AN INVESTIGATION OF BROADBAND TECHNOLOGY ADOPTION IN KENYA: The Case of the Banking Sector in Kenya

BY

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DECLARATION

This management Research Project is my original work and has not been presented for a degree in any other University.

Signed: .....**Date:** 7/11/2006

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This Management Research Project has been submitted for examination with my approval as University Supervisor.

Signed: .....**Date:** 10/11/2006

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DEDICATION

This work is dedicated to my late wife, eternal lover and friend, Jane Florence Achieng Odero Gumbo, whose incomparable love, dedication, genuine friendship, respect, humility and gentleness shall always remain unique source of admiration, inspiration, and everlasting source of strength, encouragement and hope to me.

It is also dedicated to my late father, Francis Gumbo Ayiecho whose stewardship and unparalleled fatherly love showed us sound parenting has values far beyond material wealth. It is also dedicated to my mother, the incomparable Dorcas Tabitha Check Gumbo, that epitome of hope, hard work and strictness. Mama, you made the journey from the hostility and barrenness of Okenye to where we are now that much possible. You shall always have a permanent place in my heart.

Last but not least, I make a very special dedication of this work to the five most precious beings in my life today, my children, those little inexhaustible sources of energy for me.... Dorcas Tabitha Akinyi, Cynthia Mathilda Adhiambo, Nicolas Francis Gumbo, Samuel Mutwiri Omondi, and Nicole Jane Achieng. Anyone who gets the privilege to be a father to such wonderful human beings has every reason to want to conquer everything /anything there is to conquer.....

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Thank you FATHER.

PROLOGUE

The future belongs to those who believe in the beauty of their dreams.

.....Nelson Rolihlahla Mandela

The world's greatest lie is that at a certain point in our lives, we lose control of what is happening to us, and our lives become controlled by fate .....

To realize one's destiny is a person's only real obligation. All things are one .....

And, when you want something, all the universe conspires in helping you to achieve it.

.....Paolo Coelho, Brazilian author and novelist, in his bestseller "The Alchemist"

ABSTRACT

This project investigates the determinants, views and impacts of Broadband Technology adoption by examining the perceptions of decision makers in the banking sector in Kenya.

The research uses theoretical frameworks that have been drawn from the literature especially on the diffusion of innovations and technology adoption models. In terms of the research framework, the research investigates the determinants of broadband adoption with respect to perceived drivers of the decision to adopt the technology, how the technology is conceptualized as well as an investigation of the impacts realized from its adoption.

The project finds that, for the banking sector in Kenya, the perceived determinants of Broadband adoption decision revolve around the drivers of Usefulness of the technology in accomplishing communications tasks, ease of use, compatibility with work practices as well as financial resources as being critical drivers. The conceptualization of Broadband Technology was of the tool view whilst the predominant impact was considered to be the technology's effectiveness in improving Internet communications. A number of barriers were also identified from the survey.

The thesis provides a model for understanding broadband technology adoption at an organizational level. Additionally, the study makes a contribution to information systems research into technology adoption amongst banks.

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1.0 INTRODUCTION

1.1. Background

Many organizations, public and private, have increasingly recognized the pivotal role of the Internet infrastructure as a platform for achieving cost savings especially in communications. This has been noticeable since the introduction of the Internet in Kenya in 1996, whence access to the Internet was largely via dial-up connections. However, as a result of advancement in communications technologies, many organizations in Kenya have started to look at other alternative modes of Internet access. One such access technology is use of broadband technology.

However, while recognizing that broadband technology has been there for sometime now, it needs to be acknowledged that the uptake of broadband has been disappointingly low and well below expectations, in all countries except Korea (Firth and Kelly, 2001; Houghton and Morris, 2001; Zhang, 2002). This has prompted those who have a stake in broadband such as governments, telecommunications companies and equipment vendors to increasingly turn their focus from the supply side to the demand side as it becomes increasingly apparent that even where the infrastructure is available and the cost feasible, demand for broadband remains still remains sluggish (Firth et al., 2002). Increasingly though, there is noticeable change in the nature of broadband uptake which has shown increasing trends since the turn of the century (ACCC, 2002). There is still however, a lack of understanding in industry and in research institutions (Firth and Kelly, 2001; OECD, 2001; Tyler, 2002) as to why broadband has been adopted by some organizations but not by others.

A number of suppliers of broadband in different countries have indicated generally that broadband penetration is still quite low. For instance, research carried out in Australia in 2002 indicated that the uptake of broadband has been particularly low (David Nell, *Siemens*, personal communication, 23 April 2002).

However, this presumed low demand for broadband services does not reflect the importance that governments, industry leaders, and academics believe it has for the future. The Kenya Government for instance has already licensed three broadband backbone providers with at least over 78 ISPs providing connectivity to end users (CCK, 2004).

Africa latest Internet user-base stands at just over 16 million with Kenya representing a about 3.2% of that total (Internet World Statistics, 2005). The over 500,000 Internet users are accessing the Internet in some way and it maybe of interest to understand the extent of d ffusion of broadband technology within this user-base. Table 1 below provides some statistics of the state of the telecommunications market in Kenya, in terms of license category. Figure 2 below gives an indication of the growth of one of broadband access technologies in the world compared to US statistics.

Table 1:	**Number of Licensees (Cumulative)**				
License Category	**1999/2000**	**2000/2001**	**2001/2002**	**2002/2003**	**2003/2004**
Vendors & Contractors	180	740	783	813	888
Internet Exchange Point Providers	0	0	1	2	2
Technical Personnel	30	71	108	139	182
Value Added Service Providers	0	1	1	3	17
Public Data Network Operators	1	1	1	4	6
Public Switched Network Operators	1	1	1	2	2
VSAT Terminal licenses	36	56	75	130	336
Local Loop Providers	0	0	0	2	4
VSAT Hub Operators	1	1	1	2	2
Internet Service Providers	43	66	72	76	78
Cyber Cafes/Telephone bureaus	0	0	0	51	70

Table 1: Number of licenses (Source: CCK, 2004)

From table 1, it is noticeable that the number of users expected to use this type of broadband is expected to pick at around 6 million worldwide. Other statistics indicate that in other regions such as the US, 80 percent of US Internet users still connect via narrowband services (such as dialup), while 20% connect via various broadband technologies. In a preliminary sense therefore, it may seem that there is some value in the use of broadband technologies.

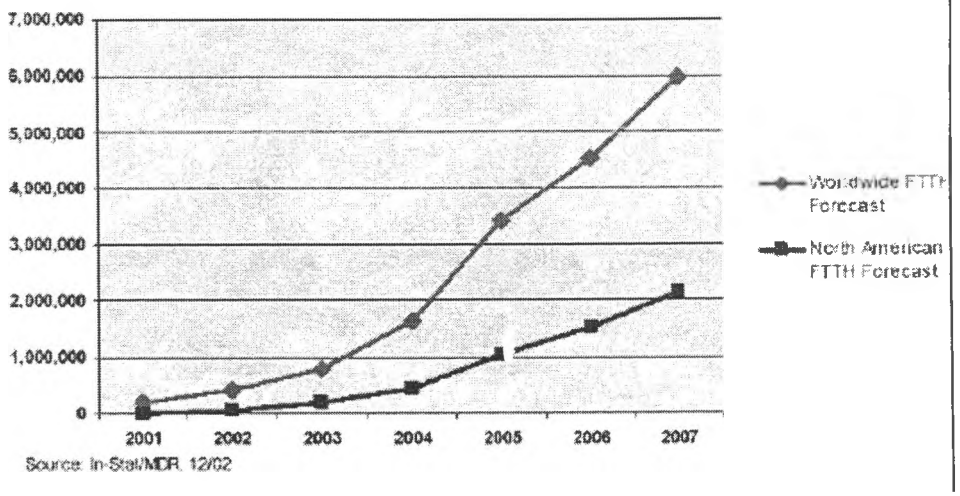


Figure 2: Worldwide & USA Forecasts of Broadband

Broadband offers high-speed, high-capacity communication. The primary use of broadband in organizations is for Internet access; however it may also be used to access remote databases and as the communication medium for intra-organizational and inter-organizational systems, including electronic data interchange (EDI)(Houghton and Morris, 2001). OECD (2001) acknowledges that the demand for broadband is highly influenced by the demand for the applications that it enables. EDI is the electronic exchange of structured business documents in a standardized format between computer applications of trading partners (Swatman, Swatman and Fowler, 1993).

To date, much of the media and corporate attention on broadband has focused on supply aspects. This includes the roll-out of broadband infrastructure, the

convergence of communication networks, competition among technologies and companies, and the regulatory role of Government (Firth and Kelly, 2001).

Currently, broadband technology is widely available in developed countries (Houghton and Morris, 2001; OECD, 2001; Tyler, 2002). Horrigan (2002) reports that, in Australia, robust broadband services have been available on a large scale for over five years, and Houghton and Morris (2001) state that more than 90% of the Australian population has the potential to access broadband.

As with all new services or technologies, it is usually very difficult to predict the demand for mass-market broadband service. The nature of broadband technology demand in the market may appear to be evolving very rapidly at first, or even its potential use may be changing rapidly. In a country context, the interest shown by organizations may vary. Some organizations may not be interested until others show them the value of adopting the service or provide them the opportunity to reap the benefits of consumption externalities generated by the service.

The first empirical studies to examine broadband adoption are Madden and Savage (1996) and Madden, Savage, and Simpson (1996). They utilized survey data from a sample of Australian households that asked participants to indicate their preferences for a broadband service that had not yet been deployed. They find that the interest in broadband is directly related to the level of education of the adopters. Further, households were less interested in broadband if one or more people in the household was 65 years or older. They interpret their results as portending a danger of the creation of a class of "information poor." This danger seems to have receded since then as the real cost of personal computers and Internet subscriptions has fallen dramatically

One of the earliest studies of the demand for high- speed connections in the United States was undertaken by Hal Varian and his colleagues in an experimental setting at the University of California, Berkeley. In 1998-99, 70 members of the Berkeley community were provided with various access speeds up to 128Kb/s at different prices, admittedly a low ceiling by today's standards but not by the standards of 1998-99. Varian found that his sample of users exhibited a rather high price elasticity of demand for bandwidth, with very low demand. Varian attributed this low demand for bandwidth to the absence of applications requiring high speed and the ability of users to occupy their time productively in other pursuits while waiting for file downloads.

