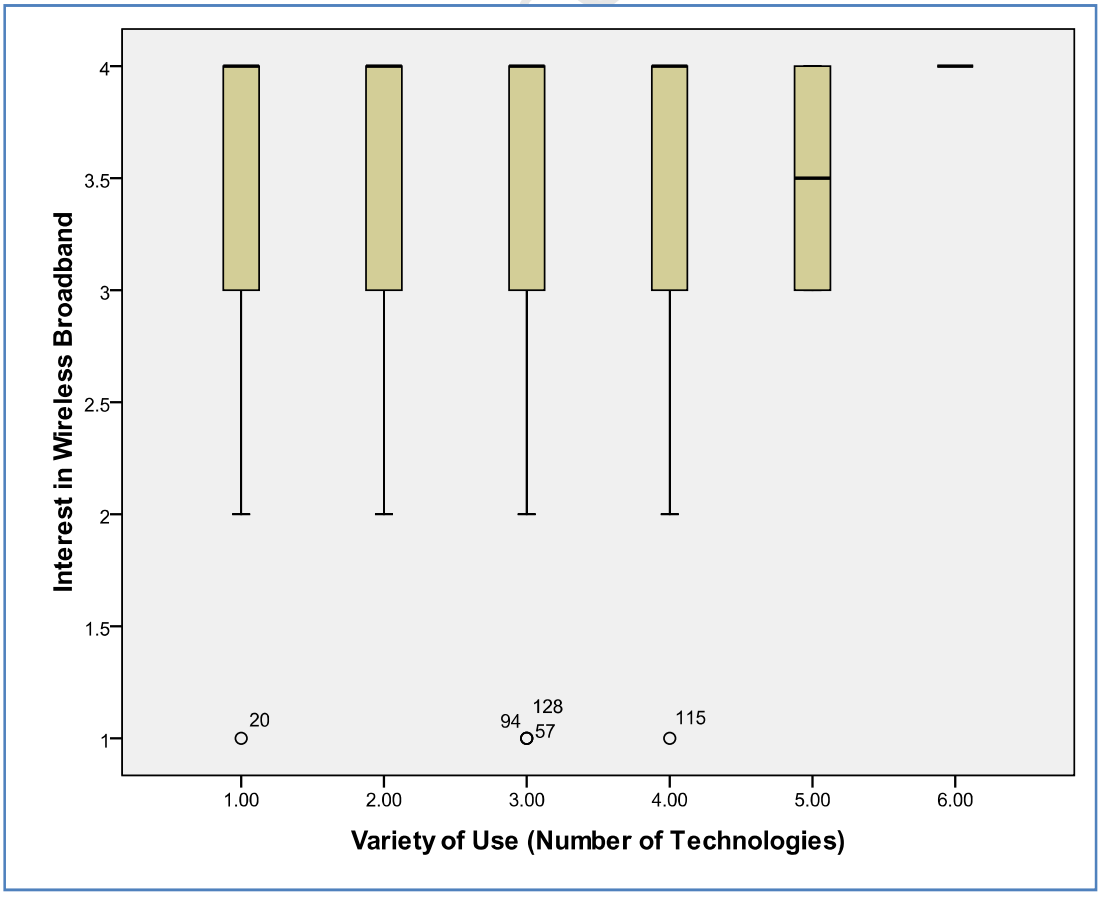

Figure 54: Association between Variety of Use and Consumers Interest Wireless Broadband

			FT2	Number_of_Tech
Spearman's rho	FT2	Correlation Coefficient	1.000	-.004
		Sig. (1-tailed)	.	.481
		N	154	154
	Number_of_Tech	Correlation Coefficient	-.004	1.000
		Sig. (1-tailed)	.481	.
		N	154	154

Table 64: Spearman's Rho (r_s) test to determine association between Variety of Use and Consumers Interest Wireless Broadband

The findings from Figure 54 suggest that a majority of consumers that showed signs of strong interest (median = 4) in higher speed wireless technologies had between 1-4 technologies accessing their broadband subscription. However, when associating their interest in higher speed wireless technologies, the relationships were not significant (> 0.1). This could be that the consumers that rated highly on their interest are spread between low and high number of technologies accessing their broadband subscription. Therefore, it cannot be concluded that there is a relationship between interest in higher speed wireless technologies and variety of use.

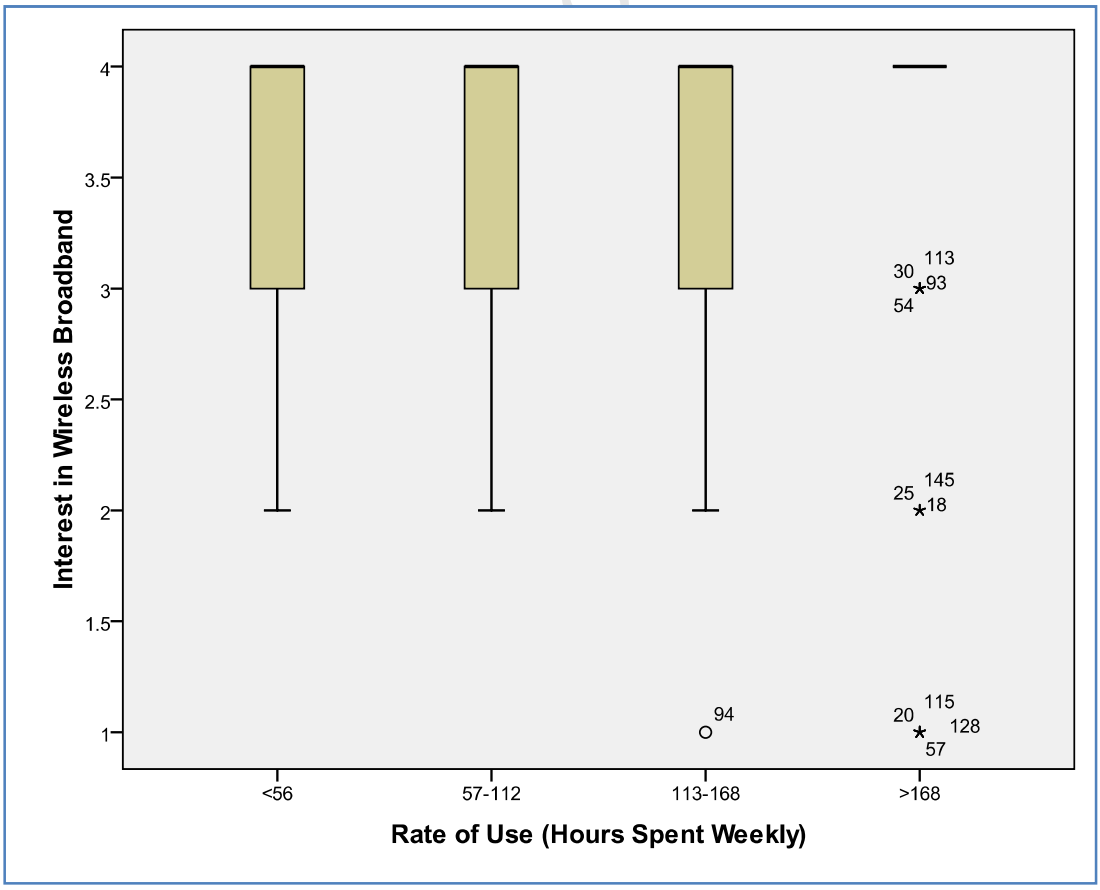

Figure 55: Association between consumers interest in Wireless Broadband and Rate of Use

			FT2	Hours_Spent_Weekly
Spearman's rho	FT2	Correlation Coefficient	1.000	.102
		Sig. (1-tailed)	.	.103
		N	154	154
	Hours_Spent_Weekly	Correlation Coefficient	.102	1.000
		Sig. (1-tailed)	.103	.
		N	154	154

Table 65: Spearman's Rho (r_s) test to determine association between Wireless Broadband and Rate of Use

The findings from Figure 55 suggest that a majority of consumers that showed signs of strong interest (median = 4) in higher speed wireless technologies seemed to be spread across all rate of use categories. However, the largest of the categories were those consumers that made use of their broadband subscription of more than 168 hours per week. When associating their interest in higher speed wireless technologies with rate of use, the significance level was not that much higher than 0.1. Therefore, the relationships were "somewhat" significant. As a result, there appears to be a relationship between interest in higher speed wireless technologies and higher rate of use.

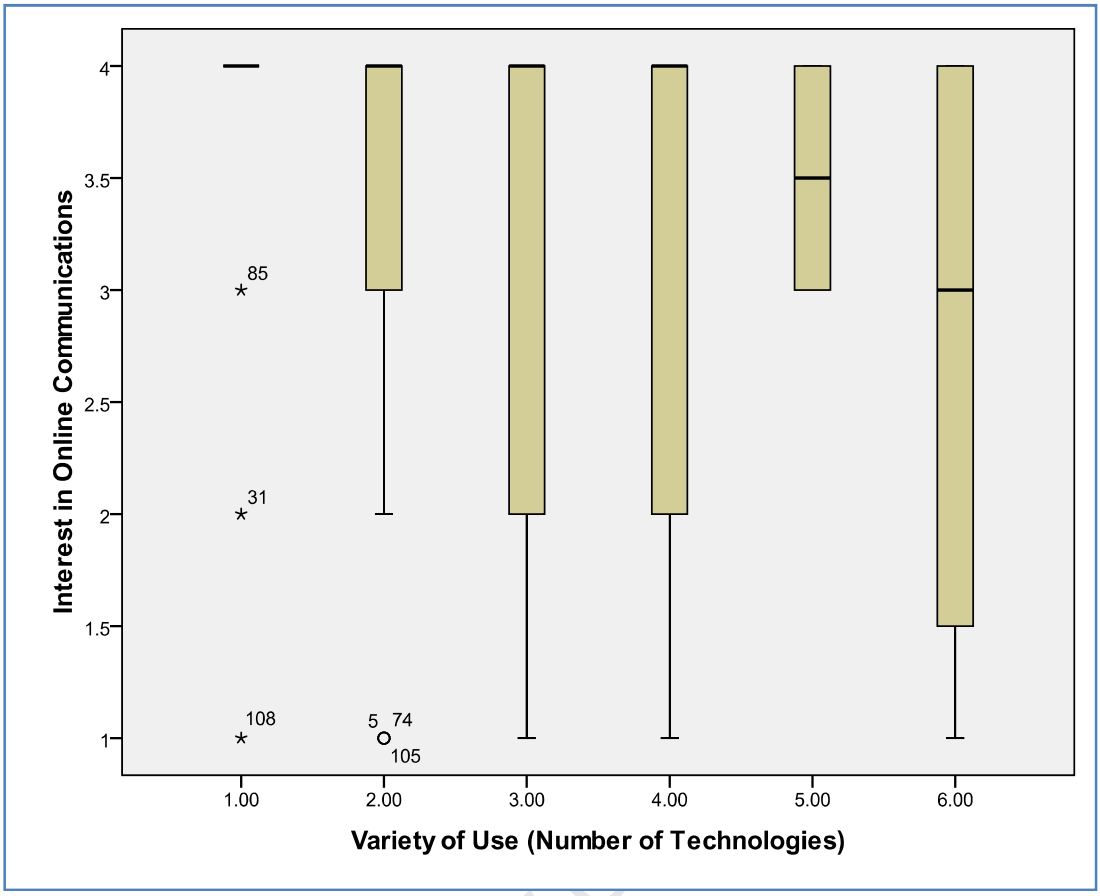

Figure 56: Association between Consumers Interest in Interactive Online Communications and Variety of Use

			FT3	Number_of_Tech
Spearman's rho	FT3	Correlation Coefficient	1.000	-.164*
		Sig. (1-tailed)	.	.021
		N	154	154
	Number_of_Tech	Correlation Coefficient	-.164*	1.000
		Sig. (1-tailed)	.021	.
		N	154	154

Table 66: Spearman's Rho (r_s) test to determine association between Consumers Interest in Interactive Online Communications and Variety of Use

The results from Figure 56 suggest that a majority of consumers that showed signs of strong interest (median = 4) in interactive online communication had between 1-4 technologies accessing their broadband subscription. However, Figure 56 above illustrates that as the variety of use increases, interest in online communications decreases. When associating their interest in interactive online communication variety of use, the relationship appeared to be significant (< 0.1) but the relationship was negative. Therefore, the relationship between interest in interactive online communication and higher variety of use will be rejected.

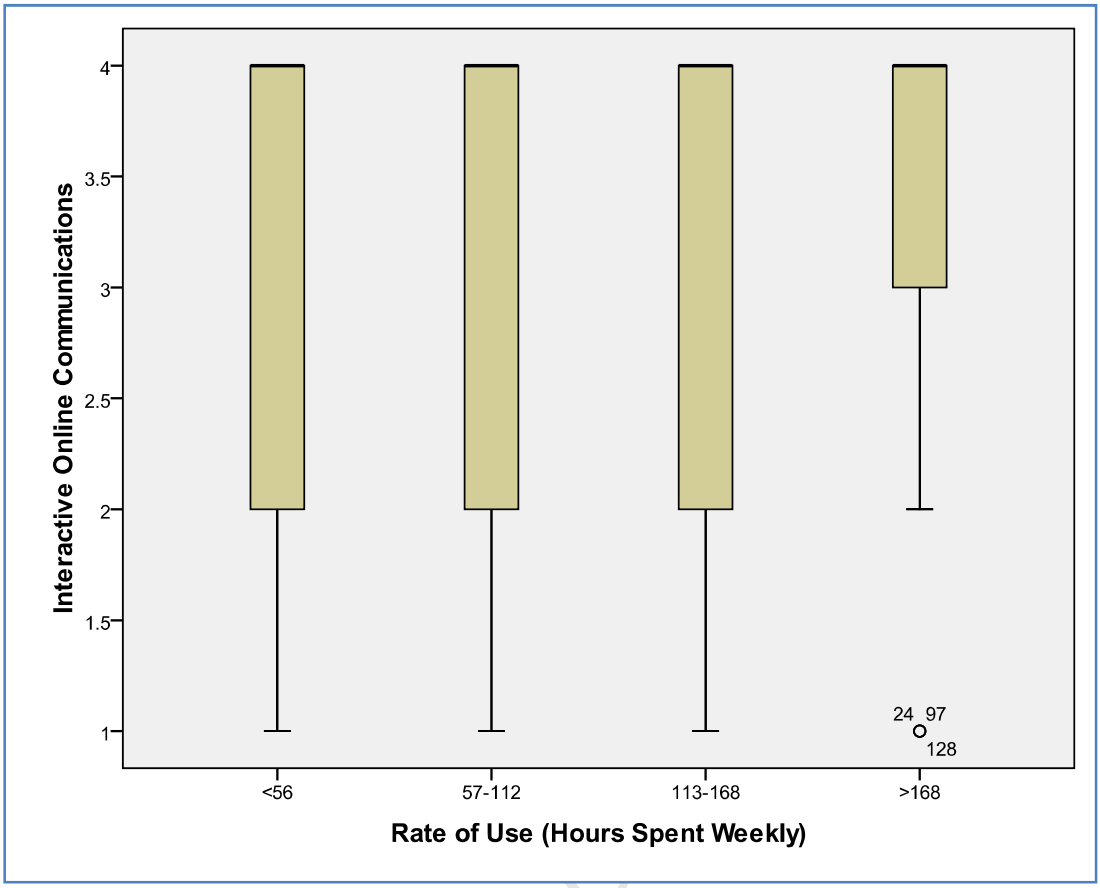

Figure 57: Association between Consumers Interest in Interactive Online Communications and Rate of Use

			FT3	Hours_Spent_Weekly
Spearman's rho	FT3	Correlation Coefficient	1.000	.128
		Sig. (1-tailed)	.	.057
		N	154	154
	Hours_Spent_Weekly	Correlation Coefficient	.128	1.000
		Sig. (1-tailed)	.057	.
		N	154	154

Table 67: Spearman's Rho (r_s) test to determine Association between consumers interest in interactive online communications and rate of use

The results from Figure 57 suggest that a majority of consumers that showed signs of strong interest (median = 4) in interactive online communication seemed to be spread amongst the different rate of use categories. The consumers appeared to be specialised users. When associating their interest in interactive online communication rate of use, the relationship appeared to be significant (< 0.1). Therefore, there appears to be a relationship between interest in interactive online communication and a higher rate of use.

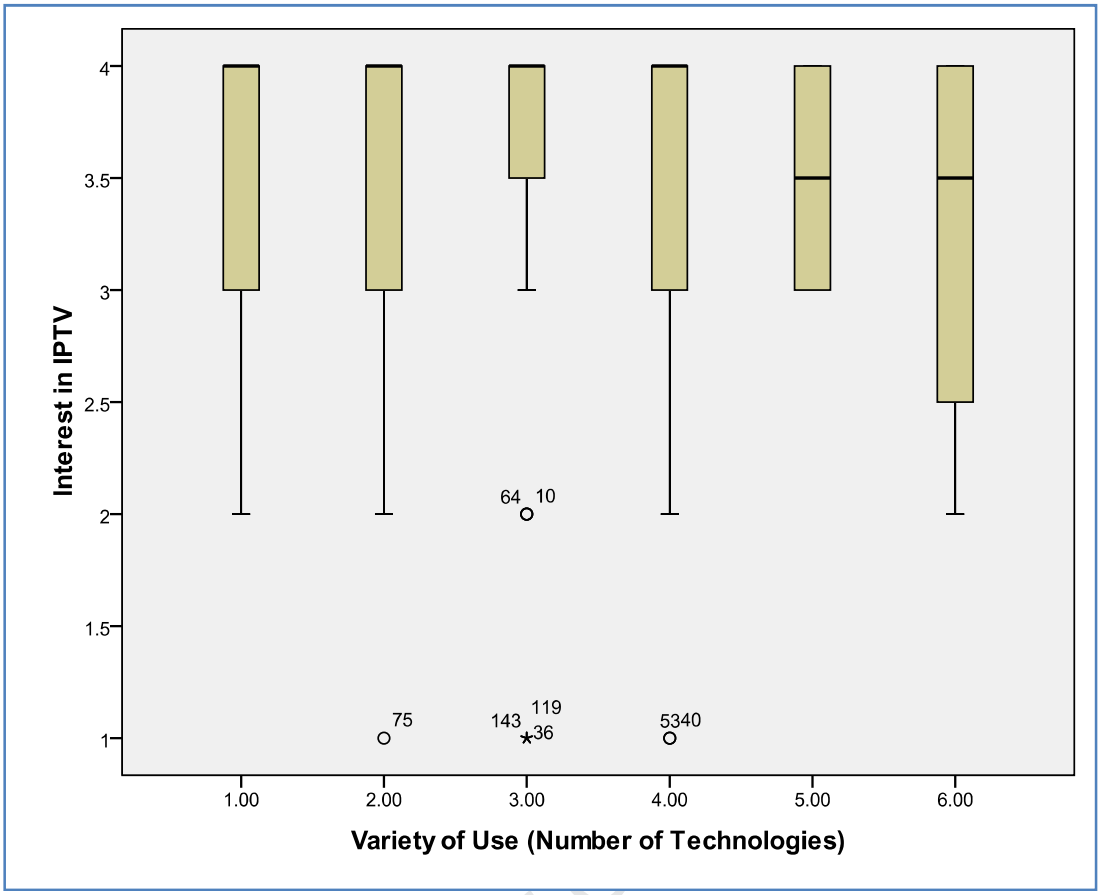

Figure 58: Association between Consumers Interest in IPTV and Variety of Use

			FT4	Number_of_Tech
Spearman's rho	FT4	Correlation Coefficient	1.000	-.023
		Sig. (1-tailed)	.	.388
		N	154	154
	Number_of_Tech	Correlation Coefficient	-.023	1.000
		Sig. (1-tailed)	.388	.
		N	154	154

Table 68: Spearman's Rho (r_s) test to determine association between Consumers Interest in IPTV and Variety of Use

The findings from Figure 58 suggest that a majority of consumers that showed signs of strong (median = 4) interest in IPTV had between 1-4 technologies accessing their broadband subscription. However, when associating their interest in higher speed wireless technologies, the relationships were not significant (> 0.1) enough. This could be that the consumers that rated highly on their interest are spread between low and high number of technologies accessing their broadband subscription. Therefore, it cannot be concluded that there is a relationship between interest in IPTV and higher variety of use.

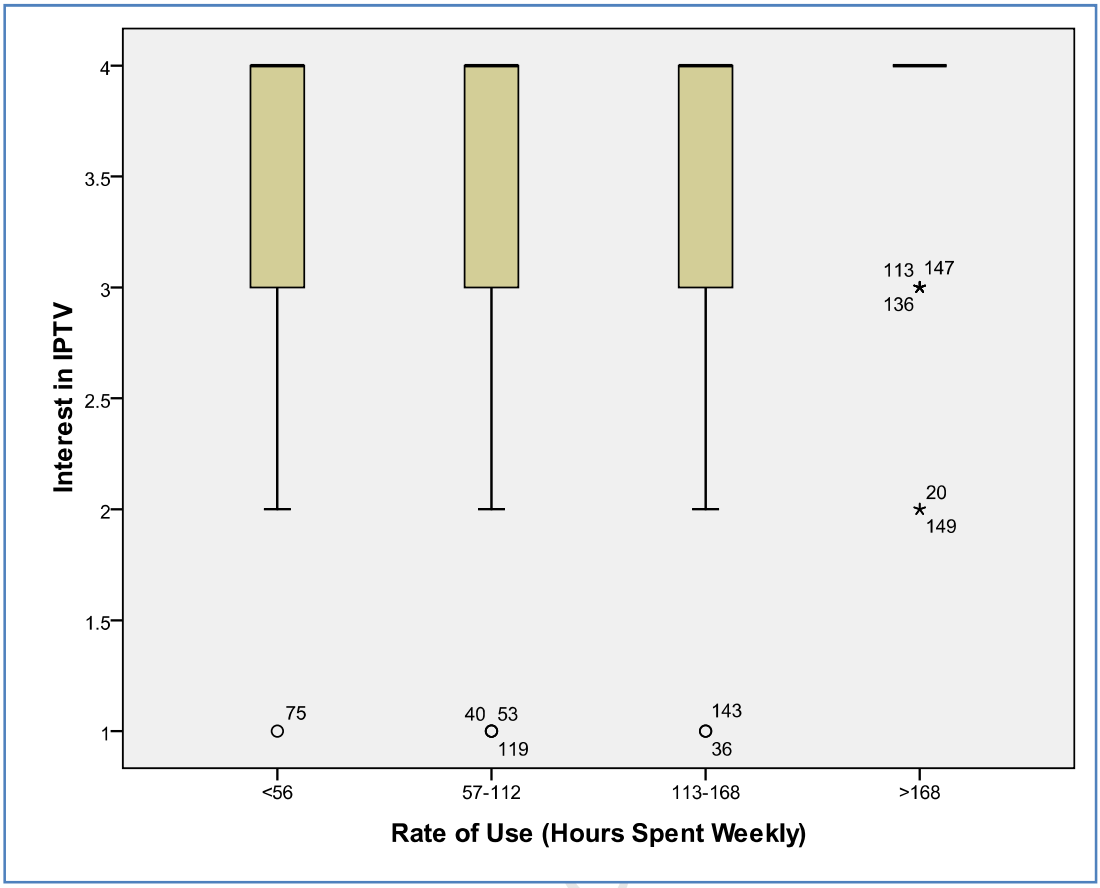

Figure 59: Association between Consumers Interest in IPTV and Rate of Use

			FT4	Hours_Spent_Weekly
Spearman's rho	FT4	Correlation Coefficient	1.000	.248**
		Sig. (1-tailed)	.	.001
		N	154	154
	Hours_Spent_Weekly	Correlation Coefficient	.248**	1.000
		Sig. (1-tailed)	.001	.
		N	154	154

Table 69: Spearman's Rho (r_s) test to determine association between Consumers Interest in IPTV and Rate of Use

The findings from Figure 59 suggest that a majority of consumers that showed signs of strong (median = 4) interest in IPTV seemed to be spread amongst the different rate of use categories. However, the largest of the category appeared to be consumers that made use of their broadband subscription of more than 168 hours per week. When associating their interest in higher speed wireless technologies, the relationships were significant (< 0.1). Therefore, there appears to be a relationship between IPTV and a higher rate of use.

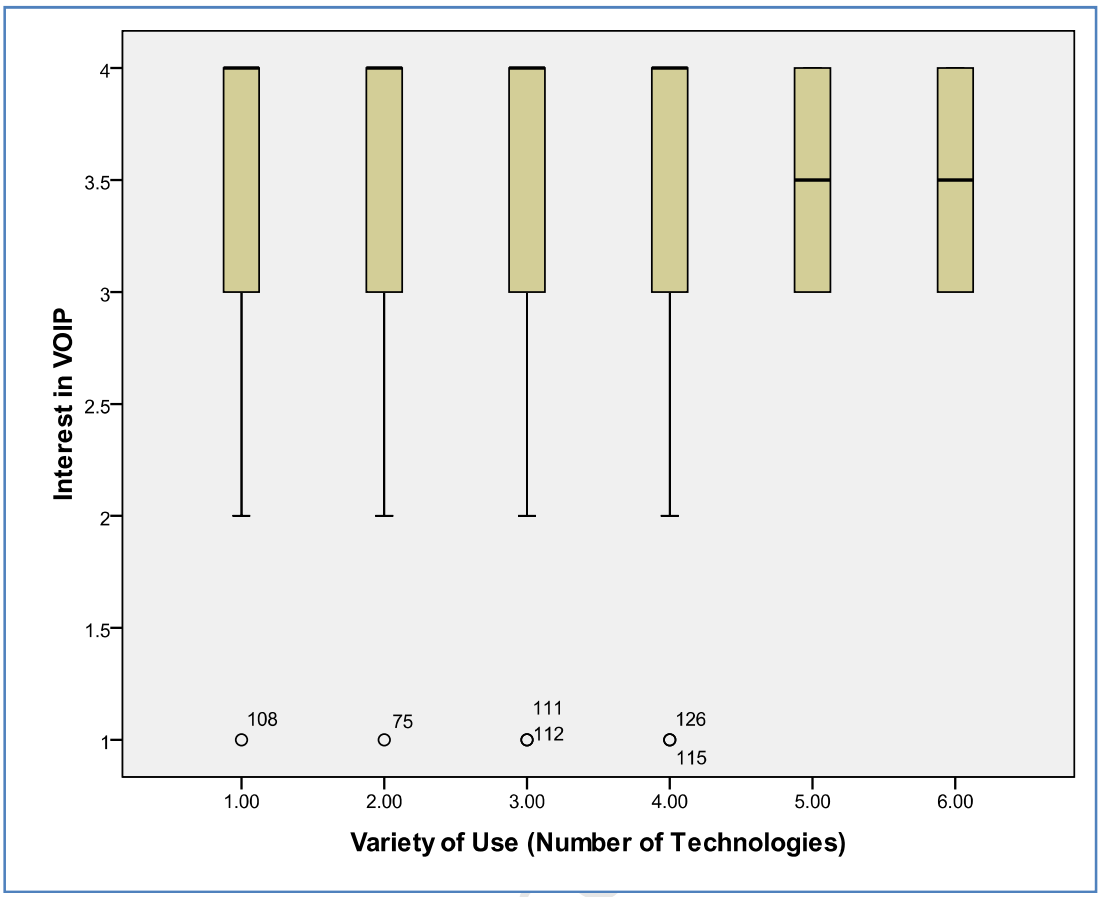

Figure 60: Association between Consumers Interest in VOIP and Variety of Use

			FT5	Number_of_Tech
Spearman's rho	FT5	Correlation Coefficient	1.000	-.024
		Sig. (1-tailed)	.	.382
		N	154	154
	Number_of_Tech	Correlation Coefficient	-.024	1.000
		Sig. (1-tailed)	.382	.
		N	154	154

Table 70: Spearman's Rho (r_s) test to determine association between Consumers Interest in VOIP and Variety of Use

The findings from Figure 60 suggest that a majority of consumers that showed signs of strong (median = 4) interest in VOIP had between 1-4 technologies accessing their broadband subscription. However, when associating their interest in VOIP technologies, the relationships were not significant (> 0.1) enough. This could be that the consumers that rated highly on their interest are spread between low and high number of technologies accessing their broadband subscription. Therefore, it cannot be concluded that there is a relationship between interest in VOIP and higher variety of use.

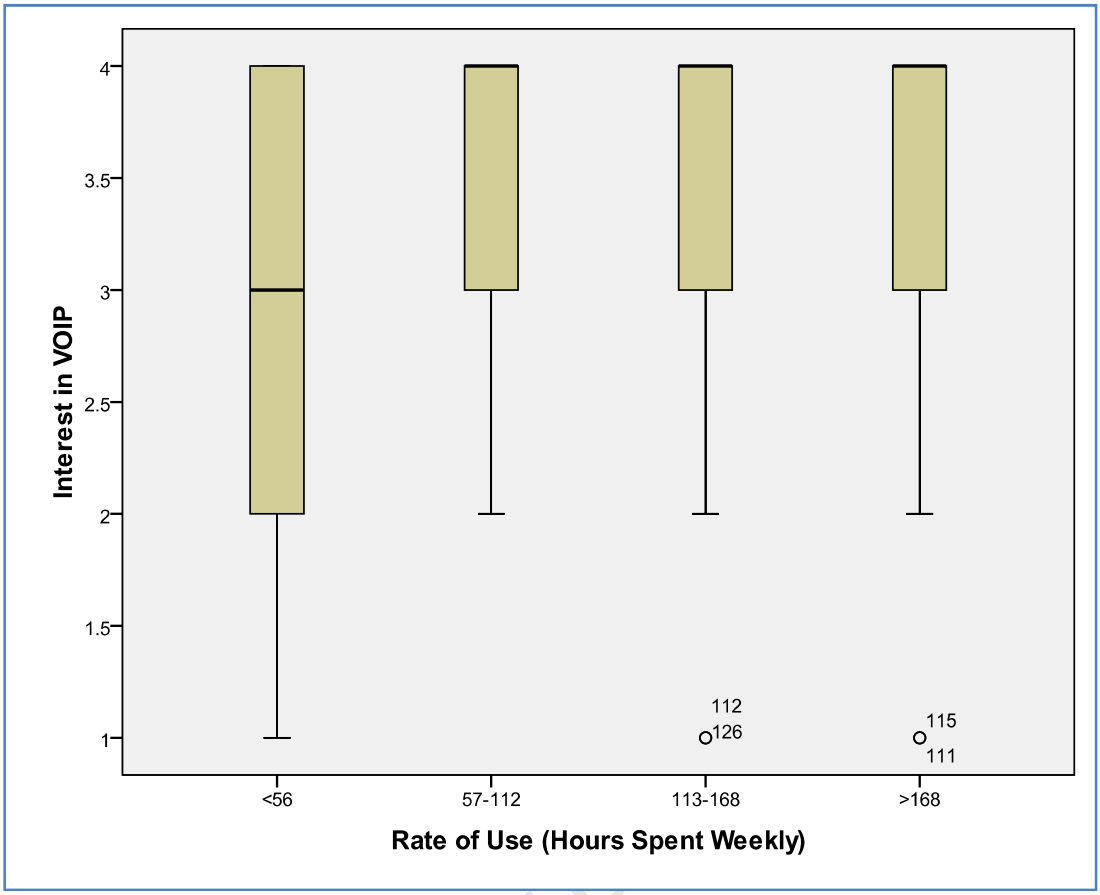

Figure 61: Association between Consumers Interest in VOIP and Rate of Use

			FT5	Hours_Spent_Weekly
Spearman's rho	FT5	Correlation Coefficient	1.000	.149*
		Sig. (1-tailed)	.	.033
		N	154	154
	Hours_Spent_Weekly	Correlation Coefficient	.149*	1.000
		Sig. (1-tailed)	.033	.
		N	154	154

Table 71: : Spearman's Rho (r_s) test to determine association between Consumers Interest in VOIP and Rate of Use

The findings from Figure 61 suggest that a majority of consumers that showed signs of strong (median = 4) interest in VOIP seemed to be spread amongst the different rate of use categories. However, the largest of the category appeared to be consumers that made use of their broadband subscription of more than 168 hours per week. When associating their interest in higher speed wireless technologies, the relationships were significant (< 0.1). Therefore, there appears to be a relationship between VOIP and a higher rate of use.

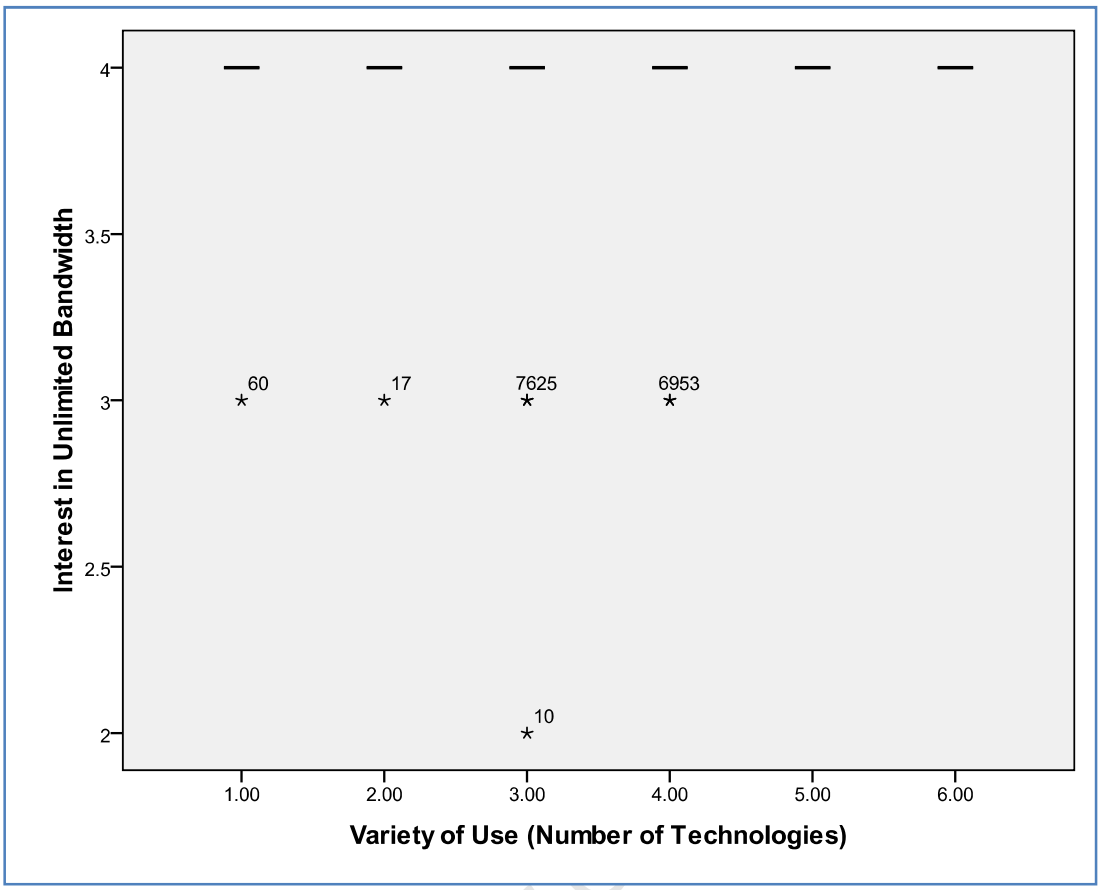

Figure 62: Association between Consumers Interest in Unlimited Bandwidth and Variety of Use

			FT6	Number_of_Tech
Spearman's rho	FT6	Correlation Coefficient	1.000	.034
		Sig. (1-tailed)	.	.338
		N	154	154
	Number_of_Tech	Correlation Coefficient	.034	1.000
		Sig. (1-tailed)	.338	.
		N	154	154

Table 72: Spearman's Rho (r_s) test to determine association between Consumers Interest in Unlimited Bandwidth and Variety of Use

The findings from Figure 62 suggest that a majority of consumers that showed signs of strong (median = 4) interest in unlimited bandwidth had between 1-4 technologies accessing their broadband subscription. However, when associating their interest in unlimited bandwidth, the relationships were not significant (> 0.1) enough. This could be that the consumers that rated highly on their interest are spread between low and high number of technologies accessing their broadband subscription. Therefore, it cannot be concluded that there is a relationship between interest in unlimited and higher variety of use.

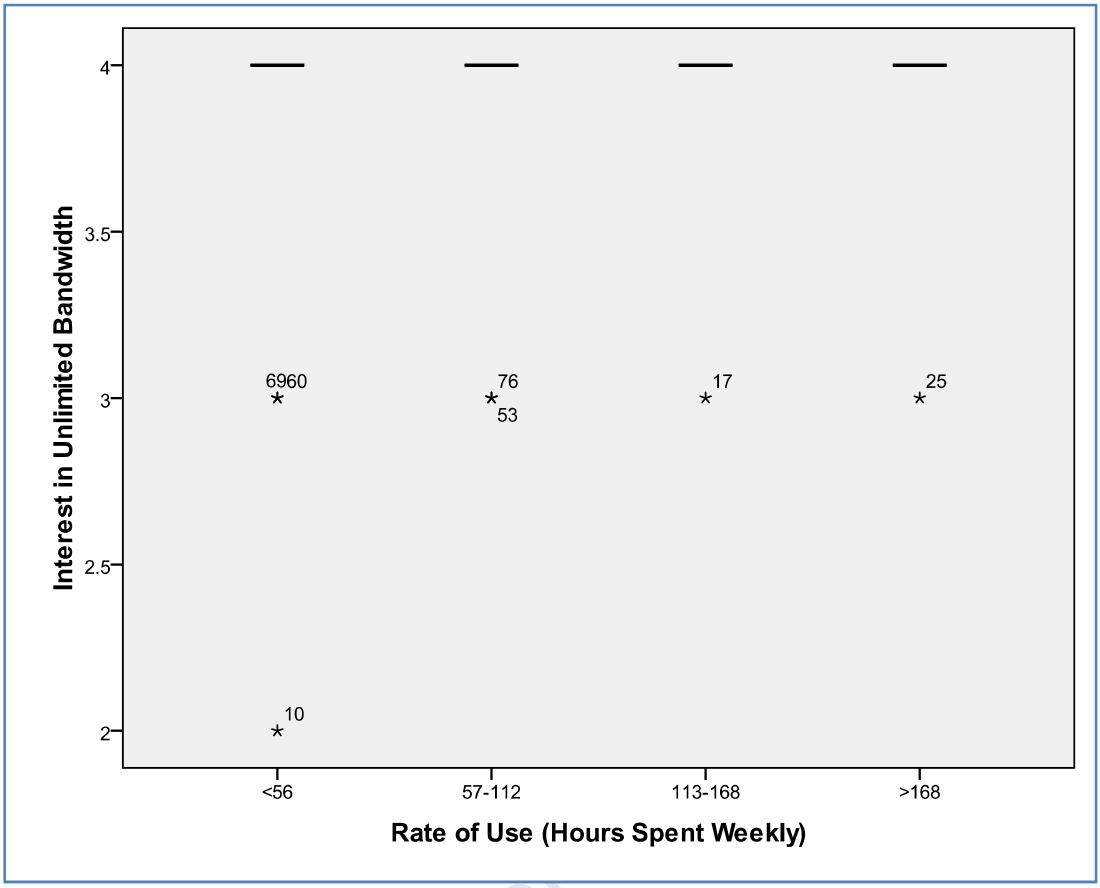

Figure 63: Association between Consumers Interest in Unlimited Bandwidth and Rate of Use

			FT6	Hours_Spent_Weekly
Spearman's rho	FT6	Correlation Coefficient	1.000	.158*
		Sig. (1-tailed)	.	.025
		N	154	154
	Hours_Spent_Weekly	Correlation Coefficient	.158*	1.000
		Sig. (1-tailed)	.025	.
		N	154	154

Table 73: Spearman's Rho (r_s) test to determine association between Consumers Interest in Unlimited Bandwidth and Rate of Use

The findings from Figure 63 suggest that a majority of consumers that showed signs of strong (median = 4) interest in unlimited bandwidth seemed to be spread amongst the different rate of use categories. However, the largest of the category appeared to be consumers that made use of their broadband subscription of more than 168 hours per week. When associating their interest in higher speed wireless technologies, the

relationships were significant (< 0.1). Therefore, there appears to be a relationship between unlimited bandwidth and a higher rate of use.

Table 74 below illustrates a summary of the hypotheses that were tested and whether each of the hypotheses was supported by the data. Of the 41 research hypotheses, 10 were fully supported and 5 were partially supported leaving a total of 26 hypotheses not supported by the data collected.

Research Hypotheses	Results
INITIAL ADOPTION	
H_{1a}: ***Adopters of broadband will have a younger age distribution than non-adopters***	Not Supported
H_{1b}: ***Adopters of broadband will have a higher annual household income than non-adopters***	Not Supported
H_{1c}: ***Adopters of broadband will have higher education levels than non-adopters***	**Supported**
H_{1d}: ***Adopters of broadband will belong to a higher occupation category than non-adopters***	Not Supported
H_{2a}: ***The older the consumer, the higher the skills in using broadband***	Not Supported
H_{2b}: ***The higher the level of the consumer's education, the higher the consumer's skills in using broadband***	**Supported**
H_{2c}: ***The higher the level of the consumer's occupation, the higher the consumer's skills in using broadband***	Not Supported
H_{2d}: ***The higher the level of the consumer's occupation, the greater the consumer's knowledge about broadband***	Not Supported
H_{2e}: ***The higher the level of the consumer's monthly income, the more affordable broadband will be for the consumer***	Not Supported
H_{3a}: ***The greater the perceived relative advantage of using broadband over dial-up, the more likely that broadband will be adopted in the household.***	Not Supported
H_{3b}: ***The greater the perceived entertainment (hedonic outcomes) potential of using broadband, the more likely that broadband will be adopted in the household.***	**Supported**
H_{3c}: ***The greater the perceived usage (utilitarian outcomes) of Broadband for household activities the more likely its adoption.***	Not Supported

Research Hypotheses	Results
H_{3d}: *The greater the perceived security of broadband the more likely it will be adopted.*	Not Supported
H_{3e}: *The greater the perceived technology comfort provided by broadband the more likely its adoption.*	**Supported**
H_{3f}: *The greater the consumer loyalty to a particular service provider the more likely broadband is adopted.*	Not Supported
H_{4a}: *The lack of knowledge on broadband, its availability and benefits inhibit broadband adoption.*	Not Supported
H_{4b}: *The lack of skills in using the PC and the Internet, the less likely that broadband will be adopted.*	**Supported**
H_{4c}: *The lack of perceived needs of obtaining broadband, the less likely that it will be adopted.*	Not Supported
H_{4d}: *The greater the perceived monthly cost of broadband access, the less likely that it will be adopted.*	**Supported**
H_{4e}: *The perceived lack of broadband content provided, the less likely that broadband will be adopted.*	Not Supported
H_{4f}: *The lack of infrastructure will inhibit broadband adoption.*	Not Supported
H_{4g}: *The lack of owning a PC, the greater the perceived cost of upgrading the old PC or buying a new PC the less likely that broadband will be adopted.*	**Supported**
H_{5a}: *The greater the social influence by family, friends and colleagues the more likely broadband will be adopted.*	Not Supported
SUSTAINED ADOPTION	
H_{6a}: *Higher intensity of household communication with other users about broadband leads to a higher variety of use (intense and experimental use).*	**Supported**
H_{6b}: *Greater competition for limited resources within the household leads to a lower rate of use (specialised use).*	**Supported**
H_{6c}: *Greater previous experience in the family of using the Internet results in a higher variety and rate of use (intense and experimental user).*	Not Supported
H_{6d}: *Greater technology sophistication of broadband leads to higher variety*	Not Supported

Research Hypotheses	Results
and rate of use (intense, specialized, experimental use).	
H_{6e}: *The greater the complementary technologies that access the broadband service the higher the variety and rate of use (intense, specialized, experimental use).*	**Supported**
H_{6f}: *Higher use innovativeness within broadband users results in higher variety of use (intense and experimental use).*	Not Supported
H_{6g}: *Higher frustration with the technology leads to lower variety and lower rate of use (low use).*	**Partially Supported**
H_{6h}: *Higher skills of users lead to higher variety of use (intense and experimental use).*	Not Supported
H_{6i}: *Higher levels of international communication with family and friends leads to an increase in variety of use (intense and experimental use).*	Not Supported
H_{6j}: *Access to a broadband Internet connection outside the home environment leads to a higher variety of use but lower rate of use in the home (experimental use).*	Not Supported
H_{6k}: *Increase in family exposure to target media leads to an increase in variety of use and rate of use of broadband services (intense, specialized, experimental use).*	Not Supported
H_{6l}: *An increase in the quality of broadband services will increase its rate of use (intense use).*	Not Supported
IMPACT	
H_{7a}: *The greater a users' rate and variety of use, the easier it is for users to communicate with distant families.*	Not Supported
H_{7b}: *The greater a users' rate and variety of use, the more a user will be able to commence with other life activities.*	**Partially Supported**
H_{7c}: *The greater a users' rate and variety of use, the more a user will be able to save on costs.*	Not Supported
H_{7d}: *The greater a users' rate and variety of use, the easier a user will be able to perform work related activities at home.*	**Partially Supported**
H_{7e}: *The greater a users' rate and variety of use, the more satisfied a user will be with the technology.*	**Partially Supported**

Research Hypotheses	Results
H_{7i}: *The greater a users' rate and variety of use, the higher the level of interest in acquiring futuristic-oriented technologies.*	Partially Supported

Table 74: Summary of Research Hypotheses

Using the results from the hypotheses tested, the factors from each phase were consolidated. The model for South Africa was then refined based on the quantitative results obtained. Figure 64 below illustrates the refined model. Note that for the use diffusion patterns, the dots illustrate the type of broadband users that South African consumers are classified as. The bigger the size of the dot illustrates the amount of respondents that fell within that specific category.