Obviously, Varian's results pre-date the development of Napster and the increased use of the Internet for downloading video or engaging in real- time electronic games. More current estimates of the demand for broadband are reflected in the work of Rappoport and associates. Their work addresses two related issues: (1) what are the own and cross price elasticities of demand for broadband and narrowband services? And (2) how different are the users and uses of broadband and narrowband Internet services? Using a sample of 20,000 United States households that were surveyed in 2000, Rappoport, et.al. (2001) estimated a model of Internet subscription and choice of narrowband or broadband access. They found out that the own price elasticity of demand for broadband service is much greater than the demand elasticity for narrowband. In general, they found that dial- up service and broadband services are substitutes for each other, a result that conflicts with the results in Hausman (2002). Hausman points out that narrowband and broadband services are not likely in the same market given that residential dial- up telephone rates vary substantially when used for narrowband and broadband services. As broadband diffuses throughout the economy, the degree of substitution between broadband and narrowband connections will surely decline even further.

Using data from 2000-01, Crandall, Sidak, and Singer (2002) estimate a model similar to that used by Rappoport, et.al., and obtain own-price elasticities for both services equal to -1.2. In a later paper that uses August 2001 Internet user data, Rappoport, et.al. (2002) examine the intensity and nature of Internet use of households with narrowband or broadband connections. They show that the decision to use a broadband connection depends on the opportunity cost of time for the user and intensity of Internet use. Higher income households who use the Internet intensively are most likely to subscribe to broadband. Broadband subscribers tend to visit more Internet sites, particularly "entertainment" and "Internet services" sites and spend more time online.

However, in this later paper, Rappoport, et. al., find that the demand for broadband is substantially less price elastic than it was a year earlier. This suggests that broadband is moving from the "luxury" category to one closer to a "necessity," particularly as consumers learn to use it and increasingly understand its potential benefits.

These studies that have been carried out from other parts of the world provide a need for similar researches to be carried out in a developing country's context. Given concerns of the inappropriateness of using results from other contexts wholesome, it may be relevant to carry out research in Kenya that focuses on some of the issues that have been raised. Adoption of services or new technologies is affected by a number of factors which are not necessarily similar as those that were 'unearthed' in other sections such as U.S.A, Australia or Europe. In addition, adoption decisions are affected by how a new technology is viewed or conceptualized, which in the end affect the expected impact of the new technology.

As per this study, the following definitions shall be adopted:

- Adoption: This is regarded as the process of accepting the initiation, implementation and use of a particular technological innovation, especially those that are regarded as new in an organization.
- Broadband Technology is considered to refer to any type of connectivity, which is always online, with the ability to transfer the different types of information such as voice, video, data and image. The requirement for a communications connectivity technology to be regarded as Broadband requires that it operates at a minimum speed of 64 Kilobits per second.

1.2 Overview of the Banking sector

The banking sector comprises 49 financial institutions with 41 commercial banks, 2 non-bank financial institutions (NBFIs), 2 mortgage finance companies and 4 building societies (Monthly economic review; June 2004 issue). According to the Central Bank of Kenya, during the year to May 2004, the balance sheet of the banking industry expanded with total assets increasing by 14.2% to Ksh. 542.2 billion by the end of May 2004 from Ksh. 474.7 billion in May 2003. The sector recorded an improved performance in 2003 with net profits increasing by134% from Ksh 6bn in 2002 to Ksh 14.1bn. According to an Annual Bank Supervision report (2003), the Kenyan economy recovered to expand in real terms by 1.8 % in 2003 compared with 1.1.% in 2002 and 1.2% in 2001. The economic expansion was broad based but driven mainly by the agricultural and services sectors and partly reinforced by strong macro economic fundamentals.

The banking sector has embraced changes occurring in Information Technology with most banks having already achieved branchless banking as a result of the adoption of communications options. According to The Central Bank Annual Supervision report (2003), the increased utilization of modern information and communications technology has for example led to several banks acquiring ATMs

as part of their branchless development strategy measures. The Central Bank notes that advancement in Information and Communications Technology (ICT) in the banking industry has enhanced efficiency and improved customer service. This is reflected particularly in the increased use of ATM cards resulting from broadening of ATM network, including additional ATM machines and a wider network of merchants that accept payment through credit/debit cards.

According to the report, the total number of ATMs in the industry as at 31st December 2003 was 230 compared with 166 as at end of December 2001. The number has since increased with the implementation of Kenswitch, a Shared ATM network comprising a consortium of eighteen small and medium sized banks, which went live in December 2002.

Several banks have also entered into the Internet Banking and established websites. Internet banking however is still at its infancy and more in terms of utilization is expected in this sector. Additionally in May 2004, VISA estimated that the use of Visa cards had increased by 43 per cent in Kenya last year, which translated to US$452 million growth. They noted that in 2003, the number of Visa and Visa Electron cards issued by Visa member banks in Kenya rose to over 557,000. They described Kenya as the fastest growing market in Africa, outside South Africa. According to the Bank Supervision report (2003), this progress has, however, been accompanied with increased need for connectivity which can match the need for these operational requirements. There is therefore the need for well-formulated ICT strategies and communications policies to enable banks have a responsive infrastructure given the changing internal and external threats and opportunities facing these institutions.

1.3 The Research Problem

Today, most consumers access the Internet over relatively low-speed dial-up connections. In most cases, this means that residential consumers are limited to data rates of from 28.8 Kbps to 56 Kbps for standard analog modems and 128 Kbps for ISDN services. Furthermore, additional delays and inconvenience result from the need to establish a dial-up connection each time an Internet session is established (*e.g.,* to check email or browse the Web).

For the Internet to realize its true potential as a platform for global communications infrastructure supporting integrated, interactive multimedia services, consumers will need "always on" broadband access.

Broadband Internet access has important policy implications. First, if the Internet is successful in realizing its full potential, then telecommunications policy-makers will need to broaden their definitions of universal service to include Internet services. Second, the Internet can help facilitate competition among alternative physical infrastructure networks (*e.g.,* wireline telephone networks, electric utility power lines, cable television cables, or wireless networks). While today, the Internet is largely an application that runs on top of the telephone network, in the future, telephony will be one of many applications provided over the Internet. This is especially important in light of the trend towards liberalization and competition, with an increased reliance on market forces to assure efficient provisioning and pricing of telecommunications services.

The International Telecommunication Union (ITU) refers to broadband as the infrastructure of the knowledge economy (OECD, 2001). Firth and Kelly (2001) indicate that countries around the world have nominated broadband networks as crucial infrastructure for their social, economic and scientific goals. Furthermore, broadband has been described as the panacea for a range of social and

economic woes attributed to isolation from political, personal, geographical and other factors (Firth, Gilwall, Houghton, Morris, Prosperetti and Merini, 2002).

The Internet-user base in Kenya has peaked at over 500,000 in Africa which is considered to be one of the highest in Africa. The telecommunications sector in Kenya is also considered to be one of the most vibrant with the government actively taking steps to liberalization in order to spur competition in the sector (CCK, 2005). In addition, the growth of Internet users in Kenya is estimated at over 150% (IWS, 2005). With over 78 internet Service Providers, it may seem that competition within the ISP industry may be intense. One of the technologies that are now being offered as a product is broadband technology, which is one of the access technologies. Broadband is therefore becoming an increasingly visible technology, not only in other parts of the world, but also in Kenya.

For instance, the Government of Kenya, in an effort to promote broadband connectivity and to stimulate demand for broadband has come up with a Draft National ICT policy as well as a Draft Universal Access Policy (GOK, 2004). These initiatives clearly point out the important role of the Internet in enabling the growth of the ICT. Access to information efficiently to a large extent is determined by the mode of access, of which broadband is key.

Horrigan (2002) estimates that by 2010 broadband will account for approximately US$ 64 billion of the telecommunications market. He also reports that consumer groups in the United States estimate that within 10 years broadband could be worth as much as USD300 billion a year to the United States economy. It is evident that broadband is an important focus of public policy and is likely to be a significant part of the economy in the future.

Thus despite worldwide attention that governments, academics, telecommunications companies and other stakeholders have paid on broadband technology, in other parts of the world, there seems to be inadequate attention by developing countries on this new tech nology in terms of adoption determinants, views of stakeholders on the technology and the impact of this technology use. With this in mind, this research aims to investigate broadband technology adoption within the Kenyan context; given the academic research it has been afforded.

The following research questions shall guide this inquiry:

- What are the factors involved in the decision to adopt broadband technologies?
- How is broadband technology viewed (conceptualized) by adopting firms?
- What are the potential impacts of broa dband technologies in terms of their organizational effects?
- What are some of the barriers to Broadband Technology adoption?

Thus, this research will provide insight into what drives broadband uptake in the Kenyan banking sector, especially given the fact that the technology is still nascent in the local context. Further, the thesis will provide a framework for understanding broadband adoption at an organizational level.

1.4 Research Objectives

A broad objective of the study is to investigate broadband technology adoption. It focuses on broadband technology adoption, not only as a technology to increase efficiency and effectiveness of Internet access, but also as a technology that is enabling new possibilities, unfeasible before, especially through the interactive nature of the Internet.

The specific objectives of the study are:

1. To investigate the determinants of broadband technology adoption;
2. To investigate how broadband technology is viewed (conceptualized) by decision-makers;
3. To determine the impacts of use of broadband technology within the Kenyan context and lastly
4. To determine the barriers to Broadband Technology adoption within the context of the Kenyan banking industry.

1.5 Importance of the Research

1. The study will be of value to researchers as a basis for future empirical and conceptual research, which will be helpful in refining and validating findings especially when a significant number of experiences is collected and studied.
2. It will be significant to the business community, especially to decision makers involved in crafting communications technology strategy for their businesses. The study will be important to this group, whether they already have broadband technology or not.
3. The study will also be of importance to government policy makers, since an understanding of the environment of broadband technology adoption will enable them come up with appropriate policies that encourage market growth.

2.0 LITERATURE REVIEW

2.0 Chapter Overview

This chapter presents and discusses the literature relating to the adoption of broadband. The chapter begins by reviewing the literature relating to the various approaches to understanding broadband technology. This shall then be followed by research into technology adoption by focusing on various models that have been used for understanding the concept of technology adoption. The literature review shall then focus on specific aspects of adoption relevant to this research in terms of how technology has been conceptualized, the factors at play as well as research into the impact of technology adoption. This shall be followed by application of broadband technology.