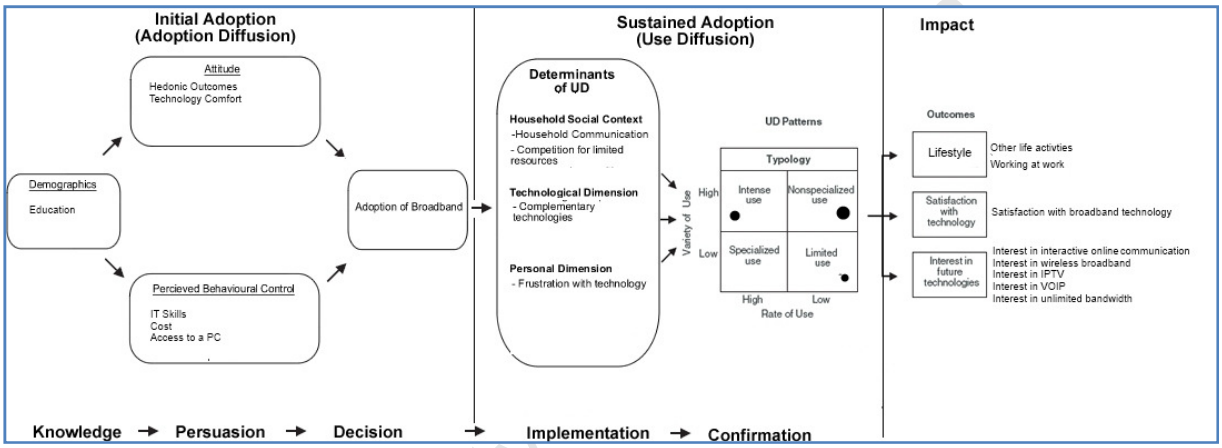

Figure 64: Quantitative Refined Model for Broadband Diffusion in Households of South Africa

7.7 Chapter Summary

This chapter investigated the diffusion of broadband in households of South Africa quantitatively. Of the 388 surveys distributed, only 177 valid responses were obtained. Of this, 155 respondents had Internet access at home.

A description of the demographic profiles of the survey respondents was provided where a majority of the respondents fell within the 18-25 age group, had at most an honours degree, were professionals and technicians and had earned an income of less than R20 000.

This was followed by a description of the usage profiles of the adopters of broadband. The majority of the adopter respondents had broadband for more than a year and spent most of their time using the connection for downloading files, music and videos via their PC, laptops, mobile phones and video games console.

A combination of the Cronbach Alpha reliability test and a confirmatory factor analysis was conducted in order to assess the internal consistency of the survey

instrument. Factors were either removed or kept based on the strength of the factor loadings and resultant alphas. Descriptive statistics were performed on factors in each phase of the diffusion process. All factors within the initial adoption, sustained adoption and impact phase were weakly to strongly agreed on by the respondents except for loyalty and subjective norms within the initial adoption phase.

The chapter then focused on testing each of the proposed hypotheses for this research study with various quantitative analysis techniques. The deficiency in the amount of survey responses collected resulted in a low sample size which required the confidence interval (CI) to be lowered to 90%. Therefore, when testing the hypothesis (significance test), a significance level of 0.1 (90% CI) was used. Furthermore, a one-tailed test was used due to each instance of the hypotheses having one direction unless otherwise stated.

Of the 41 research hypotheses that were tested, 10 were fully supported and 5 were partially supported leaving a total of 26 hypotheses not supported by the data collected. Using the results from the hypotheses tested the factors from each phase were consolidated. The model for South Africa was then refined based on the quantitative results obtained. The next chapter provides, in further detail, an explanation and discussion on each hypothesis and the quantitatively refined model in relation to the literature review and the qualitative study.

8

Discussion of Results

"Getting Information off the Internet is like taking a drink from a fire hydrant."

Mitchell Kapor

Founder of Lotus Development Corporation, 1950-Present

8.1 Chapter Overview

This chapter presents a discussion on the findings from the literature review, qualitative study and finally the quantitative study. The discussion aimed to combine all three studies in order to validate the Model for Broadband Adoption in South Africa, see Figure 64 in Chapter 7. It should be noted that the qualitative study was done in 2007 and the quantitative study in 2009. The chapter is structured as follows. The next section provides an overview of the research hypotheses that were supported by the quantitative analysis of data. This is followed by a detailed discussion of all hypotheses that were supported and not supported by the data, providing reasons as to why this was the case. Each stage of the broadband diffusion model was discussed and the finally the summary of the chapter is provided.

8.2 Research Hypotheses

This section provides a summary of the hypotheses proposed in Chapter 6 and the results from the tests performed to determine whether the hypotheses were supported by the data in Chapter 7. As Table 74 in Chapter 7 illustrates, out of the 41 research hypotheses, 10 were fully supported and 5 were partially supported leaving a total of 26 hypotheses not supported by the data collected.

For the initial adoption phase, the tests examined demographic differences as well as if demographics variables had any relationship with a consumer's perceived behavioural control. Moreover, tests were performed to determine if broadband factors (independent variables) successfully predicted consumers' intention to adopt broadband.

Only one (H_{1c}) hypothesis was supported by the data which meant that the difference in education levels between adopters and non-adopters significantly explained consumer's behavioural control. Five (H_{3b}, H_{3e}, H_{4b}, H_{4d} and H_{4g}) hypotheses were supported by the data that significantly explained consumer's intention to adopt broadband. The independent variables included the Hedonic Outcomes, Technology Comfort, Skills, Cost and PC constructs.

For the sustained adoption phase, the tests examined whether there is a relationship between consumer's use determinants and use patterns. Three ($H_{6a,}$ H_{6b} and H_{6e}) hypotheses were supported by the data that significantly explained a consumer's use diffusion patterns. The independent variables included Household Communication, Competition for Limited Resources and Complementary Technologies. One (H_{6g}) hypothesis was partially supported by the data that explained a consumer's use diffusion patterns. The hypothesis that was partially supported was due to the data either only supporting a consumer's rate of use or variety of use. The independent variables included technology frustration.

Finally, for the impact phase tests examined whether a relationship exists between a consumer's use diffusion patterns (independent variables) and the impact that broadband has on their lives. The dependant variables in this case included lifestyle, satisfaction and interest in future technologies. Five ($H_{7b,}$ $H_{7d,}$ $H_{7e,}$ $H_{7f\ and}$ $H_{7g)}$ hypotheses were partially supported by the data that explained broadband's impact on consumer's lives. As with the sustained adoption phase, the hypotheses that were partially supported were due to the data either only supporting a consumer's rate of use or variety of use. The independent variables included international communication, costs, performing work related activities at home, satisfaction and interest in future technologies.

Further discussions on the research hypotheses are provided in the subsequent sections.

8.3 Demographics

Literature states that the role of socio-economic attributes and the solitary use of demographic variables such as age, income, education and occupation help differentiate adopters from non-adopters (DCITA, 2004; Choudrie and Dwivedi, 2004b, Dwivedi, 2008). Socio-economic attributes also play a role in the knowledge part of the Diffusion of Innovations five stage process (Rogers, 1995). All four variables were expected to have an impact on attitude and perceived behavioural control constructs (Choudrie and Dwivedi, 2004b, Dwivedi, 2008).

The findings from the qualitative study suggested that demographic variables mostly affected factors within perceived behavioural control. It appeared that age, education and occupation affected the skill levels of consumers. Income affected the type of broadband service that the consumer subscribes to, which is directly related to the cost of the service.

In contrast the findings from the quantitative study suggested that age and occupation had no significant influence on a consumer's behavioural control. Age was not a significant factor in determining the differences between adopters and non-adopters as both adopters and non-adopters fell into younger age groups. Moreover, age had no significant influence on the consumer's skill level. However in contrast, anecdotal evidence suggests many young people adopt new technologies because it is fun, "cool" and they are curious. In the technology driven world today, the youths skill set are different to what their elders were and the youth are ultimately increasing their skills in order to "survive" (Lee et al., 2003; Lee & Choudrie, 2002).

Occupation was not a significant factor in terms of differentiating adopters and non-adopters of broadband as both adopters and non-adopters fell into the lower categories of professionals. As result, a comparison could not be drawn between both populations. Moreover, occupation had no impact on the consumer's knowledge about broadband. It should be noted that when categorising occupation for the basis of the quantitative testing, students were categorised as part of the lower occupation levels of Clerks & Administrative Workers. If these were to be separated, different results may have been obtained.

Earlier anecdotal evidence suggested that people with higher occupation levels are more likely to be knowledgeable due to gaining industry experience in using broadband (Gilligan & Wilson, 2003; Rice 1997). A possible explanation is that as the world is becoming a "knowledge economy", people are becoming more skilful and tech savvy. Moreover, broadband in its basic form may not be a difficult technology to learn, making the learning levels constant across the board (Kefela, 2010).

Findings revealed that income levels are good predictors of broadband adoption which are in line with previous studies (DCITA, 2004; Choudrie and Dwivedi,

2004b; Dwivedi, 2008). Most consumers that felt that they had a high enough income to subscribe to broadband fell within the medium income category. However, results show that only a few adopters fell within the lower income groups and the largest percentage of non-adopters were among the lower income groups. This was not in line with theoretical arguments that the number of adopters increase as the income level rises.

The findings from the quantitative study are in accordance with predictions for education (DCITA, 2004; Choudrie and Dwivedi, 2004b; Dwivedi, 2008). Theoretical arguments state that a large number of educated consumers are more likely to adopt broadband. The majority of adopters possessed an undergraduate and postgraduate education. This is in contrast to the non-adopters where the majority possessed a Matric Exemption or high school diploma, which was the lowest listed level of education. A possible reason for this is that highly educated people require broadband to access work or tertiary VPNs in order to undertake office work at home. Moreover, broadband can be used as an effective communication tool for business people and can be used as a utility tool to access study material (Anderson et al., 2002; Lee et al., 2003).

8.4 Initial Adoption

8.4.1 Actual Adoption

The findings from the quantitative study suggested that 154 respondents had adopted a broadband technology which represents 87% of the total sample population. Broadband with ADSL and Mobile 3G/HSDPA appeared to be the preferred technology of choice. Most of these respondents had more than 1 type of broadband technology in the household.

8.4.2 Attitudinal Constructs

Literature states that if the attitude of consumers towards technology adoption is positive, then they are likely to adopt the technology (Fishbein & Ajzen, 1975; Todd & Taylor, 1995). Using this theoretical basis, the research decomposed attitude into five dimensions: Relative Advantage (Rogers, 1995), Hedonic Outcomes, Utilitarian Outcomes (Venkatesh & Brown, 2001) and Security and Technology Comfort (DCITA, 2004). Using the results from the qualitative study, Loyalty was added as the sixth dimension for attitude. All six factors were expected to predict a consumer's attitude towards broadband adoption in South Africa.

Relative Advantage

Relative advantage is the degree to which an innovation, in this case broadband, is perceived to be better than existing technology, such as dial-up. In comparison to narrowband, broadband offers "faster, unmetered, always on access to the Internet" and provides "significant advantages, convenience and satisfaction" (Choudrie and Dwivedi, 2004a, p331). It was, therefore, expected that respondents who perceived broadband as advantageous would likely adopt the technology.

The findings from the qualitative study suggested that relative advantage was one of the dominant themes voiced by both adopters and non-adopters and contributed to the development of the Model for Broadband Diffusion in Households of South Africa. Respondents believed that broadband offered numerous advantages such as faster access, always on, freed up the phone line, multi-tasking, mobility and geographic convenience.

In contrast, the quantitative study showed that relative advantage had no significant influence on consumer's (adopters and non-adopters) intention to adopt broadband. This was, therefore, not in line with the previous work on technology diffusion and as a result was not incorporated in the final model for broadband diffusion in households. Previous studies showed that South Korean consumers were made aware of the advantages of broadband (Lee and Choudrie, 2002; Lee et al., 2003; KPMG, 2005) over narrowband. If consumers are not made aware of the advantages of broadband then it is likely that the technology will not be adopted. Therefore, it may be possible that the lack of awareness of the advantages of broadband is the reason why this construct has not contributed to explaining the variance in intention to adopt broadband.

Hedonic Outcomes

Hedonic Outcomes is the pleasure derived from the consumption or use of broadband Internet. It is the entertainment potential of the Internet via offerings such as online radio, streaming audio and video, electronic greetings, online games and online casino (Venkatesh and Brown, 2001). It was therefore expected that respondents who perceived that broadband as a good entertainment medium would likely adopt the technology.

The findings from the qualitative study suggested that hedonic outcomes were one of the themes voiced by both adopters and non-adopters. Adopters noted that they gained pleasure from using their broadband connections; while non-adopters expressed that they were aware for the entertainment potential of broadband as faster connections would allow them to download movies without waiting for long periods, streaming digital media and online gaming.

The quantitative study suggested that hedonic outcomes had a "somewhat" significant influence on consumers' (adopters and non-adopters) intention to adopt broadband. This is in line with recent studies (Lee et al., 2003; Choudrie & Lee,

2004; Choudrie & Dwivedi, 2006; Daly et al., 2008) which argued that hedonic outcomes was an important factor that influenced a consumers decision when subscribing to broadband.

While the hedonic outcomes construct predicted broadband adoption in South Africa, the construct still had a lower significance level compared to technology comfort and broadband skills factors. Possible reasons could include the issue surrounding piracy. A study examined the relationship between regulations, information technologies, and human behaviour. Regulation affects human behaviour of file sharing (music, videos and applications) in peer-to-peer applications (Mlcakova & Whiteley, 2004). As such, legal regulation may hinder consumers realising the entertainment potential of broadband.

Utilitarian Outcomes

Utilitarian Outcomes refers to the extent to which technology in the household can assist with household activities and provide a more flexible lifestyle (Venkatesh & Brown, 2001). In this sense, consumers will subscribe to broadband in order to work at home instead of the office, assist children with their homework and other household activities. It was therefore expected that those respondents who perceived that broadband was useful for performing work related activities at home, would most likely adopt the technology.

The findings from the qualitative study suggested that utilitarian outcomes were one of the themes voiced by adopters of the technology. Respondents emphasised that broadband allowed them to undertake office work at home, spend more time with the family and look for information or product search and purchases.

In contrast, the findings from the quantitative study suggested that utilitarian outcomes had no significant influence on consumer's (adopters and non-adopters) intention to adopt broadband. Based on the observations of this study, it is likely that broadband speeds are not fast enough to access work material from home. To access large files from office servers, one would require a large amount of bandwidth that would be costly. Another possible reason is that as the workforce becomes more mobile, employees are given work laptops with 3G cards to access work information over their company's VPN, which as a result would not require broadband at the household. With regards to assisting children with their homework and performing other household activities, it may be that the lack of awareness of utilitarian outcomes could be the reason why this construct has not contributed to explaining the variance in intention to adopt broadband.

Security and Technology Comfort

Attitudinal factors that were not included in the Choudrie and Dwivedi's (2004b) Model of Broadband Diffusion but were deemed as essential factors for South African broadband uptake were that of security and technology comfort. Broadband can offer security to those who are concerned with online invasion of privacy or the

control of family content. Security can bring comfort to consumers when using their credit cards online or being able to filter adult content on the web (DCITA, 2004).

The qualitative study suggested that most consumers felt secure when using broadband particularly since security is watched by their ISPs by tracking any suspicious activity, virus and pop-up problems. Moreover, consumers felt that broadband offered better control of family content.

In contrast, the quantitative study suggested that security had no significant influence on consumer's (adopters and non-adopters) decision to adopt broadband and was therefore not incorporated in the final model. Based on interviews of this study consumers felt indifferent with regards to security from a broadband connection or from a dial-up connection. Consumers may feel that accessing content online with a broadband connection makes them susceptible to the same vulnerabilities as with dial-up.

With regards to technology comfort, broadband can also offer comfort when learning a new technology and hence can be used as an information tool (DCITA, 2004). The quantitative study suggested that most consumers felt that broadband technology was easy to setup, is user friendly and easy to learn.

The findings from the study suggested that technology comfort had a significant influence on consumer's (adopters and non-adopters) intention to adopt broadband. The factor was therefore included in the final model. Consumers found more comfort in broadband than dial-up which offered constant disconnects slower speeds and higher monthly charges. Therefore the perceived comfort provided by broadband appeared to be high which contributed to the high probability of adopting it.

Loyalty

Although not included in the Choudrie and Dwivedi's (2004b) Model of Broadband Diffusion, loyalty was a deemed as an essential factor for determining South African broadband uptake. The qualitative study suggested that consumers chose a particular broadband service due to having previous modes of internet access with a specific ISP. Loyalty was deemed as an important factor due to those consumers, who already had existing narrowband connections to the internet, upgraded to broadband connections based on their loyalty to their ISP.

In contrast, the quantitative study suggested that loyalty did not have a significant influence on consumers' (adopters and non-adopters) intention to adopt broadband. Possible reasons could be that at the time when the qualitative study was performed, broadband was still in its growth phase. The high cost of broadband subscriptions possibly had no influence on consumers' loyalty as it may have prevented them from switching to other ISPs or switching from a narrowband connection to a broadband connection with their current ISP. However, it is expected that with the increase of undersea cables bringing cheaper international bandwidth, consumers are most likely

to become disloyal to their current ISPs. Consumers are expected to move to different ISPs offering cheaper yet similar broadband services.

8.4.3 Subjective Norms

Subjective norms in the theory of planned behaviour (TPB) are considered directly related to behavioural intention. Subjective norms are a measure of social influence and it is the extent to which consumers perceive that important others believe they should use broadband technologies (Tan & Teo, 2000). Social influence was one of the factors expected to predict broadband adoption in South Africa.

Social Influence

If consumers are positively influenced by family, friends, TV and newspapers about the benefits of broadband, then they are likely to adopt the technology (Venkatesh and Brown, 2001; Choudrie and Dwivedi, 2004a).

The qualitative study suggested that consumers (adopters and non-adopters) believed that social influence was one of the key factors that influenced their decision to adopt broadband. Consumers were either influenced by immediate family members or through social networks and friends.

The quantitative study, however, suggested that social influence had no significant influence on a consumers (adopters and non-adopters) decision to adopt broadband. The theoretical argument was therefore not supported by the findings of this study. A possible reason for the non significant effect of social influence is that with the high costs of broadband subscriptions, consumers are unlikely to be affected by the influence of others. Moreover, the demographic factors could have impacted on social influence that in turn may have influenced perceptions on usefulness leading to influencing behavioural intention which may eventually translate into adoption (De Silva, Ratnadiwakara and Zainudeen, 2009). These factors are different for each consumer and hence cannot be fully observed. What can be observed is whether the consumer has adopted the technology or not (De Silva et al., 2009).

It should also be noted that late adopters are likely to wait for an innovation to be well established and supported by feedback from their peers before making the decision to adopt (Dwivedi and Irani, 2009).

8.4.4 Perceived Behavioural Control

Perceived behavioural control is the individual's perception of their ability to perform a given behaviour. It is the beliefs of having the necessary resources and opportunities to adopt broadband in the home (Choudrie and Dwivedi, 2004a). As a result, the presence of constraints can inhibit a consumer's behaviour to adopt a specific technology (Ajzen, 1985, 1991). Using this theoretical basis, Choudrie and

Dwivedi (2004b) decomposed perceived behavioural control into five dimensions: Cost, Requisite Knowledge, Broadband Content, Needs and Skills. Using the results from the qualitative study, Infrastructure and PC were added as the sixth and seventh dimension for PBC respectively. All PBC factors were expected to have an influence on a consumer's intention to adopt broadband in South Africa.

Cost

Previous studies in the UK suggested that high monthly cost was a major barrier that inhibited the adoption of broadband in the household (Choudrie and Dwivedi, 2004a; Choudrie and Dwivedi, 2004b; Koumbati, et al., 2007). Moreover, if the perceived cost of broadband is high, then it is unlikely that the technology will be adopted. In South Africa, the costs of broadband subscriptions may be too high for the average consumer.

The qualitative study suggest that both adopters and non-adopters felt that the price of line rentals, modem costs and the prices of bandwidth caps are too high for them to acquire broadband services. Moreover, the recent price cuts in the South African broadband market did not seem to change their perception on the cost of broadband services. It should be noted that the price of broadband had reduced significantly since the qualitative study took place and this may have impacted on the overall results of the study.

The quantitative study provided evidence that the high costs of broadband had an impact on the intention to adopt broadband. Both adopters and non-adopters equally perceived that broadband prices in South Africa are still too high as compared to other countries. For similar prices in South Africa, consumers can get up to 5 times the speed and unlimited data plans elsewhere in the world. Particularly in the UK where consumers can purchase unlimited data subscriptions and a 50Mbps ADSL line (Meyers, 2010). Until prices are reduced significantly in South Africa, there will be a lack of high adoption rates.

Requisite Knowledge

The level of knowledge about an innovation, its risks and benefits affects the adoption rate (Rogers, 1995). Previous studies suggested that the greater the knowledge of an innovation amongst consumers and users, the more likely the technology will be adopted (Choudrie and Dwivedi, 2004b; Koumbati, et al., 2007).

The findings from the qualitative study suggested that both non-adopters and adopters were aware of broadband technologies available to them and what broadband can do for them. Moreover, requisite knowledge was affected by the skill levels of consumers and social influences by others. Data also showed that requisite knowledge was related to relative advantage, hedonic outcomes and utilitarian outcomes.

In contrast, the quantitative study suggested that requisite knowledge did not have a significant effect in predicting broadband adoption. This was, therefore, not in line with the previous work on technology diffusion and was excluded from the resultant model.

Broadband Content

If there is a lack of true broadband content and applications made available for the service to be used optimally, then it is less likely that the technology would be adopted (Choudrie and Dwivedi, 2004a; Naidoo et al., 2006; Yun, Lee, Lim, 2002). The qualitative study suggested that adopters and non-adopters believed that a range of appropriate services were made available to them such as video streaming, movie downloads, applications such as VoIP and video conferencing.

The quantitative study, however, suggested that broadband content was not a significant factor in predicting broadband adoption.

Needs

The needs requirement is what broadband must fulfil in order for consumers to adopt the technology. Previous studies suggest that if consumers are not aware of the benefits of adopting a particular innovation then they are not likely to make a purchase due to the lack of need for it (Choudrie and Dwivedi, 2004b). The qualitative study suggest that actual adopters were respondents that felt broadband fulfilled their actual needs while in the case of non-adopters these were the potential needs that broadband may fill. The needs that broadband filled were entertainment needs such as online gaming and video streaming, communication needs such as contacting relatives overseas via VoIP and video conferencing, multitasking and most importantly having high speed access to the internet for emails, product purchases and surfing the web. Data also shows that the factors mentioned above have an effect on requisite knowledge as consumers mentioned that when a need arises they would research a particular service that would best meet these needs.

The quantitative study suggests that the needs construct was not a significant factor in predicting broadband adoption. Possible reasons are that needs may be linked to requisite knowledge and there is a possibility that consumers are not aware of the full potential of broadband, which could essentially satisfy their needs. This could be one of the major factors considered dampening broadband penetration in South Africa as adoption of broadband requires a clear message of its usage and benefits amongst consumers (Lee and Choudrie, 2004, Rogers 1995). Once this message is instilled within consumers, it creates a mindset of perceived needs for the technology.

Skills

The use of broadband requires using the PC and Internet. The ease or difficulty of use and the requisite knowledge of a PC and Internet are expected to have an impact

on broadband adoption (Choudrie and Dwivedi, 2004b; Naidoo et al., 2006; Yun, et al., 2002).

Findings from the qualitative study suggest that most adopters and non-adopters believed that they had the necessary skills to use a PC and the Internet. Most adopters expressed that they acquired their levels through either formal training, having an interest in PC and the Internet, being self-taught, starting from a young age, through social influence and from working in the environment.

Results from the quantitative study revealed that a skill was a significant factor in predicting broadband adoption. Previous studies show that the promotion of providing PC and Internet skills to users contributed towards the adoption of the Internet. Initiatives by the South Korean government led to removing barriers of self-efficacy which led to large-scale broadband adoption within a short period of time (Choudrie and Dwivedi, 2004b). Moreover, other studies contributed to the body of research that finds digital literacy skills critical for bridging the gap between consumers participating in the information age and those consumers in lower-income or rural areas (Lee and Choudrie, 2002).

Infrastructure

Infrastructure was a new factor that emerged from the qualitative study. The findings suggest that having the necessary infrastructure in place, such as a telephone line, influenced an adopter's decision to acquire their particular broadband service in their households. Moreover, findings suggest that non-adopters did not have some level of infrastructure in place and as result this affected their decision to adopt broadband.

In contrast, the quantitative study suggests that infrastructure was not a significant factor in predicting broadband adoption. Possible reasons are that consumers were not too concerned with infrastructure as they felt that having a PC was the initial step to adopting broadband. Moreover, previous studies suggest that PC formed an important part of ICT infrastructure technologies necessary for broadband adoption (Lee and Brown, 2008). One cannot obtain the necessary infrastructure for broadband without first acquiring the necessary devices to access the infrastructure. Access to a PC is discussed in more detail in the next section.

Access to a Personal Computer

Access to a PC was a new factor that emerged from the qualitative study and was deemed important as the first step in acquiring broadband. Moreover, it was determined that PC had a large impact on broadband adoption as consumers perceived that if the cost of acquiring a new PC and subscribing to broadband are too high then this may not lead them to adopt the technology.

The quantitative study suggests that Access to a PC significantly predicted broadband adoption. Moreover, data shows that Access to a PC had the second highest probability in predicting broadband adoption. Consumers believed that if

they did not have a PC or their PC does not meet the minimum requirements to access the Internet, they would less likely adopt broadband.

8.5 Use Diffusion Patterns

Literature states that by utilising usage rate and variety of use, four possible types of use diffusion patterns were identified (Shih and Venkatesh, 2002) as either low, experimental, specialised or intense users.

The quantitative study grouped South African broadband users into the use diffusion patterns topology based on variety of use (number of online activities performed and the number of technologies that access their broadband connections) and rate of use (number of hours spent per week using their broadband connection). This gave a sense that South African broadband users are experimental, specialised or intense users with emphasis on being experimental users. It is interesting to note why South African broadband users fell into these categories as broadband was relatively new at the time this research study took place. Moreover, there was also a low Internet penetration rate in South Africa. A possible reason for users falling mostly within the experimental category is that broadband was a relatively new technology at the time, hence users may have been experimenting with the various online activities that could be performed with the technology.

Other reasons can be attributed to the different variables that came into play, affecting the usage behaviour of broadband consumers as mentioned in previous sections.

8.6 Sustained Adoption

The sustained adoption phase completes the five stage process of the Diffusion of Innovations theory. Sustained adoption starts where initial adoption has ended which essentially is the implementation followed by the confirmation of adoption through technology use. Use diffusion affects how consumers ultimately end up using a technology after they have adopted it (Shih and Venkatesh, 2004). Therefore, this phase of the study focused solely on the perceptions of broadband adopters. Using this theoretical basis, the use diffusion constructs are made up of variety and rate of broadband use and influencing variables such as household social context, personal dimensions of users, technological dimensions, and external communications (Shih and Venkatesh, 2004b). Service quality was another factor deemed as an important part of the usage constructs (DCITA, 2004; Choudrie and Dwivedi, 2004b). All five constructs were expected to have an effect on consumer's usage patterns of broadband.

8.6.1 Household Social Context

Household social context is the environment in which the user operates within the household. It is suggested that the higher the social context within the household, the higher the variety and rate of use of broadband (Shih and Venkatesh, 2004; Choudrie and Dwivedi, 2004b). This context is made up of three variables, namely household communication, competition for limited resources and prior experience with technology.

Household Communication

Household communication is the need to communicate or consult with others who are more knowledgeable for assistance when trying different things relating to broadband. Studies show that higher intensity of communication with other users about broadband leads to a higher variety of use (Choudrie and Dwivedi, 2004b; Shih and Venkatesh, 2004). The qualitative study suggests that consulting with more knowledgeable people in the family will have an effect on the use patterns of consumers. If there is an increase in communication between members of the family then this may lead to a higher variety of use of broadband services.

The quantitative study suggests that there was significant relationship between household communication of consumers and the variety of use with their broadband subscription. This is therefore in line with the theoretical underpinnings. Possible reasons can be attributed to the population sample being tech savvy and the large amount of technologies present accessing their broadband subscription. Moreover, consumers within the household were the actual owners of the subscription and ultimate decision makers, who family members turn to for consultation in using broadband services.

Competition for Limited Resources

Competition for limited resources leads to family members negotiating times in determining who uses the technology and when. Tension can sometimes arise if the technology is not available to all family members all the time. Studies have shown that for social technologies, variety and rate of use could be enhanced by the existence of other users within the adopting unit. Alternatively, existence of other users within the adopting unit could impede the rate and variety of use for personal technology by enforcing competition for a limited resource, the technology (Choudrie and Dwivedi, 2004b; Shih and Venkatesh, 2004). The qualitative study suggests that due to the limited availability of devices accessing the broadband connection at home, there are clashes between family members in terms of who uses the devices and when.

In line with theoretical reasoning and the qualitative study, the quantitative findings suggest that there is a significant relationship between the competition for limited

resources and the rate of use of broadband. If there is a limited amount of devices, such as a PC, which accesses the broadband connection within the household, then more clashes would be between family members in order to use them. This ultimately results in a lower rate of use with the consumer's broadband subscription. The lower variety of use suggest that South Africa users exhibit specialised use characteristics since when users do get to use the broadband connection they are limited to a single set of tasks that they would perform for the limited time period.

Prior Experience with Technology in the Family

If the family member has prior experience with using similar older technologies then this may provide them with the necessary skills to recognise any situation in which the technology can be applied and how to apply it. The results from higher involvement resulting from prior experience should be an increase in rate and variety of use (Choudrie and Dwivedi, 2004b; Shih and Venkatesh, 2004). The findings from the qualitative study suggest that consumers with dial-up experience had an easier learning curve with using broadband technologies. Moreover, continued use of broadband increased their experience in using it. The higher the accumulated broadband experience affected their use patterns in terms of increasing variety and rate of use.

In contrast, the quantitative study suggested that there was no significant relationship between prior experience with technology in the family and the consumer's rate and variety of use of broadband. This was, therefore, not in line with theoretical arguments and the qualitative study. Possible reasons can be attributed to broadband being easy to setup and use, not requiring any prior technical knowledge. Other reasons may include, with the low fixed lines and Internet penetration in South Africa, that the majority of the population sample had only acquired experience with broadband from either studying or working in the environment.

8.6.2 Technological Dimension

Technological dimension is the overall technological environment in which the user operates. It is suggested that the technology sophistication within a consumer's household and the greater the number of complementary technologies accessing the broadband connection, the higher the rate and variety of use will be (Shih and Venkatesh, 2002; Shih and Venkatesh, 2004). The construct is made up of two variables, namely technology sophistication and complementary technologies.

Technological Sophistication

Technology can be sophisticated without being difficult to use. Users with access to more advanced technologies are expected to use their broadband connections more. Studies have shown that using more advanced technology (i.e., technological sophistication) results in higher variety and rate of use (intense, specialized,

experimental use) (Shih and Venkatesh, 2002; Shih and Venkatesh, 2004). The qualitative study suggests that consumer's found broadband more sophisticated than dial-up connections since they found it easier to obtain information and get more work done. Using the more sophisticated broadband technology is therefore likely to increase variety and rate of use of the service.

The quantitative study suggested that there was a significant but negative relationship between technological sophistication and a consumer's rate of use. It also failed to show that broadband had an effect on variety of use. This was not in line with theoretical reasoning and the qualitative study. Broadband allows consumers to connect more than one device. This, therefore, increases the rate in which the technology can be used as compared to a dial-up connection where its speed and bandwidth capacity only allows for one type of use at a time. South African consumers who believed that broadband was a more sophisticated technology had a variety of technologies accessing the connection. A possible reason is that broadband at the time of the quantitative study was a relatively new technology in which the user was engaged in trial and error to determine the technological fit in daily activities (Shih and Venkatesh, 2002).

Complementary Technologies

Complementary technologies complement the broadband technology in use. The complementary nature of technologies or their inter-connective potential increases the use of a given technology with other complementary technologies (Choudrie and Dwivedi, 2004b; Shih and Venkatesh, 2004). The qualitative study suggest that complementary technologies within a South African household ranged from laptops, mobile phones, video editing devices to video game consoles for online gaming. Moreover, complementary technologies seemed to reduce the competition for limited resources since sophisticated setups allowed for more people to access the broadband network at a given time.

The quantitative study suggested that there was a significant relationship between complementary technologies and a consumer's rate and variety of use. This shows that complementary technologies are indicators of acquisition of new technologies, such as broadband (Choudrie and Dwivedi, 2004b; Shih and Venkatesh, 2004). Previous studies suggest that using other complementary technologies results in higher variety of use (Shih and Venkatesh, 2002). However, contrary to previous studies, this study found that complementary technologies affect both a consumer's variety and rate of use. South African consumers tend to have, on average, two or more technologies accessing their broadband connection and this, as a result, increases the amount of time they spend online.

8.6.3 Personal Dimension

Personal dimension is the overall effect that personal variables have on usage behaviour of broadband. It is suggested that use innovativeness, frustration with technology and skills of users will have an effect on a consumer's rate and variety of use of broadband.

Use Innovativeness

Shih and Venkatesh (2002) suggest that if consumers are to be innovative, then they must use the product in multiple novel ways. They must also have the creativity and curiosity to learn new things with the technology (Shih and Venkatesh, 2002). It was further suggested that involvement and innovativeness have a positive relationship with variety of use. The qualitative study suggested that consumers felt more adventurous, creative and performed different kinds of activities online. Moreover, users with online businesses are more inclined to be innovative with broadband connections.

In contrast, the qualitative study suggests that there was no significant relationship between use innovativeness and a consumer's variety of use. This was, therefore, not in line with the theoretical arguments and findings from the qualitative study. Possible reasons could be that even though consumers had many technologies accessing their broadband connection, these technologies have a specific purpose to perform specific tasks. For example, a consumer would use their PC or laptop to surf the Internet or access email or they can use their video games console for online gaming. These are used for specific tasks where there is no need for the consumer to be innovative. Moreover, the population sample was made up of consumers who did not run an online business from home and therefore could not be innovative in this sense.

Frustration with Technology

Complex technologies often trigger feelings of frustration among users. Even though a technology is useful, difficulties in performing the intended tasks can cause feelings of aggravation to disappointment (Shi and Venkatesh, 2002). Frustration therefore acts as a barrier to high levels of use diffusion resulting in a consumer's lower rate of use and variety of use of a technology. The findings from the qualitative study suggested that consumers expressed frustration in terms of broadband speed and cost that impacted on their rate and variety of use.

The quantitative study suggested that there was a significant relationship between frustration and rate of use but not variety of use. Consumers that were frustrated with their broadband connection had more than two devices accessing. From this perspective, it is probable that the speed of their connection was not fast enough to support all devices accessing it. Moreover, the speed to cost ratio may be another

reason why consumers would be frustrated with broadband technology in South Africa in general. In terms of rate of use, South African consumers seem to be performing more online activities as a result of broadband and this would not be a contributing factor to frustration.

Skills of Users

The broadband skills of users were not originally part of the Use Diffusion Model proposed by Shih and Venkatesh (2002). However, for the purposes of this study, the skills factor was deemed necessary, especially during the use of broadband technologies after its adoption. It is expected that consumers with advanced skills in using broadband are more innovative than those with lower skill levels. The qualitative study suggested that skills of users led to higher variety of use since the higher the skills the higher the number technologies a consumer would use to access broadband for various online activities.

The quantitative study, however, suggested that there was no significant relationship between skills of users and a consumer's variety of use. As mentioned above, South African consumers are not innovative in terms of using their broadband connection. As the qualitative study points out, skills of users are linked to innovativeness. This, therefore, suggests that South African users are not as skilled in order to be innovative in using their broadband subscriptions. Moreover, performing specific tasks such as surfing the web or reading emails does not require an advanced skill set.

8.6.4 External Dimension

External dimension is the overall effect that external variables have on usage behaviour of broadband. External factors contributing to the usage behaviour of consumers include external communications, external technology access and family exposure to target media. It is expected that these external factors have a significant effect on a consumer's variety and rate of use of broadband.

External Communication

If a person speaks to friends, family and co-workers about products, such communication reinforces their belief systems and, consequently, behaviours. If friends, family or co-workers, through external communication, make the consumer aware of broadband capabilities then the consumer is more likely to adopt broadband and also increase the variety of use (Choudrie and Dwivedi, 2004b; Shih and Venkatesh, 2004). The qualitative study suggested that consumer's friends and family living overseas had increased their use of broadband for external communication. Online friends and co-workers made consumers aware of the benefits of broadband such as playing online games and performing work-related activities at home, thereby increasing broadband use.

The empirical findings suggested that there was no significant relationship between external communication and consumer's variety of use of broadband. Very few respondents that communicated with friends and family overseas played online games or performed work activities at home had more than two technologies accessing their broadband connection. This was therefore in line with theoretical reasoning and the qualitative findings.

External Technology Access

The use of broadband technology outside the household, particularly at work or school, has an overall effect on a consumer's usage behaviour with regards to broadband within the household. It is expected that access to broadband Internet outside the home environment leads to a high variety but lower rates of use in the home (Choudrie and Dwivedi, 2004b; Shih and Venkatesh, 2004). The qualitative findings suggest that consumers made regular use of their work, university or Internet cafes high speed Internet, which resulted in lower use of their home broadband connections.

In contrast, the quantitative study suggested that there was no significant relationship between external technology access and a consumer's rate and variety of use of broadband. Reasons can be attributed to the actual data presented in the quantitative study where, even though South African consumers accessed the Internet from outside their household, they still performed a variety of online tasks and spent some time using their broadband connections at home. It is also likely that consumers brought work or schoolwork home and used their home broadband connections to access information.

Family Exposure to Target Media

If consumers are exposed to media, this may stimulate their involvement with broadband technology. Previous studies show that exposure to target-related media results in a higher variety and rate of use of broadband services (Choudrie and Dwivedi, 2004b; Shih and Venkatesh, 2004). The qualitative study suggested that consumers had become more aware of video, voice and online-chat capabilities of broadband which increased their use of the technology. Data also shows that video and voice calling applications were the "killer applications" for broadband adoption. Moreover, as consumers are exposed to the different media available, they can use the experience to become more innovative. Hence, this links exposure to target media to use innovation.

The quantitative study, however, suggested that there was no significant relationship between exposure to target media and a consumer's rate and variety of use. Reasons can be attributed to the data that shows that consumer felt that they were not influenced by target-media. One possible reason for this is that, as mentioned above, consumers were more influenced by external communication such as friends, family and co-workers rather than target-media. Another reason is that ISPs or telecommu-

nication companies are not promoting broadband enough to make consumers aware of its benefits. If telecommunication companies find innovative ways in marketing their broadband products then South Africa might see an increase in broadband adoption and use.

8.6.5 Service Quality

Service quality is the final determinant of use diffusion. It was not originally part of the Use Diffusion Model proposed by Shih and Venkatesh (2002). Moreover, Choudrie and Dwivedi (2004a) had included service quality as a contributing factor towards broadband adoption. However, for the purposes of this study, service quality was deemed as an important factor for use diffusion. After the user has adopted and has been making use of their broadband subscription, the quality of service provided by their service provider determines whether the user will continue using the service or not. Findings from the qualitative study suggested that the service quality received by broadband service providers were generally good. Poor service quality was attributed to frequent downtimes, poor help desk services and general quality of the technology. It was determined that consumers that experienced good service quality spent more time online which increased their rate of use.

The findings from the quantitative study suggested that there was no significant relationship between service quality and a consumer's rate of use. This was not in line with the findings from the qualitative study. It appears that South African consumers were dissatisfied with the quality of their broadband subscription and this decreased the number of hours that they spent online. Moreover, only a few respondents felt that good customer support, security, less downtime and quality of connections were contributing attributes of good service quality offered by their broadband service providers.

It should be noted that if service quality had a negative influence on the usage behaviour of consumers then they are likely to switch to new providers or cancel the subscription to the technology. However, this requires a longitudinal study in which consumer usage behaviour is tracked from adoption to usage over a long term and is recommended for future research.

8.7 Impact

Previous impact studies have not yet touched on consumer's broadband usage and its effect on their daily lives (Shih and Venkatesh, 2004). The impact of broadband is the ultimate outcome of the usage of broadband. Broadband can offer entertainment and alternative ways to work and is likely to impact people's lives especially with their normal daily activities (Shih and Venkatesh, 2004; Choudrie and Dwivedi, 2004b). Impact outcomes in the impact phase included broadband impact on lifestyle,

consumer's satisfaction and interest in future technologies. It was expected that the greater a consumers rate and variety of use, the greater the impact of broadband would be on each of these factors.

8.7.1 **Lifestyle**

Literature states that the degree of broadband use directly results in the perceived impact of the technology on daily lives. In terms of consequences of diffusion, consumers in the intense use category appear to live better lifestyles (Shih & Venkatesh, 2004).

The qualitative study suggested that broadband has had a major impact on their lifestyles. Lifestyle changes include easier communication with family, saving in time to do more activities, cost savings and the ease of working from home.

The quantitative study suggested that there was no significant relationship between a consumer's variety of use and communication with distant families. Data showed that few respondents had a variety of communication devices, such as IP phones and software such as Skype, accessing their broadband connection. Since its adoption and use, broadband has impacted on consumer's lives in terms of allowing consumers to communicate more with distant family members but was not the case in this study.

Consumers that were experimental, specialised or intense users showed a significant relationship between variety of use and commencing with other life activities. This suggests that the more consumers spent online performing a variety of tasks with their broadband connection such as purchasing products or groceries, paying bills or searching for information, the more time they will gain than from actually travelling to designated areas to perform these tasks. The amount of time saved allowed consumers to perform other important daily life activities. Linking this to commencing with other life activities, if a consumer paid their bills or purchased products or groceries online then they would ultimately be saving on travelling costs. However, this was not the case within the study as empirical findings suggested that consumers that performed a variety of tasks online did not experience cost savings.