2.1 Approaches to Understanding Broadband Technology

There are several approaches to the current understanding of the nature of Broadband Technology. The intent of these approaches acts as an aid in capturing the 'obvious' meanings of the Broadband Technology especially within the body of academic literature. In a preliminary sense, this proposal shall espouse the definitional approach as reported in the literature in order to adequately ground this proposed research.

Broadband refers to high-speed, high-capacity communication (Firth and Kelly, 2001). The term is widely used as shorthand for high-speed Internet access (OECD, 2001). Broadband can be defined in terms of the technology used, in terms of the transmission capacity provided, or in terms of the functionality enabled.

2.1.1 Broadband as Technology

Currently, the most popular broadband access technologies worldwide are cable modem and Digital Subscriber Line (DSL). Cable modem technology uses coaxial cable (over networks traditionally used for cable television) as the transmission medium. DSL refers to a group of technologies that operate over standard copper wires using existing telephone networks. The most common DSL technology is Asymmetric DSL (ADSL) (NOIE, 2002).

Other less popular technologies with more limited applications include satellite, terrestrial microwave signals, and laser (Zhang, 2002). Horrigan (2002) believes that in the future, fixed wireless broadband access is likely to be increasingly common. NOIE (2002) suggests that it is likely that mobile devices will develop in such a way as to support rich multi-media communications.

DSL involves electronic equipment in the form of DSL modems at both the telephone company (DSLAMs) and the subscriber's premises to send high-speed digital signals across the copper wires (Houghton and Morris, 2001). "Asymmetric" refers to the fact that the download rate of communication is greater than the upload rate. ADSL is suited to web browsing, where more downloading than uploading typically takes place (Houghton and Morris, 2001).

2.1.2 Broadband as Capacity

OECD (2001) defines broadband as transmission capacity that is faster than basic rate ISDN at approximately 128 kbit/s (kilobits per second). However, the Canadian National Broadband Task Force (2001) notes that national definitions of broadband range from as low as 32 kbit/s to as high as 4 Mbit/s among depending on different countries. For cable modems, speeds can range from 128 kbit/s to 2 Mbit/s. Typical ADSL products offer speeds of 512 kbit/s for downloads and 128 kbit/s for uploads; however, telecommunications providers

advertise data communications speeds up to 8 Mbit/s downstream and up to 640 kbit/s upstream (Houghton and Morris, 2001). The actual speeds attained depend on a number of factors including distance of the customer premises from the service provider (Zhang, 2002).

2.1.3 Broadband as Functionality

Broadband can be described in terms of the functionality it provides and the applications it enables. Broadband can be contrasted with narrowband by its ability to carry multiple channels across a single "pipe". Thus, broadband can be understood to mean technology that is capable of carrying voice, text, image and video at the same time.

For the purposes of this project, and in line with common usage of the term, broadband is understood to be communication technology capable of carrying full motion video (Firth and Kelly, 2001; Tyler, 2002). Additionally, cable modem and DSL are the assumed access technologies as they are currently the most popular (Firth and Kelly, 2001; Houghton and Morris, 2001).

ISDN (Integrated Services Digital Network) is a set of standards for digital transmission over ordinary telephone copper wires (Firth and Kelly, 2001). Traditionally, businesses have used ISDN for Internet access and other inter-organizational systems. The term "narrowband" typically refers to data exchange using a 56K modem across standard telephone lines (Houghton and Morris, 2001).

2.2 Overview of Broadband Technologies

This section of the literature review presents some of the Broadband Technologies.

2.2.1 Current Wireline Broadband

a) ISDN

The International Telecommunication Union standards body known as ITU-T specified the Integrated Services Digital Network (ISDN) standards in 1984. It was originally designed as a "next generation" telephone system, integrating voice and data into one digital connection. There are two distinct ISDN standards: Basic Rate Interface (BRI) and Primary Rate Interface (PRI). BRI is the type of connection you would have in a home or small business, offers two simultaneous connections (any mix of fax, voice and data). When used as a data connection, ISDN BRI can offer two independent, symmetrical, data channels of 64 kbps each, or 128 kbps when combined into one connection. The PRI standard offers 30 channels (of 64 kbps each), giving a total of 1920 kbps. As with BRI, each channel can be connected to a different destination, or they can be combined to give a larger bandwidth (Eicon Networks, 2003).

The primary applications of BRI are for Internet connections, point-to-point videoconferencing, and telephony applications that require multiple phone numbers. DSL and COAX (cable modems) compete directly with BRI, which is why IDC forecasts a *negative* 5 percent CAGR th rough 2006. By and large, ISDN has grown into a premium service, targeted towards high-end or high volume telephony users such as medium and large business customers who need, and are willing to pay for, PRI services.

b) COAX

The International Telecommunication Union (ITU-TS) ratified Data Over Cable Service Interface Specifications (DOCSIS) version 1.0 in March of 1998. ITU-TS approved the DOCSIS 2.0 standard in December 2002. DOCSIS transmissions look just like any other TV channel on the cable and use the equivalent of one-and-a-half channels of bandwidth. DOCSIS supports data rates of 27 Mbps downstream and 10 Mbps upstream, although the actual data rates to end users are limited by the number of concurrent users. End users experience data rates of 1.5 to 3 Mbps downstream and 500 kbps upstream.

c) xDSL

Digital subscriber line (DSL) is a generic term for a type of broadband access technology that sends data over legacy phone networks. It blasts data over regular copper telephone lines at megabit speeds using frequencies far above what the human ear can detect. DSL is an always-on technology, meaning that computers are always connected to the Internet; no additional steps to log on are required. The technology carries voice and data over the same line, as shown in Diagram 1, meaning that customers can talk on the phone and access the Internet at the same time. There are a number of technology issues such as distance limitations and competing standards impeding DSL technology from becoming the technology of choice for Internet access, especially with enterprise customers, but subscriber numbers are still increasing: in the second half of 2002 there were 6.5 million new ADSL subscribers in the US 41.

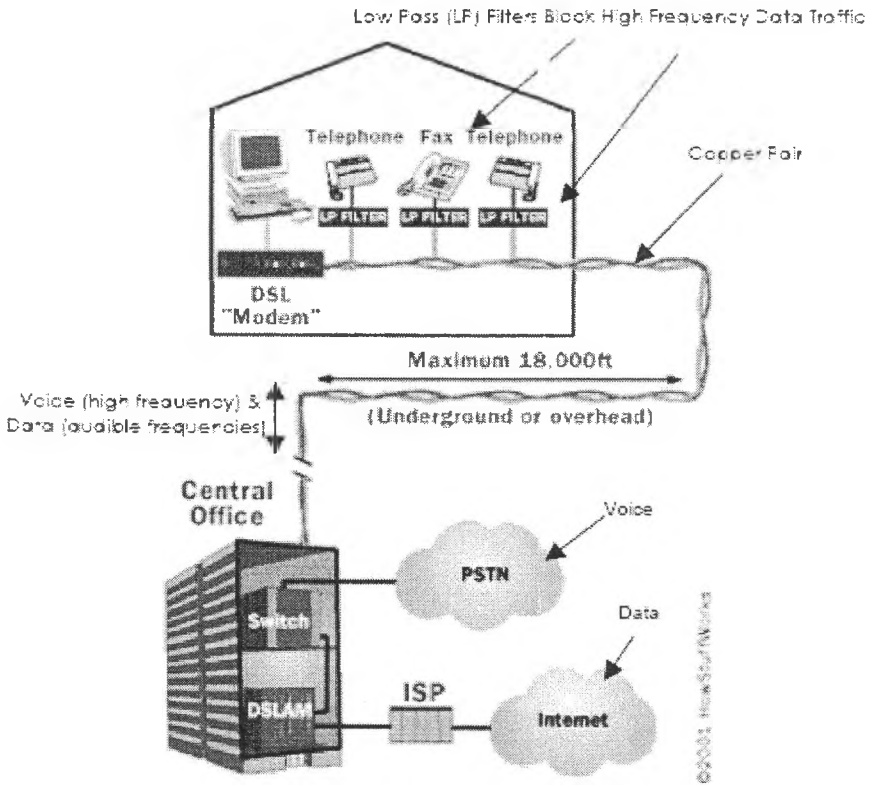


Diagram 1: Adopted from How xDSL Works (2005)

DSL is capable of delivering and supporting bandwidth-intensive applications, such as streaming video, online gaming, and conferencing. Some of the technologies other advantages include the following (Digital Subscriber Line Technologies, 2003):

- Operates over existing phone lines and generally does not require new wiring
- Much faster than a dial-up Internet connection
- Customers can receive phone calls and be online at the same time
- Relatively easy to install

The reason many refer to the technology as *x*DSL is because there are multiple versions of DSL, the most prevalent being ADSL, IDSL, SDSL.

Asymmetrical Digital Subscriber Line (ADSL) – Specifically designed for activities such as Internet browsing, ADSL is engineered to receive data at high rates at the expense of sending at slower rates (asymmetrical rates). Speeds of 1.5 Mbps downstream and 256 kbps upstream are typical. ADSL signals can only travel 18,000 wire-feet before the signal deteriorates too much to stay in sync with the host provider.

Symmetrical Digital Subscriber Line (SDSL) – Symmetrical speeds upstream and downstream are necessary for applications such as gaming and enterprise systems that would otherwise need a dedicated data circuit.

d) Frame Relay and Dedicated Circuits

The terms *frame relay* and *dedicated circuit* encompass a wide variety of products, standards, and protocols. Frame relay circuits work by sharing bandwidth within the frame relay network amongst all customers. Customers receive a private line connection to the nearest r ode on the frame relay network. From there, traffic is routed in packets throughout the network until it reaches its destination. Frame relay protocol is efficient, relatively easy to administer, and is supported by a wide variety of providers and vendors.

Dedicated circuits are also referred to as point-to-point connections. These lines can be very expensive and can take several weeks to provide due to the coordination that has to happen at each switching station between the two connection points. The most common dedicated circuits use PRI signaling protocols:

- DS0 - 64 kilobits per second
- ISDN - Two DS0 lines plus signaling (16 kilobits per second), or 128 kbps

- T1 - 1.544 megabits per second (24 DS0 lines)
- T3 - 43.232 megabits per second (28 T1s)
- OC3 - 155 megabits per second (84 T1s)
- OC12 - 622 megabits per second (4 OC3s)
- OC48 - 2.5 gigabits per seconds (4 OC12s)
- OC192 - 9.6 gigabits per second (4 OC48s)

e) Fiber to the Premise

Fiber-to-the-Premise [FTTP] extends fiber connections from the central office to the customer premises (fiber to the curb or FTTC) and into customer's houses or places of business (Phillips, 2003). Dedicated fiber connections provide extremely high bandwidth and make possible movies-on-demand and online multimedia presentations would arrive without noticeable delay.