The quantitative study suggested that experimental, specialised or intense users showed a significant relationship between a consumers' rate of use and performing work related activities at home. Data showed that consumers that performed these activities at home seemed to use the technology less. Possible reasons could be attributed to consumers performing a variety of online activities relating to work but performing them within a short space of time. The remaining time used may have been spent on other personal activities such as online banking or video gaming. Moreover, in the near future, an increasing number of people will begin working from home and this may benefit the organisation through cost savings and the workers time savings providing better convenience and comfort (Dwivedi, 2008).

8.7.2 Satisfaction with Broadband Technologies

Literature states that how consumers make use of technology directly impacts the nature and level of their perception regarding the technology. In terms of consequences of diffusion, consumers in the intense use category show greater degree of satisfaction (Shih & Venkatesh, 2004).

The qualitative study suggested that consumers were satisfied with their broadband subscriptions. Broadband allows consumers to have more control over their lives and are less frustrated due to faster connections.

The quantitative study suggested that there was a significant relationship between a user's rate of use and satisfaction with the technology. Moreover, this shows that consumers that are specialised and intense users are more satisfied with the technology. This was in line with the qualitative findings that suggested that consumers who use the technology more for a number of tasks and longer time are more satisfied with the technology.

8.7.3 Interest in Future Technologies

Literature states that intense use diffusion pattern will result in the highest level of interest in acquiring futuristic-oriented technologies, followed by experimental use. In addition, adopters with higher levels of use-diffusion are also more interested in adopting future technologies (Shih & Venkatesh, 2004).

The qualitative study suggested that consumers realising the benefits of broadband and its potential, show an interest in future technologies of broadband.

The quantitative study suggested that there was a partially significant relationship between a consumer's rate and variety of use and interest in future technologies. Reasons can be attributed to consumers only showing a strong interest in interactive online communications and partial interest in IPTV, VoIP and unlimited bandwidth. This gives a sense that the South African consumers are communication orientated. Moreover, the partial results obtained from the interest in IPTV, VoIP and unlimited data could be attributed to the cost of bandwidth that was swaying consumers away from these technologies. IPTV and VoIP have taken off noticeably in first world countries but are yet to be fully realised in South Africa. The delay in IPTV roll out in South Africa was due to a lack of sufficient broadband and infrastructure. VoIP was seen to be adopted largely by businesses in South Africa but is yet to reach the consumers on the same adoption level. With the new submarine cables linking South Africa to the rest of the world, South Africa has seen an increase of international bandwidth. This led to a decrease in prices and unlimited bandwidth became more affordable to the masses. However, at the time of this study unlimited bandwidth was

still too expensive for the average consumer; hence there was very little interest in unlimited bandwidth.

8.8 Chapter Summary

This chapter discussed and reflected upon findings from the literature review, qualitative study and finally the quantitative study. It validated and refined the Model for Broadband Adoption in Households of South Africa. The chapter first presented an overview of the research hypotheses supported by the data obtained from the quantitative study. The discussion explained why certain constructs affected the various phases of the diffusion model and why some had not. Factors from the initial adoption, sustained adoption and impact phases were discussed. Moreover, the discussion revealed that use of broadband significantly affected the time allocation patterns on various activities performed by consumers who were dependant on broadband access. The study also found that South African consumers exhibit characteristics of experimental, specialised and intense users of broadband technologies. Finally, the discussion revealed that South African consumers have a much more comfortable lifestyle when using broadband, are more satisfied and show an interest in future-oriented communication technologies.

Chapter 9 is the final chapter of this research study. It discusses the contributions, implications, limitations and future research directions.

9

Conclusion : Implications, Limitations and Future Research

"Education is the most powerful weapon which you can use to change the world."

Nelson Mandela

Former President of South Africa, 1918-Present

9.1 Chapter Overview

This chapter provides a conclusion to the research study. The chapter begins with an overview of the research performed which is followed by the main conclusions drawn. A discussion of the research contributions and implications of the study is then provided in terms of theory, policy and practice. Finally, research limitations and a review of future research directions are discussed which is followed by a summary of the chapter.

9.2 Research Overview

Chapter 1 provided an introduction to the research study. It discussed the research problem and defined the research objectives and research questions that this research study attempts to answer. Various studies and models aimed to explain the adoption of broadband services in several countries, but few focus on the African continent. As a result there is little available literature on the adoption, use and impact of broadband services in African countries.

Another concern is that most of the literature available focuses on the factors which may influence intention to adopt a particular service but very few comprehensively explain the adoption and use process. Therefore, this research attempts to investigate the adoption, use and impact of broadband services from a holistic point of view encompassing the factors influencing the adoption, use and impact of broadband.

Chapter 1 provided information on the objectives as well as the scope of the research study, that is, from a consumer household perspective. The intended contributions to theory, practice and policy are also provided. The objectives included developing a comprehensive model specific to broadband adoption, use and impact through an initial literature review; then to inductively build a model for South Africa through the qualitative study and finally to formulate research hypothesis to validate the proposed South African model through the quantitative study.

To achieve these objectives, Chapter 2 reviewed the various technology adoption and diffusion related theories and models including TAM, TBP, DTPB, DI, MATH and UD. Integrating the constructs across all models resulted in providing the most appropriate way to understanding the research problem as none of the models alone could examine broadband adoption, use and impact comprehensively. Most of these theories have been integrated in Choudrie and Dwivedi's (2004a) Model for Broadband Diffusion.

Using Choudrie and Dwivedi's (2004a) model for broadband diffusion and combining this with literature a comprehensive model also relevant to developing countries was formulated and proposed. For attitudinal factors three new constructs, security, technology comfort and broadband content were added. In South Africa while prices seem to be decreasing these may still be too high for the average consumer, therefore cost was added as well as knowledge, skill and needs (rapid changing factors).

Choudrie and Dwivedi (2004b) included service quality as a factor impacting adoption. However, it was felt that service quality is determined after the consumer had adopted broadband and the construct was therefore included in the sustained adoption phase as a use determinant. Chapter 2 therefore led to the achievement of the first objective which was to "*develop a comprehensive model for broadband adoption, use and impact through an initial literature review.*"

Chapter 3 introduced the qualitative and quantitative approaches that this research undertook. The sampling techniques, namely purposive for the qualitative study and stratified for the quantitative study, were used for this research study.

Chapter 4 provided a description of how the qualitative research study was conducted. The study followed an inductive approach to analyse the data collected. The result was the development of categories into a model and summarisation of the raw data to convey themes and processes. A constant comparative analysis was performed to ensure at each stage that the data is coherent. To ensure that the data collected was reliable and valid, a triangulation of interviews was performed with audio tapes and notes taken and an audit trail of documentation was kept.

The qualitative study also provided a general idea of whether the issues are comparable to those experienced in other countries and provided an indication of the expected relationship between variables. Furthermore, it was expected that some factors would correlate with those identified in the literature survey and some additional new factors/constructs were discovered.

Chapter 5 provided a narration of the themes and patterns that emerged from the qualitative data analysis. It segmented the sample into adopters, users and non-adopters. Each phase of the diffusion process was analysed specifically looking at interviewee responses for factors that affected each phase. The findings of this study suggested that the factors affecting initial adoption were similar to that of the proposed adoption model produced in the literature review, with some new factors emerging from the data gathered. In the case of a consumers attitudinal belief a new factor "loyalty" emerged. New factors as part of PCB that emerged were infrastructure and access to a PC.

The sustained adoption phase analysed the responses of those users who subscribed to and were making use of broadband technology. It analysed their usage characteristics in order to determine which factors impact on their use patterns. All factors remained and fell within the variables of household social contexts, the personal dimensions of users, technological dimensions, external dimensions and security respectively. A new factor emerged, skill of users, which had an impact on use innovativeness.

The impact phase identified the different ways in which broadband had impacted on consumers' lifestyles. Findings showed that consumers perceptions of broadband are that the technology provides them with easier communications with the family, time savings to do more of other activities, cost savings and the ease of working from home. Moreover, consumers were satisfied with their broadband service as it allows them to have more control over their lives, they are less frustrated due to faster connections and it makes it easier to gets things done. Realising the benefits of broadband and its potential, consumers have expressed interest in future technologies of broadband particularly in increased speeds and wireless connections. The impact

phase completed findings of the various factors that are needed to build the model specifically for South Africa.

Chapters 3 to 5 therefore led to the achievement of the second objective which was to "*inductively build a model for South Africa through the qualitative study.*"

Chapter 6 began by outlining the research time frame for the quantitative study. A cross-sectional study was selected as it analysed responses at a single point in time since there was limited time available due to the context of broadband changing quite rapidly. The research sample selected were typically the respondents for the adoption decision of broadband that 18 years or older, had a steady income and some form of formal education. Due to time constraints and expenses the target population included in the research was limited to the Western Cape province of South Africa looking at subjects particularly in the Cape Town region.

Based on the model for broadband adoption in households of South Africa derived from both the literature review and qualitative study, the main research hypotheses were provided and split between the three stages of diffusion i.e. initial adoption, sustained adoption and the impact of broadband.

A description of how the quantitative instrument was designed and how the data collection was conducted was then provided. Through the use of a questionnaire the model for broadband adoption in households of South Africa was validated.

Chapter 7 led to the investigation of the diffusion of broadband in households of South Africa quantitatively. A description of the demographic profiles of the survey respondents was provided. The majority of the adopter respondents had broadband for more than a year and spent most of their time using the connection for downloading files, music and videos via their PC, laptops, mobile phones and video games console. Using the results from the hypotheses tested the factors from each phase were consolidated. The model for South Africa was then refined based on the quantitative results obtained.

Chapter 8 discussed and reflected upon findings from the literature review, qualitative study and finally the quantitative study. It discussed the final model for Broadband Adoption in Households of South Africa. The discussion justified why certain constructs influenced the various phases of the diffusion model and why some had not. The discussion revealed that use of broadband significantly affected the time allocation patterns on various activities performed by consumers who were dependant on broadband access. The study also found that South African consumers exhibit characteristics of experimental, specialised and intense users of broadband technologies. Finally, the discussion revealed that South African consumers due to using broadband perceive that they have a more comfortable lifestyle, are more satisfied with the technology and show an interest in future-oriented communication technologies.

Chapters 6 to 8 therefore led to the achievement of the third and final objective which was to "*deductively combine the initial literature review and the interpretive study and formulate research hypothesis to validate the proposed model.*" Accomplishment of these chapters all led to the answering of the research questions outlined in Chapter 1.

9.3 Main Conclusions

Figure 65 depicts the overall paths of constructs towards the adoption, usage and impact of broadband. The figure aids in explaining the main conclusions drawn from this research study.

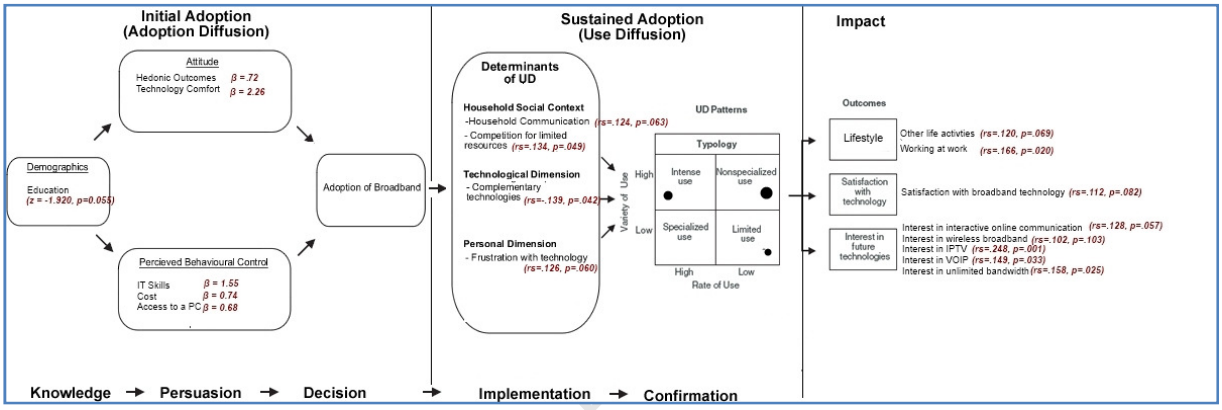

Figure 65: Overall impact of adoption, usage and impact factors

The main conclusions drawn from the research study are based on the three main underlying research questions proposed in Chapter 1:

2. *What factors affect a South African consumers' decision to adopt broadband?*

   Out of the three constructs in the initial adoption phase only attitude and perceived behavioural control significantly explained a consumer's intention to adopt broadband. Within the attitude construct, technology comfort had a significant influence on broadband adoption while hedonic outcomes had a "somewhat" significant influence. With regards to perceived behavioural control skills, costs and access to PC had a significant influence on a consumer's intention to adopt broadband. Overall, technology comfort had the largest part in explaining actual adoption. This was followed by skills in using a PC and the Internet, cost of broadband and having access to a PC. Amongst the four demographic variables, only education levels of consumers were associated with the adoption of broadband. Education had a significant effect on perceived behavioural control factors which in turn had an impact on the intention to adopt broadband.

3. *What factors affect the way South African consumers use broadband and how consumers make use of the technology?*

Factors within four constructs in the sustained adoption phase had an effect on consumer's usage patterns. House communication and competition for limited resources within the household social context construct had a significant positive and negative relationship, respectively, with a consumer's rate of use of broadband. Within the technological dimension construct, complementary technologies was the other factor that had a positive influence on a consumer's variety and rate of use of broadband. Frustration with broadband technology in terms of speed within the external dimension construct had a significant negative affect on a consumer's variety of use.

Grouping South African broadband users into the use diffusion patterns topology based on variety of use (number of online activities performed and the number of technologies that access their broadband connections) and rate of use (number of hours spent per week using their broadband connection) gave a sense that South African broadband users are experimental, intense or limited users with emphasis on being experimental users.

4. *What impact does broadband have on South African consumers and their interest in future oriented technologies?*

   Experimental, specialised or intense users showed significant relationships with all three constructs within the impact phase, namely lifestyle, satisfaction and interest in future technologies. Being classified as these type of users (with emphasis on being experimental users) has shown that South African consumers have a much more comfortable lifestyle when using broadband, are more satisfied and show an interest in future-oriented communication technologies.

9.4 Research Offerings and Implications

This research, from an academic perspective, adds to the existing literature on broadband diffusion and proposes and validates a model relevant to the current South African context. By using current research to form the foundation of the study, the research built on the body of knowledge to further the understanding and successes of broadband adoption in residential households. Moreover, the research, unlike other technology adoption studies, investigated all three components of the diffusion namely adoption, usage and impact.

The study also extended the model of broadband adoption proposed by Choudrie and Dwivedi (2004b) by incorporating the Shih and Venkatesh (2001) model of use diffusion that analysed post-adoption factors to determine broadband usage and impact.

From a practical viewpoint this research provided a comprehensive analysis into the factors leading to the adoption and use of broadband in residential households that may be beneficial for various stakeholders such as government, Internet Service Providers (ISP), business consumers, public organisations as it can allow them to

make better informed decisions on their target market. The following sections attempts to explain these in more detail.

9.4.1 Offerings to Theory

As this study uses the Choudrie and Dwivedi (2004b) conceptual model for broadband adoption as the basis for constructing a model specifically for South Africa, the offerings to theory are similar to the ones listed by Dwivedi (2008). In addition, the current study also contributes to literature within the South African context. The study integrates appropriate information systems (IS) literature to enhance the body of knowledge of technology adoption from a consumer perspective. The research evaluates various adoption models and integrates various factors from these models in order to study the household diffusion process.

The Shih and Venkatesh (2001) study was based on semi-structured interviews. The study recommended that researchers go one step further and employ a survey research for validating the diffusion model. This study not only responded to their call but also used semi-structured interviews to extend their proposed model. In addition, the design of the semi-structured interviews and the development and validation of the survey instrument are considered to be major contributions to scientific practice in the field (Straus et al., 2004). Although the constructs utilised in this study were adapted from prior models, the instrument to study broadband diffusion had not been developed or validated in previous studies.

Theoretical contributions can also be attributed to the utilisation of theoretical constructs such as the rate and variety of use of technologies that examine the usage patterns of broadband consumers. This study essentially addressed limitations of previous studies. Firstly, past studies lacked theoretical underpinnings as they were data driven and exploratory in nature (Dwivedi, 2008). Secondly, Choudrie and Dwivedi (2004a, b) and Dwivedi (2008) studies only adapted usage constructs from the use diffusion model to examine the differences in use between broadband and narrowband users. In contrast, this study included the use diffusion model as a separate phase within the diffusion process in order to examine the usage behaviour of consumers after they had adopted the technology.

Chapter 8 provided a discussion on the impact of broadband which suggested that the findings supported the overall assumptions made. Therefore, this research contributed to the development of theoretical understanding of the impact of broadband. Moreover, this also added to the overall development of theory in the area of ICTs in households.

9.4.2 Offerings to Industry and Policy

While the South African telecommunications industry has seen much technological advancement, it has been undermined by a low internet penetration rate, which currently stands at 10% (InternetWorldStats, 2010). The South African government has stated that the Information and Communication Technologies (ICT) industry is key for the country's development; however, regulations and policies have not always supported this stance (Francis, 2010).

The demand for broadband in South Africa is quite high; however the adoption of the technology is lower than anticipated and this particularly within the households of consumers (MyBroadband, 2010b). Broadband adoption within the country currently stands at a mere 1.4% when taking into account fixed wired connections and 7.7% for mobile wireless connections. These figures are a fraction the OECD countries average of 'households with broadband access' percentage which stands at 57.8% (MyBroadband, 2009c; MyBroadband, 2010b).

The research findings generate a number of issues that may assist policy makers and ISPs for increasing consumer adoption of broadband. Technology comfort as the strongest factor indicates that service providers need to understand that consumers who are comfortable in using broadband technology have a higher take-up rate than those who do not. For instance, ISPs should leverage off the existing comfort that consumers feel when using broadband over dialup. South African broadband users noted that the technology offered more control over their lives and was easy to learn. ISPs should therefore find ways of making non-adopters aware of this. One example is for ISPs to identify low adoption areas and set up "live stores" which allows consumers to try and test products for free. In this way service providers will be able to teach and make consumers aware of the benefits of the technology and how it can make learning a new technology a comfortable experience. Another way for service providers to increase technological comfort is through collaborative partnership between schools, business and community members by implementing new and innovative broadband solutions within communities and for area businesses.

Lack of skills has an important influence on the adoption of broadband. This study showed that a larger percentage of adopters had possessed higher skills and knowledge about the benefits of broadband than non-adopters. Skills therefore bring policy-related issues. Policy makers or regulators need to ensure that citizens are equipped with the skills to use computers and the internet. Regulators should take a segmental approach as this identifies and provides skills to those citizens that do not have opportunities to learn or use computer technologies and applications. Moreover, regulators should identify locations that can aid in increasing skills in using computer technologies. In South Africa, most public libraries have internet access, however not all citizens visit them regularly. As an alternative, regulators should introduce internet access in more public areas such as shopping malls.

The study showed that South African consumers with higher education levels were more likely to adopt broadband technology. The majority of adopters possessed an undergraduate and postgraduate education. This was in contrast to the non-adopters where the majority possessed a Matric Exemption or high school diploma. Therefore, strategic focus should shift to those without higher education. Government could also offer community run computer courses for those who are out of school but cannot afford territory education.

Hedonic outcomes are an important factor that influences broadband adoption and is related to the entertainment utility of broadband. While the hedonic outcomes construct predicted broadband adoption in South Africa, the construct still had a lower significance level as compared to the technology comfort and skills factors. As mentioned previously, possible reasons for this is that with the new generation of online gamers, file-swapping and online music and video streaming enthusiasts speed and quality of broadband connections are paramount (Goldstuck, 2005). From an infrastructure perspective, if these are not met then consumers will not find broadband worthwhile as a medium for entertainment purposes. It was found that regulation affects human behaviour of file sharing (music, videos and applications) in peer-to-peer applications. As such, legal regulation may hinder consumers realising the entertainment potential of broadband. Policy makers should then ensure that consumers are made aware of recent regulations and available entertainment services. In addition, service and content providers should run advertising campaigns with the aim to develop positive attitudes of consumers towards paid entertainment services and applications using high-speed connectivity. Running these advertising campaigns may also make non-adopters aware of the entertainment capabilities of broadband.

Even though broadband prices are decreasing, price plans in South Africa are still too expensive for some consumers. Contract and installation fees are a barrier to broadband subscription and as a result the high cost of broadband services has a significant influence on broadband adoption. It is suggested that service providers eliminate contract periods tied to broadband subscriptions and offer free installation for first time adopters. Service providers should also consider alternate price plans by differentiating and segmenting packages. For example, service providers can offer different packages with different prices ranges based on income levels of consumers. Findings from this research shows that high income levels of consumers do not have an issue with cost of broadband services. Therefore, service providers should offer faster speeds and appealing content to these consumers when segmenting. In other words, service providers should offer more consumer-centric services and alternate price plans so that all consumers who want to subscribe to broadband can do so.

Moreover, South Africa has seen the launch of the SEACOM undersea cable which saw the end of incumbent Telkom's monopoly on international bandwidth with its SAT3 cable. However, even though prices have been decreasing as a result, costs of bandwidth are still far too expensive in South Africa when compared to first world

countries. Most consumers perceived that the cost of acquiring a new PC and subscribing to broadband is too high. If ISPs do offer contract packages, then a good idea would be to offer an option of including financed PCs in the consumer's subscription. This would be particularly useful for lower income earners who cannot afford the once-off cost of PCs. Moreover, regulators could assist in the process by maybe subsidising the cost of PCs. In this way, government can contribute to the digital economy by reaching underserved areas.

The sustained adoption phase of this study concluded that six independent variables significantly influence a consumer's usage pattern. It should be noted that regulators and service providers cannot assist in the usage of broadband as it is up to the unique usage habits of individuals when making use of the technology. However, addressing issues around consumer frustration and service quality in terms of better speeds, cheaper prices and good customer and technical support will have a greater positive impact on consumer's usage patterns.

Finally, the categorising of adopters into the four use-diffusion categories provides an effective way to segment markets for high-tech products.