Fiber-optic technology delivers Internet, voice, image and video at speeds from 2Mbps to 100Mbps and beyond. On a fiber optic network, data is transmitted as light impulses along thin strands of silica glass. Unlike copper cabling, optical fiber is not subject to electromagnetic interference because it uses light, not electricity. Moreover, fiber optics can transmit data over much longer distances.

2.2.2 Current Wireless Broadband

a) Bluetooth

Bluetooth is an open architecture wireless communication protocol capable of communicating at 1Mpbs in the 2.4 GHz frequency spectrum at a range of about 30 feet. Bluetooth operates on radio signals and provides electronic devices a

method to communicate over short distances without the line-of-sight required by infrared technology. It is intended for use in close-proximity electronics such as PC's, printers, headsets, cell phones, appliances, digital cameras, and any other electronic device requiring cable connections to communicate.

The idea for Bluetooth came from Ericsson in 1994. Ericsson was developing telecommunications infrastructure equipment and saw the need for an inexpensive way that electronics could communicate. The name "Bluetooth" comes from a story about a Viking named Bluetooth who successfully joined two Scandinavian Kingdoms peacefully. Ericsson looked for partners to help with the development of the technology and in 1998 the Bluetooth special interest group was formed.

b) Home RF

Home RF was a consortium of manufacturers that developed a standard called Shared Wireless Access Protocol (SWAP). SWAP is similar to Bluetooth in that it uses RF signals; however, SWAP utilizes six voice channels based on the Digital Enhanced Cordless Telecommunications standard. SWAP can transfer data at 1 Mbps.

Home RF was invented to compete with the 802.11b standard by being a cheaper alternative for the home user. This would mainly be targeted for personal computers accessing and transmitting data in a particular location. While it was initially more inexpensive then the 802.11b, it also was not as capable. The 802.11b is now available at a lower cost, which eliminated the need for Home RF and resulted in the abandonment of Home RF technology.

Diagram 2 below show some of the intended applications of this broadband Technology

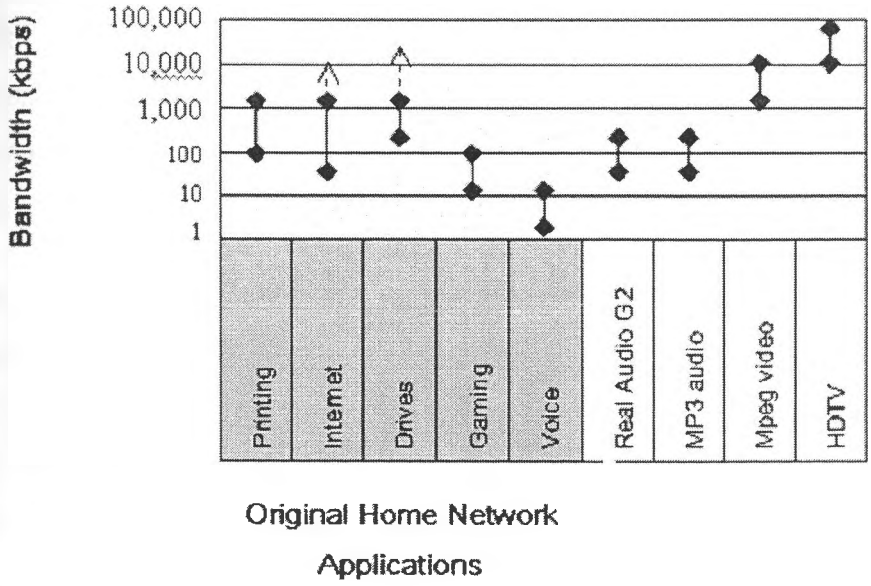


Diagram 2: Adopted from How xDSL Works (2005

c) Mobile Wireless

Mobile wireless data began as an add-on to the existing voice platform much like dial-up modems used existing phone lines to transmit data over voice-grade infrastructure (Langos et al, 2003). The first generation of wireless data technology was cellular digital packet data (CDPD). Developed in 1995, CDPD uses unused cellular channels (in the 800- to 900-MHz range) to transmit data in packets (Langos et al, 2003). This technology offers data transfer rates at 9.6 Kbps on average, bursting up to a maximum of 19.2 Kbps. Manufacturers and mobile companies recognized the need to separate mobile data so that the voice network didn't suffer at the expense of lower-revenue data traffic.

c) Satellite

Satellite data uses a specialized wireless receiver/transmitter that is launched by a rocket and placed in orbit around the earth. There are hundreds of satellites currently in operation. They are used for such diverse purposes as weather forecasting, television broadcast, amateur radio communications, Internet communications, and the Global Positioning System, (GPS). There are three types of communications satellite systems.

They are categorized according to the type of orbit they follow. A geostationary satellite orbits the earth directly over the equator, approximately 22,000 miles up. A low-earthorbit (LEO) satellite system employs a large fleet of "birds," each in a circular orbit at a constant altitude of a few hundred miles. Some satellites revolve around the earth in elliptical orbits.

d) WiFi

WiFi is an RF signal based on the IEEE 802.11 standard and is capable of transmitting signals up to 300 feet. It uses Orthogonal Frequency Division Multiplexing (OFDM) that supports high data rates with very low latency, over a distributed all-IP wireless network that can penetrate walls and associated structures. WiFi shares the unregulated, 2.4 GHz radio spectrum along with other common wireless devices including cordless phones and baby monitors. WiFi networks are called hot spots. For the most part, thousands of "doit-yourselfers" worldwide have rigged antennas to create their own hotspots. Some of them have even joined together to form networks so that the public can access the

Internet for free. WiFi is primarily meant for use in a local area wireless network and for Internet access. As an alternative to current wireline broadband, WiFi offers the opportunity of cheap, mobile Internet access. It is also an amplifier of other technologies: It can turn almost every machine, from laptops to cash

registers, into network devices. And it also fuels the demand for always-on broadband connections.

Applications range from the obvious (laptops with the WiFi friendly Windows XP) to the not so obvious (consumer electronics providers linking a host of appliances in the home to send MP3 songs and videos from their computers to TVs and stereos via WiFi). With the next generation of WiFi lifting connection speeds to 54 megabits per second, WiFi phones could become viable options to the consumer, allowing them to move from WiFi to cellular networks seamlessly. This is only the proverbial tip of the iceberg. Smart networks in the home or factory could even monitor climate control or supply chains through data fed by WiFi (Business Week, 2003; Victor, 1999).

e) "3G" Mobile

The term "3G" is used to describe the next generation of mobile communications that promises to deliver improved voice and data services. There are many interpretations of what "3G" means, however the International Telecommunication Union (ITU) has the only official definition accepted universally. The ITU is comprised of stakeholders from around the world who set the requirements and standards for 3G known as IMT-2000 (ITU, 2005). IMT-2000 networks must meet minimum data bandwidth requirements of 144 mbps for mobile devices and 2 Mbps for fixed indoor wireless.

f) Fixed Wireless

Fixed wireless is an alternative transport mechanism to traditional broadband wireline services in areas where these are not available, such as rural locations and places where competing wireline providers own the infrastructure.. Regardless of the manufacturer, there are six major components of a fixed wireless system:

- Base station (transmitter)
- Configuration tools
- Element management system
- Remote premise units (receivers)
- Transport mechanisms (wireline)
- Wireless signals

The typical data rate for fixed wireless technology is in the range of 1.5 Mbps downstream and 1.2 Mbps upstream. Actual throughput experienced by the end user will vary with environmental factors, signal level, and air link quality. Some fixed wireless signals require line-of-sight while others are non-line of sight. Typically fixed wireless signals can propagate several hundred feet to several miles, depending on the spectrum and technology.

Fixed wireless systems are configurable to work in the licensed or unlicensed spectrum.

2.2.3 Advantages and Disadvantages of Broadband

NOIE (2002a) 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 (Firth and Kelly, 2001). This is because use of broadband for Internet access is often via a permanent IP (Internet Protocol) address that may make the user more vulnerable to unauthorized attacks on their computer system (Tyler, 2002).

2.3 Theoretical Foundations for Broadband Technology Adoption

2.3.1 Innovation Diffusion Theory (IDT)

Everett Rogers spent over 30 years studying the diffusion of innovations of all kinds from the QWERTY keyboard to agricultural innovations in developing countries (Barnes and Huff, 2003). Rogers developed a set of key innovation characteristics that he and others have shown to explain the outcomes of innovation diffusion.

Damanpour (1991) states that an innovation is an idea, practice or object that is new to the adopting organization. Broadband is a new technology that has only become widely available in recent years and, therefore, its adoption can be viewed as an innovation for an organization.

A fundamental approach to the study of the adoption of innovations is therefore diffusion of innovations (DOI) theory (Rogers, 1995). DOI theory describes the process through which an individual makes the decision whether or not to adopt an innovation. Rogers refers to diffusion as a social change and defines it as the process by which an innovation is communicated among the members of a social

system. Diffusion typically takes place over time with an initial slow growth period, followed by a rapid growth period, a gradual stabilization, and often a final decline. Importantly, the rate of adoption differs between different innovations.

Premkumar, Ramamurthy and Nilakanta (1994) state that the rate at which an innovation is adopted is influenced by the perceived characteristics of the technology that either encourage or inhibit adoption. Rogers (1995) states that these characteristics include:

- Relative advantage: The degree to which the innovation is perceived to be better than the existing technology. It therefore refers to the perceived benefit of the innovation over what it is replacing not only in economic terms but also social, convenience, and satisfaction..

- Complexity: The degree to which the innovation is perceived to be difficult to understand and use. Complexity has aspects of setup, learning, using, modifying, and maintaining.

- Compatibility: The degree to which the innovation 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. Trialability is encouraged by evaluation periods and compatibility with other products.

- Observability: The degree to which the results of adoption of an innovation are visible to others. Observability is related to the directness and predictability of the consequences of the technology.

A summary of the constructs that have been researched by various authors are shown in Table 2 below.