9.5 Research Limitations

As this research adopted first a qualitative approach to propose a model of broadband diffusion for households of South Africa, one of the limitations of this research was the researchers' lack of experience in qualitative research. This may have impacted on the collection of the in-depth data which was critical for a qualitative research project. To reduce potential interpretation bias, the researcher presented the notes taken during the interview session to the subjects, showing excerpts of the researcher's interpretation of their interviews.

In order to avoid bias from an interviewee perspective, the personal views of the researcher were not mentioned during the interview, and the constructs of the research model used were also not introduced initially. However, the possibility of a biased response by the respondents should not be ruled out completely.

There were also limitations around the distribution of the questionnaire which mainly focused on the Western Cape Province. The results will not be representative of the total broadband market of South Africa. In addition, the researcher had only acquired 177 responses. To accommodate the low response rate, a 90% confidence interval was selected which allowed for the decrease of the significance level from 0.05 to 0.1.

Data that were normally distributed were included with non-normal data. It was then necessary to analyse the normal data with non-parametric tests. As a result, in cases where parametric tests would have been appropriate, non-parametric tests have less power as it is proven that parametric tests produces stronger results than that of non-parametric tests. This potentially resulted in finding fewer significant factors.

Lastly, the categorisation of Student with that of Clerks & Administrative Workers, when testing the effect of occupation on broadband adoption, was incorrectly performed. The researcher believes that, if the Student category was separated from the Clerks & Administrative Workers then this would yield positive results. It is believed that occupation may have an impact on perceived behavioural control and broadband adoption.

9.6 Future Research Directions

One of the main limitations of this study was the low survey response rate and the regional limitation to broadband consumers of South Africa only within the Western Cape region.. It is therefore suggested that a larger survey within the broader South African population be undertaken.

Due to a high mobile phone penetration rate in South Africa, there are also a number of people who are accessing mobile broadband data services in the rural areas of South Africa. These users may not have the same income and education levels as the sample of this study. As such, future research may be deemed important to investigate the use of mobile broadband data services in more rural parts of South Africa.

Furthermore, the proposed model for broadband diffusion can be used for other research studies particularly looking at emerging markets and economic impacts of broadband services on countries within the African continent. As such, a cross-cultural approach can be used when understanding broadband across other countries. Cross-cultural analysis can also be applied when investigating broadband diffusion in other emerging markets of the world.

This study focused on unravelling demand side issues as broadband growth was constrained due to consumers being reluctant to subscribe to the technology. As such it was noted that investigating supply side issues was out of scope of this research study. Supply side issues in terms of infrastructure developments, policies and regulations also contribute to the lack of broadband uptake in the country. It is therefore recommended that future research also focus on investigating supply side issues in order to gain a holistic perspective of both sides.

Due to time constraints a cross-sectional study was performed. It is therefore recommended that for future research a longitudinal study be performed. As a result, limitations to fully study the impact of broadband would be overcome. In particular the feedback loop which was out of scope of this research study. In addition, a longitudinal research will also help in identifying in greater detail the actual usage habits of broadband users over time.

Finally, over the years the impact of broadband has become a very broad area of research. There is a need to research specific areas such as new communication applications and downloads and entertainment, to name a few, on an individual basis

in order to determine the real impact of broadband. Moreover, other specific areas such as diffusion and sustainability of broadband technology, family and work life, social networks and online security and privacy will need to be explored.

9.7 Chapter Summary

This chapter provided an overview and conclusion to the results and discussions of the research study. The contents of each chapter were discussed and how the chapters had met each of the objectives of this study. This was followed by drawing together the main conclusions of this research. A discussion of the research contributions and implications that this research has made in terms of theory, policy and practice was presented which was followed by a list of research limitations. Finally, the chapter and thesis ends with a brief discussion on future research directions in the area of broadband diffusion.

Appendix

A

Broadband Pricing

1GB Bundle	Local Speed (Kbps)	International Speed (Kbps)	Average Speed (Kbps)	Cost/pm	GB	Cost/Mbps/GB
ADSL 4 Mbps	2950	1971	2461	R 1034	10	R 43
ADSL 4 Mbps	2950	1971	2461	R 685	5	R 57
NeoConnect Prime	1020	691	856	R 599	10	R 72
Neotel NeoFlex	1050	832	941	R 699	10	R 76
Telkom HSDPA	2570	1038	1804	R 1499	10	R 85
Telkom HSDPA	2570	1038	1804	R 489	3	R 93
ADSL 4 Mbps	2950	1971	2461	R 693	3	R 96
Telkom HSDPA	2570	1038	1804	R 349	2	R 99
iBurst WiMax	1030	989	1010	R 1040	10	R 105
Neotel NeoFlex	1050	832	941	R 499	5	R 109
NeoConnect Prime	1020	691	856	R 499	5	R 119
Telkom HSDPA	2570	1038	1804	R 219	1	R 124
Telkom WiMax	590	510	550	R 730	10	R 136
MTN HSDPA	1550	1241	1396	R 389	2	R 143
iBurst WiMax	1030	989	1010	R 760	5	R 154
Vodacom HSDPA	1420	1045	1233	R 389	2	R 162
Vodacom HSDPA	1420	1045	1233	R 589	3	R 163
Vodacom HSDPA	1420	1045	1233	R 989	5	R 164
Vodacom HSDPA	1420	1045	1233	R 1989	10	R 165
iBurst Wireless	630	569	600	R 999	10	R 171
Telkom WiMax	590	510	550	R 479	5	R 178
iBurst Wireless	630	569	600	R 599	5	R 205
MTN HSDPA	1550	1241	1396	R 289	1	R 212
Vodacom HSDPA	1420	1045	1233	R 289	1	R 240
ADSL 384	350	309	330	R 773	10	R 240
Telkom WiMax	590	510	550	R 389	3	R 241

1GB Bundle	Local Speed (Kbps)	International Speed (Kbps)	Average Speed (Kbps)	Cost/pm	GB	Cost/Mbps/GB
ADSL 512	420	367	394	R 947	10	R 246
iBurst Wireless	630	569	600	R 449	3	R 256
ADSL 4 Mbps	2950	1971	2461	R 623	1	R 259
ADSL 384	350	309	330	R 522	5	R 324
NeoConnect Prime	1020	691	856	R 279	1	R 334
iBurst Wireless	630	569	600	R 199	1	R 340
ADSL 512	420	367	394	R 696	5	R 362
ADSL 384	350	309	330	R 432	3	R 448
ADSL 512	420	367	394	R 606	3	R 526
Telkom WiMax	590	510	550	R 319	1	R 594
ADSL 384	350	309	330	R 389	2	R 604
ADSL 384	350	309	330	R 330	1	R 1026
ADSL 512	420	367	394	R 536	1	R 1395

Table 75: Comparison of Broadband Pricing in South Africa in 2009 (Source: MyBroadband, 2009a)

2GB broadband service					
Service	**Speed**	**Router & Setup**	**Monthly**	**Top-Up**	**Total 12 month cost**
Cell C	7.2 Mbps	R1,499	Included	39c/MB	R1,499
iBurst Wireless	1 Mbps	R1699 (modem) + R99 (setup)	R198	R69/GB	R4,174
Neotel NeoConnect Prime	2.4 Mbps	Included	R399 (2.5 GB)	8c/MB	R4,799
Telkom Mobi	7.2 Mbps	R823	R349	30c/MB	R5,011
Vodacom HSPA	14/21 Mbps	R1139	R389 (2 GB)	R2.00/MB	R5,807
MTN HSPA	7.2 Mbps	R1200	R389	R0.19/MB	R5,868
Telkom ADSL	384 Kbps	R627.23 (installation) + R899 (router)	R133.30 (line rental)+ R152 (DSL384) + R128 (data)	R49/GB	R6,486
Telkom 4/10 Mbps ADSL	4/10 Mbps	R627.23 (installation) + R899 (router)	R133.30 (line rental)+ R412 (4/10 Mbps) + R128 (data)	R49/GB	R9,606
5 GB broadband service					
Cell C	21 Mbps	R2,999	Included	39c/MB	R2,999
Neotel NeoConnect Prime	2.4 Mbps	Included	R499	8c/MB	R5,988
Neotel NeoFlex	3.1 Mbps	Included	R499	8c/MB	R5,988
Telkom ADSL	384 Kbps	R627.23 (installation) + R899 (router)	R258 (DSL384 + data) + R133.30	R49/GB	R6,222
iBurst Wireless	1 Mbps	R1699 (modem) + R99	R445	R59/GB	R7,138

		(setup)			
Telkom Mobi	7.2 Mbps	R823	R749	30c/MB	R9,811
Telkom ADSL	4/10 Mbps	R627.23 (installation) + R899 (router)	R133.30 (line rental) + R413 (4/10 Mbps) + R149 (data)	R49/GB	R9,870
MTN	7.2 Mbps	R1200	R973	R0.19/MB	R12,876
Vodacom	14/12 Mbps	R1139	R989	R2.00/MB	R13,007

Table 76: Comparison of Broadband Pricing in South Africa in 2010 (Source: MyBroadband, 2010c)

B

Qualitative Study Ethics Form

Ethics Committee Submission: Faculty of Commerce, University of Cape Town, 2007

Ethics in Research

Any individual in the Faculty of Commerce at the University of Cape Town undertaking any research that involves the use of human subjects, or research that may hold ethical consequences for the University of Cape Town, is required to complete this form. The completed form should be submitted to the Ethics Committee in the Faculty of Commerce, and should be accompanied by the following:

1. **A full copy of the research proposal**

2. **The consent form that will be signed by the participants (if no consent form is being used, then the applicant must provide a motivation as to why this is the case)**

3. **Any interview schedules, forms, instruction sheets or other material that will be used in the study.**

A. PROJECT TITLE: A Model for the State of Broadband Diffusion in Households of South Africa

A.1. Name of Principal Investigator: Mogen Naidoo

A.2. Name of Co-Investigator/s: Dr. Lisa Seymour

A.3. Primary research methodology (outline the main research tool being use i.e. interviews, experiments, secondary data use etc):

This study follows a cross sectional time frame, in which data is collected within a single point in time. It uses an interpretative paradigm. Semi-structured interviews with a balance between open-ended and structured questions will be used to collect the data required for the research. A pilot study will be carried out to test the interview questions and obtain feedback on their clarity and flow.

The data analysis will be undertaken to group and discuss the collected data. Data coding will divide the data into themes and patterns to structure the data into a framework based on the global Model for Broadband Adoption in the Household. Triangulation of interviews and the inclusion of audit trails will be used to improve the validity and reliability of this investigation.

B. CHARACTERISTICS OF STUDY PARTICIPANTS:

In this section, please describe the characteristics of the individuals who will be participating in the study. (This includes interview respondents, experimental subjects etc). *(If additional space is needed for an item, use a separate sheet)*

B.1. Sex, race or ethnic group, age range, location etc.

Sex: Male and Female

Race: No restrictions (not asked)

Age Range: Adult (18 years and older)

Location: Cape Town

B.2. Affiliation of subjects, e.g., institutions, hospitals, general public, etc.

Residential households

B.3. If human subjects are either children (aged 15 and below), mentally incompetent, or legally restricted groups please explain why it is necessary to use these particular groups

Not applicable

C. TYPE OF CONSENT

C.1. What type of consent will be obtained from study participants?

Oral consent **Written consent√** **Other (specify)_____**

C.2. If participants are required to sign a written consent form, please submit a copy of the consent from with your application. If there is no written consent, please provide a motivation as to why this is not the case.

A cover letter will be given to the respective sample to obtain consent before an interview can take place. The cover letter is attached in Appendix A.

C.3. How and where will consent/permission be recorded?

During interviews, the consent will be recorded at the place where the interviews are being carried out. The participant will sign the participation form as shown at the bottom of the consent form, APPENDIX A.

C.4. If subjects are minors or mentally incompetent, describe how and by whom permission will be granted?

Not applicable

D. CONFIDENTIALITY OF DATA

D.1. What precautions will be taken to safeguard identifiable records of individuals? These questions also apply if you are using secondary sources of data. Please describe specific procedures to be used to provide confidentiality of data by you and others, in both the short and long run.

Personal details of participants such as name, address and telephone numbers will not be asked in the questionnaires and interviews. Participants will be purposively chosen and the researcher is the only person who will have access to primary data collected.

E. RISKS TO SUBJECTS

E.1. Describe in detail the extent of any physical, psychological, social, legal, economic, or other risks to study participants you can foresee, both immediate and long range, and provide the rationale for the necessity of such risks.

Not applicable

E.2. Where possible, outline any alternative approaches that were or will be considered and why alternatives may not be feasible in the study. Also outline whether and why you feel that the value of information to be gained outweighs the risks?

Not applicable

E.3. ADDITIONAL COMMENTS:

SIGNATURE:_____

DATE:_____

C

Semi-Structured Interviews

Department of Information Systems
Leslie Commerce Building, Engineering Mall, Upper Campus
OR Private Bag. Rondebosch 77001
Tel: (021) 650-2261
Fax No: (021) 650-2280

INTERVIEW PARTICIPATION CONSENT FORM

One of the partial requirements for completing a Master's degree in Information Systems at the Department of Information Systems in the Faculty of Commerce at the University of Cape Town is the completion of a dissertation research project.

The researcher, in this case Mogen Naidoo, has chosen to perform a study entitled "**A Model for the State of Broadband Diffusion in Households of South Africa**".

The research objectives of this study are to determine:

1. What factors affect a South African consumers' decision to adopt broadband?
2. How do South African consumers use broadband?
    a. What factors affect the way they use broadband?
3. What impact does broadband have on South African consumers?
    a. How does this affect their future use of the technology?

An issue that is of utmost importance to the researcher, the department, the faculty and the University of Cape Town at large is research ethics. Consequently, the researcher guarantees the confidentiality and anonymity of the details and comments you provide, which will strictly be used for the sole purpose of the aforementioned research report.

Furthermore, your participation in this study is entirely voluntary. You may choose to be excluded from the study at any point in time without incurring any adverse consequences. If you so choose to be involved with this research project, please sign the consent form below.

Mogen Naidoo
Masters Student
Email: ndxmog006@uct.ac.za
UCT – Department of Information Systems
Phone: (072) 424 0044

Dr. Lisa Seymour
Supervisor
Email: lisa.seymour@uct.ac.za
UCT – Department of Information Systems
Phone: (021) 650 4259

PARTICIPANT CONSENT FORM

By signing this participant consent for, you are agreeing to participate in this research project. Should you wish to contact the researcher for any reasons whatsoever, please do not hesitate to email him at ndxmog006@uct.ac.za or call him on 072 424 0044.

Contact Name: _____

Signature: _____

Date: _____

INTERVIEW QUESTIONS: CONSUMERS

Determinants of Initial Adoption

Opening: By signing the participant consent form, you are agreeing to participate in a research project conducted by myself as part of the partial requirements for the course entitled Master's in Information Systems in the Faculty of Commerce at the University of Cape Town. This interview will take approximately 45-60min of your time depending on your responses. Your input is most appreciated.

NAME: _____ **DATE:** _____

Age Group: ☐ 18 – 30 yrs ☐ 31 – 40 yrs ☐ 41 – 50 yrs ☐ Other: _____

Disposable Income: ☐ < R5000 ☐ 5000 – 10 000 ☐ 10 001 – 20 000 ☐ 20 001 – 30 000 ☐ 30 000+

Formal Education: _____

Occupation: _____

1. Can you please tell me what your level of computer literacy is? What knowledge do you have about using the PC and the Internet?

None whatsoever	
Use Windows, MS Office (File Explorer, Excel, Word) and/or the Internet	
Do the above and operate a few other applications (e.g. MS Messenger, accounting software, imaging software	

Do all of the above, design web pages, communicate with Skype, build own PC, perform own troubleshooting	
Either a technical support officer, computer programmer, computer engineer and earn a living in the computer industry	

1.1 And how did you acquire this level of computer literacy?

1.2 Why did you acquire this level of computer literacy? (If consumer intended to study or self-taught)

1.3 In your opinion how do you think one's computer literacy level should be in order to use the PC and Internet?

2. Can you describe what current broadband service offerings that you are aware of in the South African market today?

2.1 Please tell me why are you aware or not aware of this?

2.2 How were you made aware of this (If they have knowledge of broadband services available?)

2.3 How do you think that a consumer should be made aware of the broadband services available to them?

3. Are you a subscriber of (a) broadband service(s)? If so, what type of broadband service(s) do you subscribe to? (Non-Adopters to answer Questions 7 and Questions 8)

3.1 Why did you choose this particular service?

3.2 How did you go about choosing this particular service?

3.3 In your opinion can you tell me how you think that one should be able to choose a broadband service?

4. What influenced you to acquire this broadband service for your household?

4.1 Why were you influenced to acquire broadband services?

4.2 How were you influenced to acquire broadband services?

4.3 How do you think that one should be influenced to acquire broadband services for the consumer household?

5. So what advantages or benefits do you feel that broadband provides for you?

5.1 Why do you say that broadband provides you with these advantages or benefits?

5.2Can you tell me how does your broadband service(s) provide these advantages or benefits to you? How is it advantageous over your previous mode of internet access?

5.3 In your opinion can you tell me what advantages or benefits should broadband be able to provide to consumers? And how should broadband services provide these to consumers?

6. Now that you have broadband are there any disadvantages that your broadband service(s) provide? What does your broadband not fulfil?

6.1 Why do you feel that your broadband service(s) provide these disadvantages?

6.2 How does your broadband service(s) provide these disadvantages?

6.3 Based on your experiences with your broadband service(s) how do you think broadband service(s) should broadband avoid these disadvantages?

NON-ADOPTERS

7. What influenced you to NOT acquire broadband service(s) for your household?

7.1 Please tell me why were you influenced to NOT acquire broadband services?

7.2 How were you influenced to NOT acquire broadband services?

7.3 In your opinion how do you think that one should be influenced to acquire broadband services for the consumer household?

8. What do you think will make you acquire broadband service(s) for your household?

8.1 Why do you think this will make you acquire broadband service(s)?

8.2 How will this make you acquire broadband service(s) for your household?

8.3 Please tell me, in your opinion, what should make a consumer acquire broadband service(s) for their household? And how should this make them acquire broadband service(s)?

Closing (Non-adopters only): Thank you for the time and energy you have spent participating in this study. Your contribution has been most valuable. I would like to assure you once again that your details will remain confidential and your comments will only be used for the academic purposes of this study.

INTERVIEW QUESTIONS: USERS

Determinants of Sustained Adoption

Opening: By signing the participant consent form, you are agreeing to participate in a research project conducted by myself as part of the partial requirements for the course entitled Master's in Information Systems in the Faculty of Commerce at the University of Cape Town. This interview will take approximately 45-60min of your time depending on your responses. Your input is most appreciated.

NAME: _____ **DATE:** _____

Age Group: ☐ 18 – 30 yrs ☐ 31 – 40 yrs ☐ 41 – 50 yrs ☐ Other: _____

Disposable Income: ☐ < R5000 ☐ 5000 – 10 000 ☐ 10 001 – 20 000 ☐ 20 001 – 30 000 ☐ 30 000+

Formal Education: _____

Occupation: _____

1. Can you please tell me what your level of computer literacy is? What knowledge do you have about using the PC and the Internet? (Ignore this question if Consumer. Proceed to Question 2)

None whatsoever	
Use Windows, MS Office (File Explorer, Excel, Word) and/or the Internet	
Do the above and operate a few other applications (e.g. MS Messenger, accounting software, imaging software	
Do all of the above, design web pages, communicate with Skype, build own PC, perform own troubleshooting	
Either a technical support officer, computer programmer, computer engineer and earn a living in the computer industry	

1.1 And how did you acquire this level of computer literacy?

1.2 Why did you acquire this level of computer literacy? (If consumer intended to study or self-taught)

1.3 In your opinion how do you think one's computer literacy level should be in order to use the PC and Internet?

2. For what activities do you use your broadband service(s)?

2.1 Why do you need broadband for these activities?

2.2 Can you explain to me how you use broadband for these activities?

2.3 How do you think, in your opinion, that consumers should use broadband for these activities? How should broadband be improved or bettered to accommodate these activities more efficiently?

3. Are there any factors that affect the way you use broadband for your activities? If so, what are they?

3.1 Can you describe why and how these factors affect the way you use broadband?

3.2 Briefly describe how you think you should be affected in the way you use broadband for your activities?

4. Now that you have acquired and been making use of broadband, can you please describe the amount of time that you spend online using broadband to access the internet?

4.1 Can you tell me how and why you spend this amount of time using broadband to access the Internet?

4.2 How do you think a consumer should spend their time using broadband to access the internet?

5. Are there any factors that affect the amount of time you spend online? (Can be affected by increasing or decreasing) **If so, what are they?**

5.1 Can you explain to me why and how these factors affect your time spent online?

5.2 How do you think that these factors should affect your time being spent online?

6. What is the level of communication in your household? That is, in what ways do you and your family communicate with each other using the Internet? What is the technological makeup of your household?

6.1 Why and how do you think this level of communication in your household exists?

6.2 In your opinion what do you think the ideal level of household communication should be?

7. What level of communication exists outside your household? That is, in what ways do you communicate with others outside your household via the internet (e.g. Messenger, VoIP, Online Gaming)? What media are you and your family exposed to?

7.1 Why and how do you think this level of communication exists?

7.2 In your opinion what do you think the ideal level of outside communication should be when using broadband?

8. Are there any technologies that complement the use of your broadband service? That is, what technology adds value to using your broadband service?

8.1 Why and how is this so?

9. What external technology do you have access to that gives you access to high speed internet?

9.1 Why do you need this external technology access?

9.2 How are you connected to these external technologies to access high speed internet?

10. What was your experience with using the internet prior to using broadband?

10.1 Why and how did this experience come about?

10.2 In your opinion how should one's experience be before using broadband?

11. Please describe the service quality you receive from your service provider?

11.1 Why do you feel that you receive this type of quality from your service provider?

11.2 Briefly describe what service quality should be expected from a broadband service provider?

12. What frustrates you when using broadband?

12.1 Why and how does it frustrate you?

12.2 In your opinion what should be done to lessen this frustration?

13. Do you think that you have become more innovative once you started using broadband?

13.1 Why and how is this so?

13.2 In your opinion, ideally how should one's innovativeness be with their use of broadband?

Impact of Broadband

14. What impact has broadband had on your lifestyle and your family's lifestyle?

14.1 Why and how has this had an effect on your lifestyle and your family's lifestyle?

14.2 How should broadband ideally affect your lifestyle and your family's lifestyle?

15. Do you get a sense of satisfaction when using broadband? If so, briefly describe why you get this sense of satisfaction?