Table2: **Construct**	**Definition**	**Source**
Relative Advantage (RA)	the degree to which the innovation is perceived as being better than the practice it supersedes	Rogers (1983)
Compatibility (CT)	the extent to which adopting the innovation is compatible with what people do	Rogers (1983)
Complexity (CP)	the degree to which an innovation is perceived as relatively difficult to understand and use	Rogers (1983)
Trialability (T)	the degree to which an innovation may be experimented with on a limited basis before making an adoption (or rejection)	Rogers (1983)
Observability (O)	the degree to which the result of an innovation are visible to others	Rogers (1983)
Image (I)	the degree to which use of an innovation is perceived to enhance one's image or status in ones social system	Moore and Benbasat (1991)
Voluntariness (V)	the degree to which use of the innovation is perceived as being voluntary or of free will	Moore and Benbasat (1991)
Cost (C)	the degree to which use of an innovation is perceived to be relatively expensive	Tornatzky and Klein (1982)

Table 2: Original Constructs

Broadband adoption has remained in the initial slow growth period for a number of years. It may be slow due to stagnation or alternatively, it may simply be a matter of time until the uptake of broadband rises rapidly. In order to gain an understanding of broadband uptake it appears necessary to understand the determinants of broadband adoption decisions. This may require a consideration of the factors that Rogers considered in the DOI theory.

However, DOI research is based primarily on individual-level adoption decisions while the adoption of broadband in organizations is an organizational-level decision (Chwelos, Benbasat and Dexter, 2001). Further, the decision whether or not to adopt broadband is often made in an inter-organizational context. Thus, organizational and inter-organizational issues will influence the broadband adoption decision for organizations. DOI theory may not capture all of these issues.

2.3.2 Technology Acceptance and Appropriation Model In Organizations

The Technology Acceptance Model (TAM) was devised to predict the acceptance of technology in organizational contexts (Davis, Bagozzi and Warshaw, 1989). The TAM contends that technology acceptance is determined by the individual's behavioural intention to use a technology, which in turn is influenced by the individual's attitude toward using the technology and its perceived usefulness and ease of use.

Carroll, Howard, Vetere, Peck and Murphy (2001) introduce a Technology Appropriation Model that describes the process by which a technology can be shaped into a user's lifestyle. Through the adoption and use of the technology, a technology-as-designed can be transformed into a technology-in-use. During a process of appropriation, the technology is explored, evaluated, and adopted or

rejected by users. Carroll et al. (2001) identify that technology will be adopted only if it satisfies a need.

Both of these models address issues of whether technology will be accepted or rejected once acquired. Once an organization subscribes to broadband services, there is little contention that the organization will make use of the technology, especially if narrowband was previously used. The focus of this thesis is instead on the organization's decision to subscribe to broadband and on the determinants of broadband uptake at an organizational level.

Studies of the adoption of technology indicate that organizations are likely to be influenced by numerous factors when contemplating the adoption of broadband. These factors are drawn from theories including DOI, critical mass theory of adoption of innovations, inter-organizational systems theory, transaction cost theory, organizational change theory and organizational behaviour theory (Chwelos et al., 2001; Mehrtens et al., 2001).

Iacovou et al. (1995) conducted a comprehensive literature review of EDI adoption models and recognized that factors that have been demonstrated to be significant in the EDI adoption decision address three levels: the technological, the organizational, and the inter-organizational. This is consistent with research by Lefebvre, Harvey and Lefebvre (1991) that identifies similar categories of influence when considering organizational technology adoption in general.

Chwelos et al. (2001) developed an EDI adoption model, based on Iacovou et al.'s (1995) model, incorporating all of these factors by focusing on:

- Perceived benefits (technological factors)
- Organizational readiness (organizational factors)
- External pressure (inter-organizational factors)

In order to develop an integrated model of IS adoption, Thong (1999) specified four contextual variables as primary determinants of IS adoption.

He highlighted the fact that the technological innovation literature has identified many variables as possible determinants of organizational adoption but this "suggest that more research is needed to identify the critical ones" and provided four groups of variables: CEO, IS, organizational characteristics, and environmental characteristics.

Based on the literature, Premkumar and Roberts (1994) identified the use of various communication technologies and the factors that influence their adoption. The technologies studied included EDI, online data access, e-mail, and the Internet. The factors studied as potential discriminators between adopters and non-adopters of communication technologies were grouped into three broad categories: innovation, organizational, and environment characteristics.

Within the innovation factor, they included relative advantage, cost, complexity, and compatibility. Organizational characteristics included top management support, and IT expertise. Finally, within the environmental characteristics variable, competitive pressure, external support, and vertical linkages were considered.

The results suggested that relative advantage, top management support, and competitive pressure were factors influencing the three communication technologies. Compatibility, complexity, external pressure, and organizational size were found to be significant discriminators between adopters and non-adopters of online data access technology. Cost was found to be an important discriminant factor only for the adoption of the Internet. IT expertise was not found to be an important factor that discriminates between adopters and non-adopters. Finally, vertical linkage was found to be an important discriminant factor for online data access and the Internet adoption.

The adoption of the Internet was also studied by Mehrtens et al.(2001). In order to develop a model of Internet adoption, they conducted a case study on seven SMEs. Based on Iacovou et al.'s work and the results of the preliminary analysis, they devised their model using perceived benefits, organizational readiness, and external pressure as determinant factors.

The emerging field of e-commerce has not been ignored in the analysis of adoption. Mirchandani and Motwani (2001) investigated the factors that differentiate adopters from non-adopters of e-commerce in small businesses. The relevant factors included enthusiasm of top management, compatibility of e commerce with the work of the company, relative advantage perceived from e-commerce, and knowledge of the company's employees about computers. The degree of dependence of the company on information, managerial time required to plan and implement the e-commerce application, the nature of the company's competition, as well as the financial cost of implementing and operating the e-commerce application were not influencing factors. Similarly, Riemenschneider and McKinney (2003) analyzed the beliefs of small business executives on the adoption of e-commerce. They found that all the component items of the normative and control beliefs differentiated between adopters and non-adopters.

In the behavioral beliefs (attitude) group, however, only some items (e-commerce enhances the distribution of information, improves information accessibility, communication, and the speed with which things get done) were found to differentiate adopters from non-adopters.

In all the studies above, it is instructive to note that all the technologies in a way rely on the form of connectivity available. All depend on the infrastructure provided by the Internet. In a preliminary sense, it may therefore be relevant to consider the factors of adoption espoused by the above theories as possible influencers of broadband technology adoption.

The TAM model or an extended version thereof has been used for many studies as a theoretical basis for predicting those factors that influence the use or adoption of information technology or new technological innovation (Pavlou, 2001).

In many researches on technology adoption, two perceptions are critical to the adoption of new technology, namely *perceived usefulness* (PU) which relates to extrinsic characteristics such as efficiency and effectiveness and *perceived ease of use* (PEOU) which relates to intrinsic characteristics such as ease of use and flexibility. Other perceptions have been used in the study of adoption are organizational support, technological compatibility, influence of external pressure as well as organizational readiness. These two combined perceptions influence the adoption of new technologies (Adams et al, 1993).

All the above theories were considered relevant for this study, however, not all the variables that have been evaluated were considered in this study. Thus in terms of the study objectives, the constructs that were presumed to be relevant in the context of the banking sector's decision to adopt Broadband Technology were the following perceptions:

- Organizational support
- Technological compatibility
- Organizational readiness
- External pressure and
- Ease of use of Broadband Technologies

2.3.3 Technology Views and Impacts

The project also borrowed from a discussion of five generalized conceptualizations of Information and Communications Technology (Orlikowski and Iacono, 2001; Sawyer, 2004). This study will rely on these ICT conceptualizations and their representations (shown in the table 3 below) as a guide to understanding the Broadband Technology conceptualization:

Table 3: Technology Views and Impacts

Conceptualization	Representation	Description
Tool View	• Social Relations Tool	Broadband Technology provides opportunities for organizations to convey social presence which enables it to alter its effectiveness and its communications behaviour
	• Labor Substitution Tool	Broadband Technology is a tool that enables organizations enhance their organizational performance more cheaply and efficiently
	• Productivity Tool	Performance capabilities of Broadband Technology is designed in the technical features of the technology used during implementation
	• Information Processing Tool	Broadband Technology alters and enhances the way that individuals within organizations process information
Proxy View	• Technology as perception	Broadband Technology is largely represented by measures of users' perceptions of the technologies that have been adopted.
	• Technology as Diffusion	Measures of diffusion and penetration of technologies such as Cable Models, ADSL, internet, Intranets, Extranets, Mobile computing and Mobile telephony are indicative of Broadband Technology
	• Technology as Capital	The impact that Broadband technology has on productivity of staff is dependent on the monetary resources allocated to Broadband Projects

Table 4: Technology Views and Impacts

Ensemble View	• Technology as Development Project	broadband Technology is a social process that is largely determinec by the roles of various stakeholders during its design, development and implementation
	• Technology as Production Network	Broadband Technology is focused on building of systems of alliances which tie together various stakeholders who work together to develop new technologies for maintaining good service delivery
	• Technology as Embedded Systems	Conditions of use of the Broadband Technology within a particular social context determines it as a continuously evolving system embedded in a complex and dynamic social context.
	• Technology as Structure	Broadband Technology embodies social structures built into it by its designers during development which are then appropriated by the users as they interact with the technology
Computational View	• Technology as Algorithm	Broadband Technology is a set of rules and procedures that is used by organizations to build new or enhance systems that enhance their service delivery
	• Technology as Model	Broadband Technology is regarded as technology used for representing organizational processes, structures, events, knowledge as accessible database through the use of data modeling or simulation
Nominal View	• Technology as Absent	Broadband Technology is absent and cannot be described, conceptualized or theorized

Source: Muganda (2005)

In terms of the impacts of Broadband Technology adoption, reliance was on the various theories espoused on earlier as well as reports from other studies that have highlighted advantages of adopting this technology.

3.0 RESEARCH METHODOLOGY

3.1 Research Design

Since this is an initial and exploratory study of the adoption of broadband, the survey method was considered to be the most suitable research method for this investigation. Previous research has revealed that the survey method is most appropriate when investigating technology and e-commerce adoption (Tan, et al. 2000; Venkatesh, et al. 2000; Venkatesh and Brown, 2001; Anckar, 2003).

Thus a census survey of the Banking Industry will be conducted. The study will therefore adopt a cross-sectional design with the respondents being the senior-most Officers in charge of the Information System function in the various banks.