16. Now that you have access to high speed internet, what impact has this had on your interests for future technologies?

16.1 Why?

17. What impact has broadband had on your overall experience and use patterns?

17.1 Why and how is this so?

17.2 How, in your opinion, should broadband impact on a consumers overall experience and use patterns?

Closing: Thank you for the time and energy you have spent participating in this study. Your contribution has been most valuable. I would like to assure you once again that your details will remain confidential and your comments will only be used for the academic purposes of this study.

D

Quantitative Study Ethics Form

Commerce Faculty Ethics in Research Committee

Any individual in the Faculty of Commerce at the University of Cape Town undertaking any research that involves the use of human subjects, or research that may hold ethical consequences for the University of Cape Town, is required to complete this form. The completed form should be submitted to departmental Ethics Committee representatives for submission to the Commerce Faculty Ethics in Research Committee

1. PROJECT DETAILS		
Project title:	Broadband Diffusion in Households of South Africa	
Principal Researcher/s:	Mogen Naidoo	Research Supervisor / Co-researchers: Dr. Lisa Seymour
E-Mail Address:	NDXMOG006@uct.ac.za	
Brief description of the project: This study is the third and final part of an ongoing research project undertaken as part of the Masters dissertation. It aims to ultimately expand and enhance the proposed model for broadband diffusion within the South African household context. Through quantitative analysis it aims to determine the following: What factors affect a South African consumers' decision to adopt broadband? How do South African consumers use broadband?		

What factors affect the way they use broadband?

What impact does broadband have on South African consumers?

How does this affect their future use of the technology?

Research methods and procedure: (please tick and explain procedure)

□ Interviews ☑ Survey questionnaire □ Experiment □ Secondary data □ Observation □ Other (please specify):

The questionnaire (included) contains a total of 14 questions. The questions were divided into four broad categories:

(SECTION A) multiple choice questions addressing the social attributes (demographic variables) including age, education, occupation and income;

(SECTION B) 7-point Likert scale questions to assess the perception of the adopters and non-adopters of broadband;

(SECTION C) to assess the consumers usage of broadband by (1) determining the consumers usage of time upon various activities and (2) 7-point Likert scale questions to assess the determinants of use;

(SECTION D) 7-point scale to assess the impact of broadband based on their lifestyles and satisfaction as well as a 4-point Likert scale to assess the consumers interest in future technologies.

For the pilot study a further set of questions (included at the end of the questionnaire) will be sent out to 20 respondents particularly those in educational institutes and/or industry who have experience in research studies in order to get a more professional opinion on the structure and content of the questionnaire.

2. PARTICIPANTS

Characteristics of participants:

Gender:	Male and Females
Race / Ethnicity:	All races
Age range:	18 years and older
Location:	Western Cape, Cape Town (CBD and surrounding areas)
Other:	N/A

Affiliations of participants: (please tick)

□ Company employees □ Hospital employees ☑ General public □ Military staff □ Farm workers □ Students □ Other (specify)

If your sample includes children (aged 15 and below), mentally incompetent persons, or legally restricted groups please explain on a separate page why it is necessary to use these particular groups

3. ORGANISATIONAL PERMISSION

If your research is being conducted within a specific organisation, please state how organisational permission will be obtained:

4. INFORMED CONSENT

What type of consent will be obtained from study participants?

Oral consent

Written consent

Anonymous survey questionnaire (covering letter required, no consent form needed)

Other (specify): _____

An anonymous survey questionnaire will be used to study the participants.

How and where will consent/permission be recorded?

Participants will be verbally asked to partake in the research study. If the participant agrees, the participant will be handed a consent form (included) to sign at the place where the survey is being conducted.

If subjects are minors or mentally incompetent, describe on a separate page how and by whom permission will be granted?

5. CONFIDENTIALITY OF DATA

What precautions will be taken to safeguard identifiable records of individuals? Please describe specific procedures to be used to provide confidentiality of data by you and others, in both the short and long run. This question also applies if you are using secondary sources of data.

Personal details of participants such as name, address and telephone numbers will not be asked in the questionnaires and interviews. Participants will be randomly chosen and the researcher is the only person who will have access to primary data collected. The email address required for the lucky draw will be stored separately from the rest of the data collected.

6. RISK TO PARTICIPANTS

Does the proposed research pose any physical, psychological, social, legal, economic, or other risks to study participants you can foresee, both immediate and long range? (tick one)

□ Yes ☑ No

If yes, answer the following questions on a separate page:

Describe in detail the nature and extent of the risk and provide the rationale for the necessity of such risks

7. intended dissemination of research findings

Have you discussed authorship issues with your co-researchers or supervisor? (tick one)

□ Yes ☑ No

If yes, what did you agree?

PLEASE ATTACH THE FOLLOWING DOCUMENTS TO YOUR APPLICATION

A full copy of the research proposal

Any consent form that will be signed by the participants or read to them (if any)

Any interview schedules, cover letters, forms, instruction sheets, survey questionnaires or other material that will be used in the study.

I certify that that the material contained herein is truthful and that all co-researchers and supervisors are aware of the contents thereof:

Applicant's signature: Mogen Naidoo (NDXMOG006) Date: 05/09/2008

E

Survey Instrument

Department of Information Systems

Leslie Commerce Building, Engineering Mall, Upper Campus
OR Private Bag. Rondebosch 77001
Tel: (021) 650-2261
Fax No: (021) 650-2280

SURVEY PARTICIPATION CONSENT FORM

One of the partial requirements for completing a Master's degree in Information Systems at the Department of Information Systems in the Faculty of Commerce at the University of Cape Town is the completion of a dissertation research project.

The researcher, in this case Mogen Naidoo, has chosen to perform a study entitled "**A Model for the State of Broadband Diffusion in Households of South Africa**".

The research objectives of this study are to determine:

1. What factors affect a South African consumers' decision to adopt broadband?
2. How do South African consumers use broadband?
    a. What factors affect the way they use broadband?
3. What impact does broadband have on South African consumers?
    a. How does this affect their future use of the technology?

An issue that is of utmost importance to the researcher, the department, the faculty and the University of Cape Town at large is research ethics. Consequently, the researcher guarantees the confidentiality and anonymity of the details and comments you provide, which will strictly be used for the sole purpose of the aforementioned research report.

Furthermore, your participation in this study is entirely voluntary. You may choose to be excluded from the study at any point in time without incurring any adverse consequences.

Mogen Naidoo
Masters Student
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UCT – Department of Information Systems
Phone: (072) 424 0044

Dr. Lisa Seymour
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Definitions and Acronyms

3G/HSDPA	3G is a more robust connection for mobile phones offering the opportunity to surf the internet and send and receive large emails and attachments. It will also allow you to do video calls. HSDPA High-Speed Downlink Packet Access. Also known as 3.5G, being the next generation of 3G. HSDPA is a mobile telephony protocol providing high data transmission speeds to mobile devices. Speeds range between 1-7mbps.
ADSL	Asymmetric Digital Subscriber Line (ADSL) is a form of DSL, a data communications technology that enables faster data transmission over copper telephone lines than a conventional modem can provide
Bandwidth	Bandwidth is how fast data transfers on a given transmission path. It is expresses in bits per second (bps). Web hosting businesses can provide you with summaries of bandwidth consumption.
Dial-up	A connection made between computers using the telephone system and a modem. (Quite slow compared to broadband)
ISP	This is an acronym for an Internet Service Provider. These are organizations or companies that provide people with network connectivity to the Internet.
MXit	MXit (pronounced "mix it") is a free instant messaging software application developed in South Africa that runs on GPRS/3G mobile phones with java.
PC	Personal Computer (can also be your personal laptop)
Skype, MSN Messenger	A piece of desktop software and service that provides VoIP — Voice over IP — calling between users.
SMS	Short Message Service. Commonly known as text messages, they are short messages that can be sent to a mobile phone.
Video Conferencing	Using a computer, video camera, and network such as the Internet, to conduct a live conference between two or more people.
VoIP	Voice over Internet Protocol. The technology used to transmit voice conversations over a data network using the Internet Protocol (WWW, Internet). Such data network may be the Internet or a corporate Intranet network.
WiFi	(Wireless Fidelity) - A radio frequency standard that is used to connect devices, such as computers, together using a wireless connection. Instead of computers being connected with network cables, signals are sent over radio frequencies using wireless network cards and hubs.
WiMAX	WiMAx is the new wireless broadband with a range of up to 80km, with a bandwith of up to 75Mbps. It is the successor to Wi-Fi.

Common definitions of "Broadband"

Broadband comes from the words "broad bandwidth" and is used to describe a high-capacity, two-way link between an end user and the Internet. Transfer rates are faster than standard dial-up.

Sometimes referred to as a high-speed internet, broadband is an 'always on' fast connection to the internet. Today there are a wide variety of broadband technologies available in most areas; most popular broadband connections are wired such as cable or DSL and wireless such as 3G/HSDPA or WiFi.

A term used in evolving digital technologies in which multiple signals share the bandwidth of a medium, such as fiber-optic cable. This allows the transmission of voice, data and video signals over a single medium.

BROADBAND DIFFUSION SURVEY

This survey will take approximately 10-20 minutes of your time. By completing this questionnaire, you give consent to participate in this research. Note that your anonymity is ensured and all answers will be treated in the strictest confidence. For any **definitions** that you are unsure about please refer to the **previous page** of this questionnaire for definitions and acronyms. Please answer ALL questions.

SECTION A

1. What is your age? _____

2. What is your highest level of education?

☐ Matric Ex./High School Diploma ☐ Degree/Technikon Diploma

☐ Honours Degree (Postgraduate) ☐ Masters Degree (Postgraduate)

☐ PhD (Postgraduate research) ☐ Other (Please specify): _____

3. What is your occupation?

☐ Legislators, Senior Officials, Directors, Managers & Owner Managers

☐ Professionals

☐ Technicians & Associated Professionals

☐ Clerks & Administrative Workers

☐ Service & Sales Workers

☐ Skilled Agricultural & Fishery Workers

☐ Skilled Workers, Craft & Related Trades

☐ Plant & Machine Operators & Assemblers

☐ Labourers & Elementary Occupations

☐ Other (Please specify): _____

4. What is your disposable monthly income?

☐ < R5000 ☐ R5000 – R10 000 ☐ R10 001 – R20 000

☐ R20 001 – R30 000 ☐ R30 000+

5. Do you have Internet access at home?

☐ Yes (Please answer the question below)

☐ No (Please proceed to SECTION B, question 7)

6. If you do have Internet access, what type of Internet access do you have?

☐ Dial-up ☐ Broadband with DSL/ADSL

☐ WiFi ☐ Mobile 3G/HSDPA

☐ WiMAX ☐ Other (Please specify) _____

SECTION B

7. Please rate each of the following statements within the 1-7 point scale.

The following statements only represent your perception about broadband. It is alright to rate them even if you **do not** subscribe to a broadband connection at home. Please answer **ALL** questions. For questions that you are not sure about select "neutral".

Please circle the appropriate option.		**Strongly Disagree**	**Disagree**	**Somewhat Disagree**	**Neutral**	**Somewhat Agree**	**Agree**	**Strongly Agree**
RA1	I feel that broadband has an advantage over dial-up/narrowband as it offers faster access to the Internet and allows for faster downloading of files	1	2	3	4	5	6	7
RA2	I feel that broadband has an advantage over dial-up/narrowband as it offers always-on access to the Internet	1	2	3	4	5	6	7
RA3	I feel that broadband has an advantage over dial-up/narrowband as it frees up the phone line whilst connected to the Internet	1	2	3	4	5	6	7

Please circle the appropriate option.		**Strongly Disagree**	**Disagree**	**Somewhat Disagree**	**Neutral**	**Somewhat Agree**	**Agree**	**Strongly Agree**
RA4	I feel that broadband has an advantage over dial-up as it allows for more multi-tasking i.e. performing tasks simultaneously and doing more things at once	1	2	3	4	5	6	7
RA5	I feel that broadband has an advantage over dial-up as certain broadband technologies can offer mobility through wireless Internet access e.g. having 3G data cards	1	2	3	4	5	6	7
RA6	I feel that broadband has an advantage over dial-up as people can access large resources from the work place at home that is not possible via dial-up.	1	2	3	4	5	6	7
HO1	I enjoy (would enjoy) using broadband to listen and download music	1	2	3	4	5	6	7
HO2	I enjoy (would enjoy) using broadband to watch and download movies	1	2	3	4	5	6	7
HO3	I enjoy (would enjoy) using broadband to play online games	1	2	3	4	5	6	7
HO4	I enjoy (would enjoy) using broadband to play online gambling/casino	1	2	3	4	5	6	7
HO5	I enjoy (would enjoy) using broadband for chat rooms and sending messages online	1	2	3	4	5	6	7
UO1	I feel that broadband can be useful to find educational materials and library resources at home	1	2	3	4	5	6	7
UO2	I feel that broadband can be useful for distance learning	1	2	3	4	5	6	7
UO3	I feel that broadband can be helpful to perform work/job related tasks at home	1	2	3	4	5	6	7

Please circle the appropriate option.		**Strongly Disagree**	**Disagree**	**Somewhat Disagree**	**Neutral**	**Somewhat Agree**	**Agree**	**Strongly Agree**
UO4	I feel that broadband can be useful in performing personal and household activities i.e. online shopping and information search.	1	2	3	4	5	6	7
UO5	I feel that subscribing to broadband is (would be) compatible with most aspects of my -life	1	2	3	4	5	6	7
UO6	I feel that subscribing to broadband allows (would allow) me to work at home and thus have more time to spend with my family	1	2	3	4	5	6	7
UO7	I feel that broadband can be helpful in establishing and operating a home business	1	2	3	4	5	6	7
UO8	I feel that broadband can help children do their homework	1	2	3	4	5	6	7
SEC1	I feel (would feel) comfortable using broadband as it offers more security features than dial-up.	1	2	3	4	5	6	7
SEC2	I feel (would feel) comfortable with the security measures provided by broadband ISPs	1	2	3	4	5	6	7
SEC3	I feel that security is relatively the same on a dial-up/narrowband connection as compared to a broadband connection	1	2	3	4	5	6	7
SEC4	It is easier to control family content with a broadband connection than with a dial-up/ narrowband connection	1	2	3	4	5	6	7
TC1	I feel (would feel) comfortable setting up a broadband connection at home.	1	2	3	4	5	6	7
TC2	I feel (would feel) comfortable setting up a wireless broadband connection as it is a mere "plug and go"	1	2	3	4	5	6	7

Please circle the appropriate option.		**Strongly Disagree**	**Disagree**	**Somewhat Disagree**	**Neutral**	**Somewhat Agree**	**Agree**	**Strongly Agree**
TC3	I feel that broadband Internet is more user friendly and easier to use than dial-up	1	2	3	4	5	6	7
TC4	I feel (would feel) comfortable using broadband Internet	1	2	3	4	5	6	7
TC5	I feel comfortable learning new broadband technologies	1	2	3	4	5	6	7
TC6	I feel (would feel) comfortable in using broadband Internet as an information tool	1	2	3	4	5	6	7
TC7	I feel (would feel) comfortable with broadband as it offers more control over my life	1	2	3	4	5	6	7
TC8	I am comfortable with the fact that broadband technologies are changing for the better	1	2	3	4	5	6	7
LOY1	I kept (would keep) the same ISP when switching from dial-up to broadband connections	1	2	3	4	5	6	7
LOY2	I will subscribe (continue to subscribe) to broadband services and will keep my current service provider well into the future	1	2	3	4	5	6	7
RK1	I do not have difficulty in explaining why adopting broadband may be beneficial	1	2	3	4	5	6	7
RK2	I know how broadband is different from dial-up or narrowband	1	2	3	4	5	6	7
RK3	I am made well aware of the benefits of broadband through media (newspapers, TV, radio)	1	2	3	4	5	6	7
RK4	I am made aware of the benefits of broadband by either working or studying in an environment	1	2	3	4	5	6	7

Please circle the appropriate option.		Strongly Disagree	Disagree	Somewhat Disagree	Neutral	Somewhat Agree	Agree	Strongly Agree
	where broadband talk is common							
RK5	I am made aware of broadband benefits through family and friends	1	2	3	4	5	6	7
RK6	I am made aware of broadband benefits by showing an interest and keeping up to date with trends in the broadband industry	1	2	3	4	5	6	7
SK1	I feel that I have the necessary computer literacy levels when using the Internet	1	2	3	4	5	6	7
SK2	I have been trained (either formally/informally) in using the PC and Internet therefore having the skill set to use broadband	1	2	3	4	5	6	7
N1	Broadband can help fulfil my communication needs such as email, chats and web cam communication (e.g. Skype, MSN Messenger, MXit)	1	2	3	4	5	6	7
N2	Broadband can help fulfil my entertainment needs such as online gaming, music/video streaming	1	2	3	4	5	6	7
N3	Broadband can help fulfil my multitasking needs where I can run more applications at once	1	2	3	4	5	6	7
N4	Broadband can help fulfil my surfing needs for information search	1	2	3	4	5	6	7
N5	Broadband can help fulfil my surfing needs for product purchasing	1	2	3	4	5	6	7
N6	Broadband Internet can help fulfil my storage needs by storing large files online for later retrieval	1	2	3	4	5	6	7
C1	My current income level is enough to afford subscribing to broadband	1	2	3	4	5	6	7

Please circle the appropriate option.		**Strongly Disagree**	**Disagree**	**Somewhat Disagree**	**Neutral**	**Somewhat Agree**	**Agree**	**Strongly Agree**
C2	Even with the current price drops I believe that the cost is still too high taking into account the speed to price ratio of broadband	1	2	3	4	5	6	7
C3	I would be able to subscribe to broadband if I wanted to	1	2	3	4	5	6	7
C4	It is not too costly for me to subscribe to broadband at its current subscription fee	1	2	3	4	5	6	7
BC1	With broadband I am (would be) able to view richer web pages in terms of animations and flash videos, stream videos and video conference.	1	2	3	4	5	6	7
BC2	There is software available for me to fully make use of broadband and its content provided	1	2	3	4	5	6	7
INF1	I have the necessary infrastructure in place (such as a telephone line at home or wireless towers in the area) in order to subscribe to broadband technology (such as ADSL, WiMAX or 3G/HSDPA)	1	2	3	4	5	6	7
INF2	It is easy for me to obtain broadband equipment from service providers that will work on existing infrastructures at my home	1	2	3	4	5	6	7
PC1	I feel that the lack of owning a PC discourages (will discourage) me from subscribing to broadband	1	2	3	4	5	6	7
PC2	I feel that it is not too costly for me to purchase a new PC or upgrade my old PC in order to subscribe to broadband	1	2	3	4	5	6	7
PC3	My current PC is good enough to access the Internet							

Please circle the appropriate option.		Strongly Disagree	Disagree	Somewhat Disagree	Neutral	Somewhat Agree	Agree	Strongly Agree
SN1	My friends influenced (influence) me to subscribe to broadband at home	1	2	3	4	5	6	7
SN2	My family members influenced (influence) me to subscribe to broadband at home	1	2	3	4	5	6	7
SN3	My work colleagues influenced (influence) me to subscribe to broadband	1	2	3	4	5	6	7

SECTION C

8. Please rate each of the following statements within the 1-7 point scale.

This section only applies to those who have subscribed and currently making use of broadband technologies in their households. For non-subscribers of broadband please proceed to SECTION D - Question 13. Please answer **ALL** questions. For questions that you are not sure about select "neutral".

Please circle the appropriate option		Strongly Disagree	Disagree	Somewhat Disagree	Neutral	Somewhat Agree	Agree	Strongly Agree
HSC1	I tend to communicate with more knowledgeable people in my family when experimenting with new things related to broadband	1	2	3	4	5	6	7
HSC2	I tend to consult with more knowledgeable people in the family when having difficulties with broadband.	1	2	3	4	5	6	7
HSC3	We sometimes have clashes in the family with regards to having limited resources (devices) available for broadband use	1	2	3	4	5	6	7

HSC4	I feel that having prior experience with dial-up connections or other previous Internet access has increased my family's experience and made the learning curve with broadband easier	1	2	3	4	5	6	7
TD1	I feel that although broadband is more sophisticated than previous dial-up/narrowband connections, it is easier to use	1	2	3	4	5	6	7
TD2	I feel that broadband is more sophisticated than dial-up and allows the me to access content and material that I would not be able to obtain with dial-up connections	1	2	3	4	5	6	7
TD3	From the list below please select all the devices (complementary technologies) that accesses the broadband connection at home: ☐ PC ☐ Laptop ☐ Mobile phones ☐ Video games consoles ☐ IP phone (e.g. Skype phone) ☐ Satellite boxes ☐ Other (Please specify) _____							
Please circle the appropriate option		**Strongly Disagree**	**Disagree**	**Somewhat Disagree**	**Neutral**	**Somewhat Agree**	**Agree**	**Strongly Agree**
TD4	Having the above complementary technologies at home reduces (would reduce) the family clashes when we need to access the broadband connection	1	2	3	4	5	6	7
TD5	Having complementary technologies will allow me to utilise my broadband connection for multi-tasking more efficiently	1	2	3	4	5	6	7
PD1	Since I have subscribed to broadband, I have become more innovative and creative with	1	2	3	4	5	6	7

	regards to performing activities online							
PD2	I am not frustrated with broadband technology as it is easy to use	1	2	3	4	5	6	7
PD3	I am frustrated with the cost/speed ratio of broadband	1	2	3	4	5	6	7
PD4	I have the required skills to perform a variety of tasks with broadband	1	2	3	4	5	6	7
ED1	I communicate often with friends and family in other states or countries through email, chat, video conferencing	1	2	3	4	5	6	7
ED2	I tend to use high speed Internet access outside my household quite often (e.g. work place, university or college, public access points, library, internet cafes)	1	2	3	4	5	6	7
ED3	I feel that media (newspapers, TV, radio) has made my family –more aware of broadband capabilities therefore we use it for a variety of activities especially that of video, voice and online-chat capabilities	1	2	3	4	5	6	7
SQ1	I am satisfied with the speed of the Internet, customer/technical support, security and overall service quality provided by my current service provider	1	2	3	4	5	6	7
SQ2	I experience less downtime with my current service provider	1	2	3	4	5	6	7

9. Please select the amount of HOURS spent PER WEEK using your broadband connection for each of the following activities. For any activity that you do not perform please enter "0" (Zero) hours spent.