3.2 The population

The study focused on all the 49 financial institutions (Economic Survey, 2004) shown in Appendix. The banking sector was selected largely because the banking sector has always taken a lead role in implementing ICT solutions and is reported to spend huge amounts on these ICT projects (Nyambati, 2001; Ngemu, 2005). The unit of analysis was the bank itself as was be presented through the relevant management staff. The study aims at doing a Census of the entire financial services sector. Census is the only complete snapshot in time hence the reason it has been selected for this study.

3.3 Data Description and Collection

Primary data was collected for the purpose of this study. It was be collected using a self-administered questionnaire available in the appendix. The questionnaire was semi-structured, having both open-ended and closed-ended questions. It was administered to the Manager- Information systems at their offices or through their electronic mail boxes.

The questionnaire is divided into two parts. The objective of the first part is getting the demographic information on the Bank that is deemed relevant for the study. The second part of the questionnaire will be used to examine the adoption factors, views and impacts of broadband adoption. The 5-scale Likert type scale will be adopted for the study.

3.4 Data Analysis

The data collected was be edited for accuracy, uniformity, consistency and completeness and arranged to enable coding and tabulation before final analysis (Cooper and Emory, 1998). The data collected from this study was mainly presented through the use of summarized percentages, proportions and tabulations in all the three sections of the questionnaire. Mean scores and standard deviations were evaluated and ranked to give the relative importance of the various variables of this study. Specifically, sections II was analyzed through the use of factor analysis.

Factor analysis is a systematic, statistical procedure used to uncover relationships amongst several variables. This procedure enables numerous correlated variables to be condensed into fewer dimensions known as factors. In the context of this research, the variables are the degree of agreement with various specific perception statements while the factors are the general underlying constructs. The factor analysis for this research will be conducted

using a statistical package SPSS. The purpose of factor analysis is to discover simple patterns in the pattern of relationships among variables. In its procedure, rotation is applied to identify meaningful factor names or descriptions. A rotation, which requires that the factors remain uncorrelated, is an orthogonal rotation, while a rotation, which requires the factors to be correlated, is called Oblique rotation.

In this study, oblique rotation using Promax will be carried out because the proposed framework indicates that the underlying constructs and variables are inter-correlated. Factor rotation is used to re-orient the factor loadings so that the factors are more interpretable. Use of Oblique rotation allows for correlations between factors since many attitudinal dimensions are in fact likely to be correlated. For easier interpretation of the factors, only the pattern matrix is examined (Rummel, 1970). The factor extraction method adopted for this study is principal axis factoring. Principal Axis Factoring, unlike principal component analysis, relaxes the assumption that the communality is equal to one. As a result, using this method enables the factor loadings to be higher, which leads to greater interpretability.

3.5 Research Framework

Given the earlier analysis presented in other sections of this project, this thesis was hypothesized to have the following variables, especially with regard to the main objectives of the study:

Objective 1: To investigate the determinants of Broadband Technology adoption

Objective 2: To investigate the views or conceptualization of Broadband Technology

Objective 3: To investigate the impacts of the adoption of Broadband Technology

4.0 DATA ANALYSIS AND FINDINGS

4.1. Introduction

This section provides the data analysis and findings of the survey. The data is analyzed using frequencies, means, standard deviations and factor analysis. It is presented in tables, pie charts and graphs. Part I was analyzed using proportions i.e. percentages, means and standard deviations. Part II was analyzed using factor analysis so as to reduce the variables to the underlying factors.

4.2. Bank demographic information

The variables considered in this section were mainly aimed at providing insight information of the various stakeholders in the banking industry.

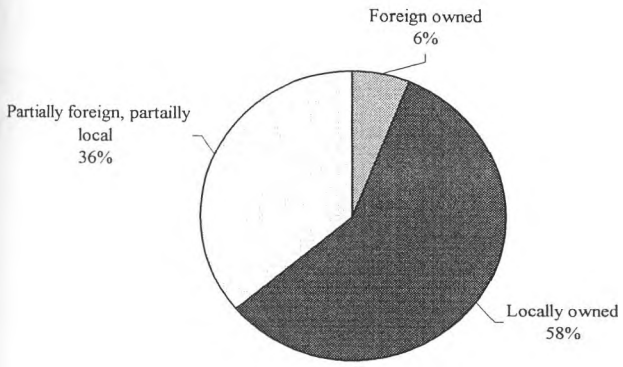
4.2.1. Response rate

From a total of 49, 43 questionnaires were returned within the specified periods. Of these, 40 questionnaires were usable for the analysis, whilst 3 were incomplete when returned. This yielded a response rate of 83% which was considered adequate for the purposes of this study.

4.2.2. Ownership of banks

Majority of the banks in the survey (58%) are locally owned whereas 36% have partially foreign and local ownership and 6% are foreign owned as shown in chart 1 below: -

Chart 1:Bank ownership



4.2.3. Customer base

Majority of the banks surveyed (66%) have a customer base of over 100,000- whereas 17 % less than 20,000 and 100,000 respectively as shown in table 5 below.

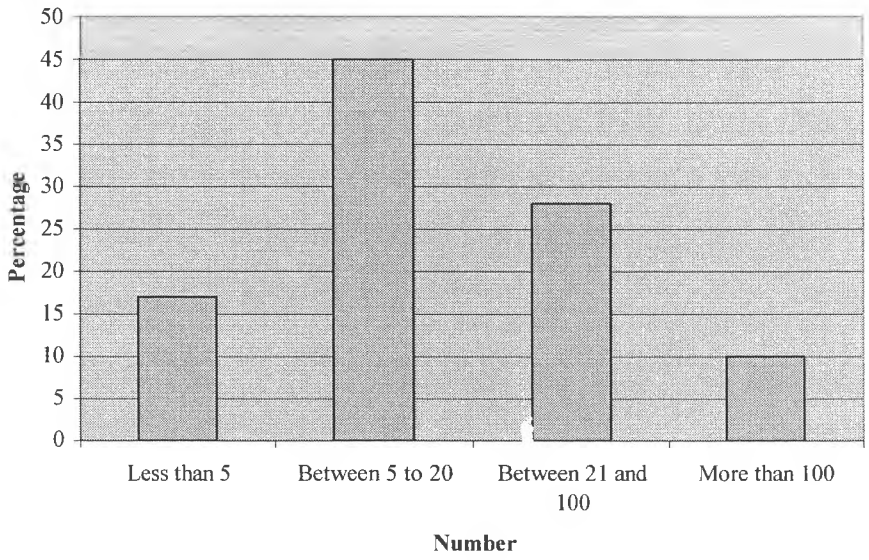
Table 5: Customer base

(In 000')	Frequency	Percentage
Less than 20	5	17
Less than 100	19	66
More than 100	5	17
Total	**29**	**100**

4.2.4. Number of branches

In terms of branch network, 17% of the banks have less than 5 branches, 28% have between 5 to 20 branches; 45% have between 21 and 100 branches; while 10% have more than 100 branches as shown in chart 2 below.

Chart2:Number of branches



4.3. Use of Broadband Technology in the Banks

To establish the level of awareness of Broadband Technologies within the banking sector, the respondent banks were requested to fill in various variables related to the applications that depend to a great extent on Broadband.

In all the respondent banks, there was a clear indication that they were employing one of the broadband applications as shown in the table below. This point to a need for these banks to focus on broadband technology. In five out of the eleven areas where broadband can be used, all the banks (100%) indicated that they used these applications. These applications were internal e-mail, external e-mail, use of the Internet in the bank, use of a wide area and local area networks. The banks also indicated that 70% of them had company websites hosted by the banks themselves, whilst 50% of them used some form of Electronic Data Interchange (EDI). The other applications that received low weightings current use of Intranets (25%), current use of extranets (40%) use of wireless LANs (28%) and the use of Internet Protocol for telephony (10%). However, even though these received low ratings, the banks indicated that they had plans to use them in the future. These statistics are covered in the table 4.3 below.

Table 4. 3 Technology	**Currently Use**	**Plan to Use**	**Don't know/Not applicable**
Internal e-mail	40 (100%)	0	0
External e-mail	40 (100%)	0	0
Internet	40 (100%)	0	0
Company Website	70%	21%	9%
Intranet(Internal Private Website)	25%	65%	15%
Extranet (provides external web access to part of the organizations network for a restricted group of users)	40%	50%	10%
Wide Area Network	100%	0%	0%
Local Area Network	100%	0%	0%
WiFi or Wireless LAN (Allows for wireless access to local area networks or internet)	28%	55%	17%

Electronic Data Interchange or EDI (Allows for transmission of orders, invoices and payments electronically from different locations via private network)	50%	23%	27%
Internet Protocol or IP Telephony (Allows for data, voice, image and video to be transmitted over a single network infrastructure)	10%	60%	30%

4.4 Confirmatory and Descriptive Data Analysis

In order to test the research model, a statistical analysis was conducted to aid in finding answers to the research questions. Since the model assumes that the Broadband Adoption construct is multidimensional, the analysis considered the three components of determinants, conceptualization and impacts separately. That these three components influence the adoption of Broadband Technology amongst banks in Kenya. The following analyses ensue:

4.4.1 Determinants of Broadband Technology Adoption

Many technology adoption researches have been carried out to determine the importance of factors influencing adoption through the use of the mean and standard deviation. This research also used this approach. The results are illustrated in Table 4.4.1 below:

Table 4.4.1: Ranking of Factors	N	Mean
PUCOMM: Perceived usefulness of Broadband in accomplishing communication tasks	40	4.4
EASEUSE: The ease of use of Broadband Technologies	40	4.2
PUIOP: Usefulness of Broadband in improving productivity	40	4.07
COMPWP: Compatibility with work practices	40	4.03
FINRE: Financial Resources of an organization	40	4.02
INTERA: Interaction with firms already using broadband	40	3.98
PUEEO: Broadband is perceived to enhance overall effectiveness of the organization	40	3.93
PUIJP: The usefulness of Broadband in improving job performance of employees	40	3.93
OBTEO: Usefulness of Broadband in operations	40	3.9
OININT: Organizational and individual interaction is clear	40	3.88
EASESK: Ease of becoming skillful at using Broadband Technology	40	3.75
COMPE: Broadband is critical in competition support	40	3.28
FLEXINT: Broadband flexibility makes it easier to interact with	40	3.17
COMPCUL: Broadband compatibility with organizational culture	40	2.83
COMPVAL: Compatibility with organizational values	40	2.8
TECHRE: Technological Resources of an organization	40	2.8
BTJEP: Broadband Technology makes hobs easier to perform	40	2.5
EASELE: Ease of learning how to implement Broadband	40	2.4
INDUSPRE :Industry Pressure	40	2.05
SOCFA: Social Factors are important in the decision to adopt	40	1.87
GOVTPRE: Pressure from the government	40	1.62
Valid N (listwise)	40	

From Table 4.4.1 above, the Broadband Technology adoption determinants that are considered significant were the following together with their means:

The variable named PUCOMM with a mean of 4.4 was ranked first. This factor considers the factor of perceived usefulness of Broadband Technology in influencing the accomplishment of communications tasks.