Activities	***Hours spent***
Downloading files (photos, software, music and movies), sharing computer files (peer-to-peer) or storing files on the Internet	
Streaming digital media (videos and audio) or online gaming	
Working from home or studying from home (online lectures, research for school or training)	
Online shopping and product information search	
Communicating online (SMS, email, chats, VoIP, video conferencing)	
Settling accounts online (bill payments and online banking)	
Creating web content (e.g. Web pages)	
Any other activities and hours spent (please state):	

10. How long have you been subscribed to broadband?

☐ <12 Months ☐ 12-24 Months ☐ 25-36 Months

☐ > 36 Months

SECTION D

11. Please rate each of the following statements within the 1-7 point scale.

This section only applies to those who have subscribed and currently making use of broadband technologies in their households. For non-subscribers of broadband please proceed to Question 13. Please answer **ALL** questions. For questions that you are not sure about select "neutral".

Please circle the appropriate option.		Strongly Disagree	Disagree	Somewhat Disagree	Neutral	Somewhat Agree	Agree	Strongly Agree
LIF1	Broadband has made it easier for me to find and communicate easily with my long lost relatives or distant families	1	2	3	4	5	6	7
LIF2	Broadband has made more time for me to commence with other life activities	1	2	3	4	5	6	7
LIF3	Broadband allows me to save on costs such as high phone bills, intermediary costs (due to online shopping), petrol costs (due online shopping)	1	2	3	4	5	6	7
LIF4	Broadband has made it a lot easier for me to perform work related activities at home	1	2	3	4	5	6	7
SAT1	I am satisfied with broadband as I believe that I have more control over my life than if I had still been using dial-up/narrowband	1	2	3	4	5	6	7
SAT2	I am satisfied with broadband as I experience fewer problems such as constant disconnects, can't use the telephone and slow download speeds found when using dial-up	1	2	3	4	5	6	7

12. How interested are you are in future broadband technologies? What would you like see in the foreseeable future?

Please circle the appropriate option.		Not at all Interested	Slightly Interested	Somewhat Interested	Very Interested
FT1	Higher speed lines direct to home through Fibre, VDSL, ADSL2+ capable of speeds of 30Mbps and over	1	2	3	4
	More high speed wireless broadband comparable to cabling that can be accessed anytime and anywhere	1	2	3	4

Please circle the appropriate option.		**Not at all Interested**	**Slightly Interested**	**Somewhat Interested**	**Very Interested**
	Interactive Online communication systems (e.g. skype and messenger in 3D/Holograms) as well as 3D interactive web pages with touch sensitivity	1	2	3	4
	Paradigm switch from traditional TV broadcast channels to Video on Demand channels such as IPTV as well as streaming HDTV content over broadband connections	1	2	3	4
	Replacing telephone landlines or cellular networks with VoIP (cable or wireless)	1	2	3	4
	Unlimited bandwidth with no shaping	1	2	3	4

13. Please provide me with your e-mail address (email addresses will be stored separately from the rest of the data collected) for the lucky draw competition giving away an ADSL modem.

……

14. Please use the space below for ANY additional comments on the adoption, use and impact of broadband in South Africa.

……

……

END: Thank you very much for your time and assistance!

You can email this document to mogen.naidoo@telkomsa.net or ndxmog006@uct.ac.za OR fax to 0866676273

Please provide your thoughts and opinions about the questionnaire by answering the following questions:

Is the length of the questionnaire acceptable?
Comments
Are the questions understandable?
Comments
Is the layout of the questionnaire acceptable?
Comments
How long did it take you to complete the questionnaire?
Comments

If you have any further comments, please provide them here:

F

Factor Loadings (Initial Adoption)

Value	Eigenvalues (Initial Adoption) Extraction: Principal components			
	Eigenvalue	% Total variance	Cumulative Eigenvalue	Cumulative %
1	9.713328	15.92349	9.71333	15.92349
2	4.411367	7.23175	14.12470	23.15524
3	2.920524	4.78774	17.04522	27.94298
4	2.638970	4.32618	19.68419	32.26916
5	2.247442	3.68433	21.93163	35.95349
6	2.213346	3.62844	24.14498	39.58193
7	2.071296	3.39557	26.21627	42.97750
8	1.921687	3.15031	28.13796	46.12780
9	1.781065	2.91978	29.91902	49.04758
10	1.761408	2.88755	31.68043	51.93514
11	1.510778	2.47668	33.19121	54.41182
12	1.457340	2.38908	34.64855	56.80090
13	1.388176	2.27570	36.03673	59.07660
14	1.319925	2.16381	37.35665	61.24041
15	1.262438	2.06957	38.61909	63.30998
16	1.223252	2.00533	39.84234	65.31531
17	1.166673	1.91258	41.00901	67.22789
18	1.108681	1.81751	42.11769	69.04540
19	1.085413	1.77937	43.20311	70.82477
20	1.000598	1.64032	44.20370	72.46509

Figure 66: Eigenvalues greater than 1 for all factors of Initial Adoption

Variable	Factor Loadings (Varimax normalized) (Initial Adoption_Original) Extraction: Principal components (Marked loadings are > 400000) (RA)	(HO)	(OU)	(SEC)	(TC)	(LOY)	(RK)	(SK) / (N)	(C)	(BC)	(INF)	(PC)	(SN)
RA1	0.667596	-0.062958	0.063615	-0.245401	0.224086	-0.146881	0.101395	0.062383	0.116773	0.218669	0.018402	0.071120	-0.161699
RA2	0.717976	-0.015105	-0.047871	-0.060450	0.155046	0.023566	0.095119	0.087870	-0.064053	0.114681	0.085069	-0.254621	-0.080120
RA3	0.721329	0.074704	0.131254	0.213602	0.008001	0.236177	0.035017	0.035311	0.030622	-0.140798	0.000167	-0.002488	0.004992
RA5	0.517066	0.190494	0.210816	0.124410	-0.038313	0.003561	-0.065694	-0.102455	0.072717	0.011451	0.168540	0.172245	-0.062931
RA6	0.557116	0.181359	0.235934	0.265622	-0.113728	0.011355	0.132290	0.155045	-0.004302	-0.134672	-0.007427	0.332630	0.070818
HO1	-0.007173	0.847396	0.060502	-0.151299	0.057892	-0.011089	0.006751	0.048036	0.098013	0.016087	-0.011742	-0.017649	-0.049329
HO2	0.111786	0.830072	0.086247	0.039128	0.061753	-0.032194	0.063927	0.110564	-0.014455	0.055084	-0.041361	-0.056689	0.022399
HO3	0.009857	0.426769	0.135994	-0.017314	0.276124	0.109536	0.278553	0.235102	-0.125006	-0.094438	0.059799	-0.015387	0.057896
UO1	0.088311	0.256240	0.542442	0.184685	0.407638	0.058239	0.091465	-0.002679	-0.031315	-0.055994	-0.030784	0.085370	0.072470
UO3	0.308528	0.146152	0.534192	0.270675	0.226219	-0.005754	0.097133	0.138142	-0.005660	0.002176	0.055272	0.192759	0.133688
UO4	0.053315	0.036051	0.584535	-0.015955	-0.049548	0.032486	0.148547	0.243382	0.193030	0.175587	0.039724	-0.106063	-0.066487
UO5	0.090214	0.198246	0.573556	0.008391	0.075673	-0.059503	0.178918	-0.033675	-0.070662	0.125645	0.118574	-0.086099	0.058634
UO7	-0.054756	0.024458	0.636199	0.158132	0.172498	-0.045200	0.196749	0.033368	0.081810	-0.129719	0.007835	0.134646	0.086271
UO8	0.105599	-0.066638	0.625865	0.285891	0.045731	0.052478	0.028715	0.094417	0.059808	0.089472	0.153172	-0.236004	0.003622
SEC1	0.097288	-0.087241	0.230986	0.759841	0.017081	0.116974	-0.107218	-0.020826	0.083831	0.061433	0.043382	-0.051399	-0.010855
SEC2	-0.009444	-0.119122	0.156929	0.722192	0.037779	0.074831	-0.044440	-0.067980	0.001259	0.018143	0.023119	-0.150366	0.060814
SEC4	-0.014155	0.056890	-0.030269	0.452999	-0.101417	0.259144	-0.065873	0.118398	0.335459	0.107839	0.045096	0.241714	0.263740
TC4	0.159162	0.079569	0.130070	-0.048356	0.766702	-0.105851	0.067543	-0.016868	0.136737	0.086509	0.039666	-0.143754	-0.146832
TC5	-0.031786	0.106158	0.052837	0.054287	0.600605	0.055594	0.449854	0.053986	-0.077889	-0.026129	0.000167	0.228933	-0.072163
TC6	0.081490	0.037350	0.048079	0.015298	0.701270	-0.144274	0.112667	0.215943	0.008819	0.109592	0.079257	0.127915	-0.021634
LOY1	0.113547	-0.005393	0.012637	0.109868	-0.104271	0.733464	-0.104653	-0.080110	0.022891	-0.042365	-0.013772	-0.117529	0.121771
LOY2	-0.014212	-0.085378	-0.020346	0.100803	-0.115716	0.592910	0.104271	-0.057395	0.421469	0.019566	0.216082	0.013639	-0.077419
RK1	0.025381	0.032043	0.148233	-0.011951	0.030259	0.156385	0.699003	0.141057	0.173559	0.254976	0.030952	-0.036633	-0.204581
RK2	0.193384	0.078753	0.172178	-0.083805	0.135854	-0.201832	0.674927	0.027389	0.119912	-0.101406	0.118133	0.001178	-0.123346
RK6	0.140019	0.079391	0.116155	-0.041529	0.251483	-0.119825	0.704484	0.075188	0.098219	-0.062992	0.036669	-0.050344	0.095845
SK1	-0.014887	-0.055218	0.046131	-0.170878	0.135919	0.099387	0.232639	0.660828	0.114216	-0.044693	0.084826	0.070680	-0.045119
N1	0.201845	0.183616	0.153173	0.095238	-0.007371	-0.170345	-0.079602	0.682183	0.019049	0.088033	0.194252	0.012802	0.036776
N2	-0.004227	0.377863	0.205005	0.125351	0.227538	-0.041427	0.178421	0.587887	-0.136653	0.030714	0.160343	-0.004919	0.022065
C1	0.042873	0.035287	0.125691	-0.053152	0.038132	0.081866	0.052327	0.041920	0.685653	0.000459	0.267561	-0.041169	0.005685
C3	0.032360	0.151498	0.199757	0.038431	-0.020207	-0.027993	0.213906	0.012330	0.533609	0.078605	0.455647	-0.072768	-0.055388
C4	-0.000283	-0.028423	-0.018351	0.173004	0.114518	0.075275	0.126411	0.031097	0.780988	0.153451	-0.090616	0.073275	0.087455
BC2	-0.000583	0.206628	0.140235	0.081066	0.250137	-0.059362	0.044712	0.229459	0.247821	0.558998	0.155576	0.071906	0.015799
INF1	0.031475	0.058382	0.228714	-0.139779	0.106061	-0.082950	-0.052116	0.206810	0.194044	0.242506	0.604049	-0.024547	0.050253
INF2	0.066558	-0.083983	-0.082665	0.033542	0.108567	0.094158	0.014136	0.044589	-0.008562	0.010781	0.783112	0.028664	0.092217
PC3	-0.023850	-0.099334	-0.038224	-0.124025	0.142419	-0.110874	-0.038425	0.035530	0.011784	0.071955	0.013500	0.751807	-0.197470
SN1	-0.028824	0.059289	0.036958	0.027714	-0.088113	-0.044431	0.086514	0.024075	-0.095789	0.080510	0.001485	-0.056443	0.808289
SN2	-0.083983	0.007111	0.041951	0.140601	-0.035497	0.130978	-0.107955	-0.013645	0.035506	0.068805	0.115048	-0.052184	0.819776
SN3	-0.027479	-0.100255	0.019738	-0.018898	-0.021795	0.024806	-0.137110	0.008878	0.123204	-0.083252	-0.065457	-0.065122	0.837972
Expl.Var	2.726246	2.741513	3.368531	3.239266	2.633771	1.622915	2.669279	2.448228	2.352008	1.554297	2.643166	1.402415	2.873237
Prp.Totl	0.044693	0.044943	0.055222	0.053103	0.043177	0.026605	0.043759	0.040135	0.038558	0.025480	0.043331	0.022990	0.047102

Figure 67: Factor Loadings (Varimax Normalised) for Initial Adoption items

Relative Advantage

All six items for the relative advantage construct loaded together component 1. The coefficients for each of the six items (RA1-RA6) varied from 0.41 to 0.72. RA4 cross loaded higher on component 12 with a coefficient of 0.42 while RA5 cross loaded on component 17 with a coefficient of 0.51.

The Cronbach Alpha for relative advantage construct yielded an Alpha of 0.74. As RA4 cross loaded higher on component 12, this item was removed from the instrument. RA5 loaded higher on component 7 (with coefficient 0.52) than component 12 (with coefficient 0.51) and was therefore kept in the instrument. Removing RA4 yielded an alpha of 0.71 which falls within the high reliability region.

As a result, the relative advantage construct in terms of the hypothesis tested was based on faster access (RA1), always-on (RA2), frees up phone line (RA3), mobility (RA5) and working from home (RA6).

Hedonic Outcomes

Three items (HO1-HO3) for the hedonic outcomes construct loaded on component 5. The coefficients were 0.85, 0.83 and 0.43 respectively. HO4 did not load on any component greater than 0.4 while HO5 loaded higher on component 17 with coefficient 0.77. The Cronbach Alpha for the hedonic outcomes construct was 0.65. HO4 and HO5 were removed which resulted in an alpha of 0.72.

As a result, the hedonic outcomes construct in terms of the hypothesis tested was based on consumer's enjoyment of using broadband to listen to music (HO1), watch and download movies (HO2) and play online games (HO3).

Utilitarian Outcomes

Seven out of the eight items for the utilitarian outcomes constructs loaded on component 6. The coefficients for the seven items ranged from 0.43 to 0.64. UO2 loaded higher on component 8 with coefficient 0.45 and UO6 loaded higher on component 4 with coefficient 0.44. The Cronbrach Alpha for the hedonic outcomes construct yielded an alpha of 0.78. UO2 and UO6 were removed which resulted in an alpha of 0.78.

As a result, the utilitarian outcomes construct in terms of the hypothesis tested was based on being useful for finding library resources (UO1), working from home (UO3), performing personal and household activities (UO4), compatible with most aspects of a consumers life (UO5), establishing and operating a home business (UO7) and help children do their homework (UO8).

Security

Three (SEC1, SEC2 and SEC4) out of the four items loaded on component 4 with coefficients 0.76, 0.72 and 0.45 respectively. SEC3 loaded higher on component 19

with coefficient 0.84. The Cronbach Alpha for the security construct yielded an alpha of 0.48. SEC3 was removed which resulted in an alpha of 0.70.

As a result, the security construct in terms of the hypothesis tested was based on offering more security than dial-up (SEC1), comfortable with security measures offered by ISP (SEC2), easier to control family content (SEC4).

Technology Comfort

Three (TC4, TC5 and TC6) out of the eight items loaded on component 8 with coefficients 0.77, 0.60 and 0.70 respectively. The Cronbach Alpha for the technology comfort construct yields an alpha of 0.62. TC1-TC3, TC7 and TC8 were removed which resulted in an alpha of 0.73.

As s result, the technology comfort construct in terms of the hypothesis tested was based on the consumers feeling comfortable in using high speed Internet (TC4), comfortable learning new broadband technologies (TC5) and comfortable as it offers the consumer more control over their lives (TC6).

Loyalty

Both loyalty items (LOY1 and LOY2) loaded on component 18 with coefficients 0.73 and 0.59 respectively. LOY2, however, cross loaded on component 3 with coefficient 0.42. The Cronbach Alpha for the loyalty construct yields a moderate alpha of 0.60. Since both items have high loadings and with a moderate reliability, these items will be kept in the final instrument.

Requisite Knowledge

Three (RK1, RK2 and RK6) out of the six requisite knowledge construct loaded on component 10 with coefficients 0.70, 0.67 and 0.71 respectively. The Cronbach Alpha for the requisite knowledge construct yielded an alpha of 0.63. RK3-RK5 items were removed and resulted in an alpha of 0.74.

As a result, the requisite knowledge construct in terms of the hypothesis tested was based on consumers could explain the benefits of broadband (RK1), consumers understand the differences between broadband and dial-up (RK2) and consumers keeping up to date with trends in the industry (RK6).

Skills

Both skills items (SK1 and SK2) loaded on component 14 with coefficients 0.66 and 0.46 respectively. No cross loadings occurred. The Cronbach Alpha for skills construct yields an alpha of 0.38 which did not fall within the 0.7 and 0.8 region of reliability. Due to the low reliability of scale the skills construct was removed from the instrument. However, since SK1 loaded higher on component 14 with coefficient 0.66 than SK2, SK1 was kept as a single item.

As a result, the skills item in terms of the hypothesis tested was based on consumers having the necessary computer literacy levels when using the Internet (SK1).

Needs

Two needs items (N1 and N2) loaded on component 14 with coefficients 0.68 and 0.59 respectively. N3 loaded on component 16 with coefficient 0.69. N4 did not load on any components higher than 0.40. N5 loaded on component 12 with a coefficient of 0.68 and N6 loaded on component 4 with a coefficient of 0.49. The Cronbach Alpha for the needs construct yielded an alpha of 0.67. Keeping the N1 and N2 items yielded an alpha of 0.70. Therefore due to the high loadings and high reliability the N1 and N2 items of the needs construct was kept.

As a result, the needs construct in terms of the hypothesis tested was based on broadband fulfilling consumers communication needs (N1) and entertainment needs (N2).

Cost

Three (C1, C3 and C4) out of the four items loaded on component 3 with coefficients 0.69, 0.53 and 0.78 respectively. The Cronbach Alpha for the cost construct yielded an alpha of 0.58. C2 did not load on any components above 0.40 and was removed. The resultant alpha after removal of C2 was 0.70.

As a result, the cost construct in terms of the hypothesis tested was based on consumers income level being enough to subscribe to broadband (C1), consumers can subscribe if they wanted to (C3) and consumers are able to subscribe at the current cost levels (C4).

Broadband Content

BC1 and BC2 loaded on component 5 and component 20 with coefficients 0.41 and 0.60 respectively. The Cronbach Alpha for the broadband content construct yielded an alpha of 0.48 which is low reliability. Therefore with moderate loadings and low reliability the broadband content construct should be removed from the scale. However, due to the higher loadings on component 20, BC2 was kept as a single item.

Broadband content, as a result, focused on the applications that were available to consumers to fully make use of their broadband subscription (BC2).

Infrastructure

Both infrastructure items (INF1 and INF2) loaded on component 12 with coefficients 0.60 and 0.78 respectively. The Cronbach Alpha for the infrastructure construct yielded an alpha of 0.60. Therefore these two items were kept due to high loadings and moderate reliability.

PC

The PC construct loaded on components 9, 11 and 15 with coefficients -0.73, 0.74 and 0.75 respectively. The Crobach Alpha for the PC construct yields an alpha of 0.32. Due to the low reliability of scale the PC construct should have been removed

from the instrument. However, since PC3 loaded higher on component 15, was kept as a single item.

The PC item, as a result, focused on whether the consumer had a personal computer or a suitable PC to effectively access the Internet (PC3). The hypothesis was therefore changed to reflect this.

Subjective Norms

All subjective norms items loaded on component 2 with coefficients varying from 0.81 to 0.83. The Cronbach Alpha for the subjective norms constructs yielded an alpha of 0.83. With both high loadings and high reliability the subjective norms construct was kept.

G

Factor Loadings (Sustained Adoption)

Household Social Context

Household social context comprised of 3 constructs. All four items (HSC1-HSC4) loaded on component 2 with coefficients 0.83, 0.83, 0.69 and 0.73 respectively. The Cronbach Alpha for items HSC1 and HSC2 yielded an alpha of 0.83. Due to high loadings and a high Alpha these items were kept. Competition for limited resources and prior experience in the family (HSC3 and HSC4) are single items and therefore a reliability test was not performed for these items.

Technology Dimension

Technology dimension comprised of 2 constructs namely, technology sophistication (TD1 and TD2) and complementary technologies (TD4 and TD5). TD1 loaded on component 1 and component 3 with coefficients 0.40 and 0.49 respectively. TD2 loaded in component 3 with a coefficient of 0.95. TD3 was not included as part of the reliability tests as it was included as a single item in the final survey instrument. The Cronback Alpha for items TD1 and TD2 yields an alpha of 0.60. Items TD4 and TD5 yielded an alpha of 0.60 but cross loaded highly on component 3 and component 4 respectively. Therefore due to high loadings and moderate alphas these items were kept.

Personal Dimension

Three constructs namely innovativeness (PD1), frustration (PD2-PD3) and skills (PD4) loaded on component 1 with coefficients 0.41, 0.90-0.74 with PD4 loading higher on component 4 and 5 with a coefficient of 0.57 and 0.58 respectively. The Cronbach Alpha on PD1 and PD4 were not performed due to being single items. The Cronbach Alpha for multi-item frustration (PD2-PD3) yielded an alpha of 0.89. Therefore due to high loadings and high alphas these items were kept.

External Dimension

Single items external access (ED2) and media (ED3) loaded on component 4 with coefficients 0.76 and 0.59 respectively. International communication (ED1) loaded on component 3 with coefficient 0.95. A reliability test was not performed as these are all single items.

Service Quality

Both items (SQ1 and SQ2) loaded on component 3 with coefficients 0.89 and 0.82 respectively. The Cronbach Alpha for the service quality construct is 0.82. Due to high loadings and a high Alpha these items were kept in the final instrument.

H

CD-ROM

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