The variable named EASEUSE with a mean of 4.2 was ranked second considers that the ease of use of Broadband Technology influences the decision to adopt it.

The variable PUIOP scored a mean of 4.07 looks at the decision to adopt Broadband as being influenced by the perception that broadband improves the overall productivity of the organization.

The variable named COMPWP, with a mean of 4.03 indicates that the decision to adopt Broadband Technology is determined by the compatibility of this technology with existing work practices in the organization.

The other factor that was considered critical in the decision to adopt Broadband Technology was captured by the variable named FINRE, which scored a mean of 4.02. This concerns the perception that the financial resources of an organization are a key determinant of the decision to adopt Broadband Technology.

Contrastingly, the social factors, named SOCFA with a mean score of 1.87 was not considered significant by the respondents. In addition the variable named GOVTPRE with a mean of 1.62 received the lowest weighting with an indication that most banks are not pressured by the government to adopt Broadband Technology in Kenya.

4.4.2 Confirmatory Factor Analysis of Determinants of Broadband Technology Adoption

The principal axis factoring extracted factors based on the prior hypotheses as shown in table 4.4.2 (a) below. Since the variables and factors are assumed to be correlated, the sums of squared loadings in the table cannot be added to obtain the total variance. Therefore, only the pattern matrix shown in table 4.4.2 (b) used for the factor analysis.

Total Variance Explained

Table 4.4.2 (a)	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
Component	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	2.697	12.844	12.844	2.697	12.844	12.844	2.494	11.875	11.875
2	2.593	12.346	25.19	2.593	12.346	25.19	2.42	11.522	23.397
3	1.932	9.201	34.391	1.932	9.201	34.391	1.947	9.27	32.667
4	1.815	8.642	43.033	1.815	8.64	43.033	1.936	9.218	41.886
5	1.619	7.707	50.741	1.619	7.707	50.741	1.86	8.855	50.741
6	1.427	6.797	57.538						
7	1.245	5.93	63.467						
8	1.195	5.689	69.156						
9	1.04	4.95	74.106						
10	0.981	4.67	78.776						
11	0.803	3.825	82.602						
12	0.73	3.475	86.077						
13	0.625	2.976	89.053						
14	0.541	2.577	91.63						
15	0.45	2.144	93.774						
16	0.333	1.588	95.362						
17	0.294	1.399	96.761						
18	0.228	1.086	97.847						
19	0.205	0.975	98.822						
20	0.132	0.63	99.452						
21	0.115	0.548	100						
Extraction Method: Principal Component Analysis.									

Five factors were extracted as per the prior hypotheses. Table 4.4.2 (a) shows the final output of the principal axis factoring, which expresses the sums of the squared loadings of the variables. However, the sums of squared loadings are irrelevant in this case since the variables are assumed to be correlated.

The communalities show the proportion of the components variation to the total variation that is involved in the correlated factors as shown in the appendices.

Table 4.4.2 (b) below is the pattern matrix which is the only matrix needed for the interpretation (Rummel, 1970). He says that the pattern matrix found using oblique rotation is more interpretable than the orthogonal rotation solutions with fewer variables loading significantly on more than one factor. The initial matrix

was rotated using promax with oblique normalization to give these results. Oblique normalization was preferred due to the assumption of correlation among variables.

Table 4.4.2 (b)	Component				
	1	2	3	4	5
FINRE	-0.338	0.378	-0.155	0.595	-0.269
TECHRE	0.292	-0.17	-0.24	0.505	0.271
COMPE	-0.336	-0.101	1.26E-02	-9.03E-02	0.456
SOCFA	-0.308	0.57	4.74E-02	-4.17E-02	5.12E-02
INTERA	-0.139	-0.863	5.80E-03	9.29E-02	-9.80E-02
INDUSPRE	-0.224	0.142	0.216	0.524	0.41
GOVTPRE	0.209	0.419	0.17	1.06E-02	-9.2 3E-02
COMPCUL	0.313	0.375	0.15	0.516	-0.174
COMPVAL	-0.104	5.72E-02	0.422	0.243	0.282
COMPWP	0.697	-5.32E-02	-2.33E-02	-0.238	4.30E-02
EASELE	-0.136	0.354	-2.87E-02	9.14E-02	0.622
FLEXINT	0.774	-3.04E-02	0.17	-0.154	2.91E-02
OININT	6.20E-02	-0.259	0.362	-4.33E-02	-4.89E-03
EASESK	-0.101	6.63E-02	0.573	-6.89E-03	0.142
EASEUSE	-0.138	0.369	0.204	5.15E-02	-0.476
PUCOMM	0.751	0.218	-5.41E-02	0.233	-7.38E-02
PUIJP	0.193	9.12E-02	0.66	-0.252	-3.70E-02
PUIOP	0.148	0.629	-0.373	0.126	0.246
PUEEO	0.117	7.17E-03	0.662	0.292	-0.171
BTJEP	-0.126	-0.174	4.25E-02	0.629	1.41E-03
OBTEO	0.277	9.24E-02	0.193	2.04E-02	0.688

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.

The pattern matrix, obtained after an oblique rotation using promax indicates that the significantly loaded factors are as follows:

Factor 1: This factor was significantly loaded by the following factors:

- COMPWP: The variable emphasized that the decision to adopt Broadband Technology is influenced by the compatibility of the technology with organizational preferred work practices. The weighting received for this was 0.697

- FLEXINT: This determinant argued that the flexibility of Broadband Technologies makes it easier to interact with, thus making it easy to use. That this had an influence on the decision to adopt this technology. It received a weighting of 0.774
- PUCOMM: That the decision to adopt is also influenced by the perceived usefulness of Broadband Technology to accomplish communications tasks more quickly. The average weighting was 0.751.

Factor 2: This factor can be named External Pressure and had the following significant loadings:

- SOCFA: Social factors are important in the decision to adopt broadband technology. This received a weighting of 0.57.
- INTERA: Interaction with firms that are already using Broadband Technology influences the decision to adopt. The sub-test was highly loaded at 0.863.
- PUIOP: The perceived usefulness of Broadband Technology is in improving overall productivity in the organization which received a weighting of 0.629.

Factor 3: This factor can be named Ease of Use with substantial factor loadings of:

- EASESK: The ease of becoming skilful at using Broadband Technology influences the decision to adopt with a loading of 0.573.
- PUIJP: The perceived usefulness of Broadband Technology in improving job performance of employees influences the decision to adopt at a weighting of 0.660.
- PUEEO: The perceived usefulness of Broadband Technology is in enhancement of the overall effectiveness of the organization. This was weighted at 0.662

Factor 4: This factor can be named Organizational Readiness with substantial factor loadings of:

- FINRE: Financial Resources of an organization are a key factor in Broadband Technology Adoption. This had a loading of 0.595.
- TECHRE: This variable received a loading of 0.505 and was concerned with Technological Resources of an organization are critical in Broadband Technology adoption
- INDUSPRE: The industry pressure is critical in the decision to adopt broadband technology. It had a loading of 0.524.
- COMPCUL: The decision to adopt Broadband Technology is influenced by the compatibility of the technology with organizational culture. This received a weighting of 0.516.
- BTJEP: Broadband Technology adoption is influenced by its ability to make jobs easier to perform. This captured a weighting of 0.629 from the respondents.

Factor 5: This factor had significant loadings of:

- EASELE: The ease of learning how to implement, operate and maintain Broadband Technology influences the decision to adopt. This was weighted at 0.622
- OBTEO: This received a weighting of 0.688 and concerned the perception that oorganizations find Broadband Technology useful in operations

4.4.3 Confirmatory Factor Analysis of Views of Broadband Technology Adoption

In this section, all the twelve variables are assumed to have probable relationships as had been argued earlier. The principal axis factoring extracted five factors based on the prior hypotheses as shown in table 4.4.3 (a) and (b)

below. Since the variables and factors are assumed to be correlated, the sums of squared loadings in table (a) cannot be added to obtain the total variance. Therefore, only the pattern matrix shown in table (b) is used for the factor analysis.

Total Variance Explained Table 4.4.3 (a)	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings(a)
Factor	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total
1	2.083	17.361	17.361	1.566	13.05	13.05	1.361
2	1.809	15.079	32.44	1.282	10.68	23.73	1.217
3	1.433	11.938	44.378	1.029	8.579	32.309	1.13
4	1.387	11.557	55.935	0.845	7.039	39.348	1.12
5	1.169	9.743	65.678	0.696	5.798	45.146	1.001
6	0.931	7.757	73.435				
7	0.744	6.204	79.639				
8	0.684	5.702	85.34				
9	0.596	4.966	90.306				
10	0.468	3.9	94.207				
11	0.417	3.476	97.683				
12	0.278	2.317	100				
Extraction Method: Principal Axis Factoring.							
a When factors are correlated, sums of squared loadings cannot be added to obtain a total variance.							

The pattern matrix depicted in table 4.4.3 (b) from an oblique rotation using promax shows the following significantly loaded factors:

Factor 1: This factor was significantly loaded with the following factors:

- Var 6: Measures of diffusion and penetration of technologies such as e-mail, Internet, Intranets, Extranets, Mobile computing and Mobile telephony are indicative of Broadband Technology. This received a weighting of 0.732.

- Var 7: This variable with a weighting of 0.654 indicated that the conceptualization of Broadband technology can be captured by the productivity it has on the employees which is dependent on the monetary resources allocated to these projects.
- Var 10: The conceptualization is that Broadband Technology is basically a set of rules and procedures that is used by organizations to build new or enhanced communication systems that enhance their service delivery. It received a weighting of 0.605.
- Var 11: Broadband Technology is regarded as technology used for representing organizational communication processes, structures, events, knowledge as to enable accessibility to databases. This received a weighting of 0.420

Factor 2: This factor had the following significant loadings:

- Var 4: Broadband Technology provides opportunities for the organizations to convey social presence (reputation) which enables it to alter its effectiveness and its communications behaviour. This received a weighting of 0.529.
- Var 5: Broadband Technology is largely represented by measures of users' perceptions of the technologies that have been adopted. This had a weighting of 0.618.
- Var 9: The variable with a weighting of 0.639, was concerned the conceptualization that the condition of use of the Broadband Technology within a particular social context determines Broadband Technology as a continuously evolving system embedded in a complex and dynamic social context.

Factor 3: This factor had the following substantial factor loading:

- Var 12: Broadband Technology is absent and cannot be described, conceptualized or theorized. This received a loading of 0.855.

Factor 4: This factor had these substantial factor loadings of:

- Var 1: Broadband Technology is a tool that enables organizations to meet their objectives more cheaply and efficiently. This had a weighting of 0.705.
- Var 2: Performance capabilities of any Internet access method such as Broadband Technology are designed in the technical features of the technology used during implementation. This conceptualization of Broadband Technology received a weighting of 0.833.
- Var 3: Broadband Technology alters and enhances the way that organizations and their employees process information. This had a loading of 0.637.

Factor 5: This factor had a significant loading of:

- Var 8: Broadband Technology is a social process that is largely determined by the roles of various stakeholders during its design, development and implementation. It received a weighting of 0.780.

Pattern Matrix4.4.3 (b)	Factor				
	1	2	3	4	5
VAR1	0.35	0.12	-6.52E-02	-0.705	2.95E-02
VAR2	3.66E-02	3.76E-03	2.43E-02	0.833	-2.84E-02
VAR3	-0.149	-0.167	-0.11	0.637	0.356
VAR4	0.179	-0.529	0.281	7.13E-02	-0.278
VAR5	-3.34E-02	0.618	6.97E-02	-0.101	-0.307
VAR6	0.732	9.88E-04	0.348	0.181	0.102
VAR7	0.654	3.03E-02	-0.159	3.10E-02	-0.114
VAR8	0.106	-4.01E-02	0.168	-0.148	0.78
VAR9	0.274	0.639	6.06E-02	9.22E-02	-8.01E-02
VAR10	0.605	6.91E-02	0.231	0.128	0.163
VAR11	-0.42	0.289	0.173	0.241	9.53E-02
VAR12	-0.154	-1.55E-02	0.855	-0.125	-5.71E-02
Extraction Method: Principal Axis Factoring. Rotation Method: Promax with Kaiser Normalization.					
a Rotation converged in 6 iterations.					

Table 4.4.3 (c) below captures the ranking of these views of Broadband Technology with a view to understanding the predominant conceptualization amongst banks in Kenya. From the table, three views of Broadband Technology standout.

The highly ranked view is represented with variable 1 with a mean of 4.25 captures the conceptualization that Broadband Technology is a tool that enables organizations to meet their objectives more cheaply and efficiently.

The second ranked view is captured by variable 3 with a mean of 4.1 captures the conceptualization that Broadband Technology alters and enhances the way that organizations and their employees process information.

The third ranked conceptualization with a mean of 4 is represented by variable 11. This concerns the view that Broadband Technology is regarded as technology used for representing organizational communication processes, structures, events, knowledge as to enable accessibility to databases.

Contrastingly, the lowest ranked views were represented by variables 12, 5, and 10 with means of 1.63, 1.95 and 2.05 respectively. Variable 12 views Broadband Technology as absent and cannot be described, conceptualized or theorized. Variable 5 conceptualizes Broadband Technology as largely represented by measures of users' perceptions of the technologies that have been adopted. On the other hand, variable 10 views this technology as basically a set of rules and procedures that is used by organizations to build new or enhanced communication systems that enhance their service delivery. The ranking of the other views are captured in Table 4.4.3 (c) below:

Table 4.4.3 (c)	N	Mean
VAR12	40	1.53
VAR5	40	1.95
VAR10	40	2.05
VAR9	40	2.07
VAR8	40	2.27
VAR2	40	2.45
VAR4	40	2.88
VAR7	40	3.3
VAR6	40	3.87
VAR11	40	4
VAR3	40	4.1
VAR1	40	4.25
Valid N (listwise)	40	

4.4.4 Summary Statistics of Impacts of Broadband Technology Adoption

Lack of understanding of the wider broadband value proposition is often cited as a major barrier to its adoption. In order to gain more insight into this theory, the respondents were also asked about that they perceived to be the benefits of Broadband Technology. The respondents were asked to choose all the options that applied from a list, including an open-ended option for additional impacts not captured in the provided list. The table 4.4.4 (a) below captures the perception of the respondents on their perceptions as to the impact of Broadband Technology adoption within the banking sector in Kenya.

From the table, it can be inferred that out of the list of impacts provided to the respondents, only two the impacts (impact 1 and impact 3) scored highly on the mean rankings. Impact 1 focused on the effect Broadband Technology has on Internet communications. That adoption of this technology enables more effective Internet communications. This variable scored a mean of 4.22.

Impact 3, with a mean score of 4.02 focused on the impact of Broadband Technology on reduced communication costs. On the other hand, the impacts which received the lowest mean rankings were impact 7, 5, and 9. Impact 7 with a mean score of 2.45, gave an indication that Broadband Technology provides better access to training opportunities such as e-learning. Impact 5 with a mean score of 2.35 focused on Broadband Technology adoption enabling more efficient procurement in the banking sector. The lowest ranked impact 9 had a mean score of 2.17. This impact focused on the effect Broadband Technology adoption is in reduced requirements for ICT skills training. The other rankings of the impacts are shown in table 4.4.4 (a).

Impacts Table 4.4.4 (a)	**N**	**Mean**
Impact1: More effective Internet Communications	40	4.22
Impact3: Reduced Communications Costs	40	4.02
Impact8: Increased Sales	40	3.97
Impact10: Provides general organizational support making it an indispensable technology	40	3.83
Impact2: Improved Business Productivity	40	3.75
Impact4: Flexible Working	40	3.43
Impact6: Competitive Advantage	40	3
Impact7: Better Access to training opportunities such as e-learning	40	2.45
Impact5: More Efficient Procurement	40	2.35
IMpact9: Results in reduced requirements for ICT skills in the organization	40	2.17
Valid N (listwise)	40	

In addition to an expose of the ranking of the impacts by the respondents, the descriptive statistics also focused on an analysis of the individual impacts in order to get an indication of the magnitude of importance attached to the various impacts provided in the list. The following sections provide results of this argument.

Table 4.4.4 (i) Impact 1	Frequency	Percent	Cumulative Percent
5: Very important	17	42.5	42.5
4: Quite Important	17	42.5	85
3: Not very important	5	12.5	97.5
2: Not at all Important	1	2.5	100
1: Not applicable	0	0	100
Total	40	100	

When asked how significant Broadband Technology is in ensuring effective Internet communications, 85% of the surveyed banks believe it to be very or quite important for all the banks interviewed. None of those surveyed believed that this is not an impact at all. These statistics are captured in table 4.4.4 (i) above.

Table 4.4.4. (ii)Impact 2	Frequency	Percent	Cumulative Percent
5: Very Important	1	2.5	2.5
4: Quite Important	9	22.5	25
3: Not Very Important	8	20	45
2: Not Important	11	27.5	72.5
1: Not applicable	11	27.5	100
Total	40	100	

Impact 2 focused on the effect of Broadband Technology adoption on improving business productivity. This was also hypothesized to be an important impact of Broadband Technology uptake. The results shown in table (ii) above clearly do not support this hypothesis since only 25% of the surveyed banks indicate that Broadband Technology uptake would result in an improvement of business productivity. 55% of the surveyed banks indicated that the technology does not result in this impact.

Table4.4.4 (iii)Impact 3		Frequency	Percent	Cumulative Percent
	5: Very Important	13	32.5	32.5
	4: Quite Important	20	50	82.5
	3: Not very Important	5	12.5	95
	2: Not Important at all	2	5	100
	1: Not applicable	0	0	100
	Total	40	100	

The respondent banks were also asked whether Broadband Technology adoption resulted in reduced communication costs. Of the 40 respondents, about 83% indicated that this was an important impact of Broadband Technology uptake. Only 5% believed that its uptake did not result in this impact as shown in table (iii) above.

Table 4.4.4. (iv) Impact 4		Frequency	Percent	Cumulative Percent
	5	2	5	5
	4	10	25	30
	3	14	35	65
	2	9	22.5	87.5
	1	5	12.5	100
	Total	40	100	

From table (iv) above, 35% of those surveyed believed that the adoption of Broadband Technology did not enable a flexible working environment. An equal number of the respondents believed that this was an impact of Broadband Technology adoption, while another 30% considered it to be not a very important impact of Broadband Technology adoption. Thus it is noticeable that there is an almost even spread in terms of the perceptions of the respondents across the measurement scale.

Table 4.4.4 (v) Impact 5		Frequency	Valid Percent	Cumulative Percent
Valid	5	1	2.5	2.5
	4	3	7.5	10
	3	5	12.5	22.5
	2	15	37.5	60
	1	16	40	100
	Total	40	100	

The results of impact 5, shown in table (v) above concerned the influence that Broadband Technology adoption uptake has on an efficient procurement process. From the table above, it is indicative that less tnan 13% of the banks surveyed believed this to be an impact of the technology's uptake. On the other hand, over 77% regarded this impact as not important at all, or even not applicable as an impact of broadband technology.

Table 4.4.4 (vi) Impact 6		Frequency	Valid Percent	Cumulative Percent
Valid	5	8	20	20
	4	22	55	75
	3	8	20	95
	2	1	2.5	97.5
	1	1	2.5	100
	Total	40	100	

Table (vi) above shows the result of the responses about the sixth impact which hypothesized that one of the critical impacts of Broadband Technology uptake is in its influence on the competitive position of the bank in the industry. 95% of the responding banks were of the belief that Broadband Technology adoption enhanced the banks competitive positive, with only 5% indicating that this impact was not important at all.

Table 4.4.4 (vii) Impact 7		Frequency	Valid Percent	Cumulative Percent
Valid	5	6	15	15
	4	14	35	50
	3	9	22.5	72.5
	2	8	20	92.5
	1	3	7.5	100
	Total	40	100	

Table (vii) above gives the results of the perceptions of the respondents with regard to Broadband Technology adoption resulting in bbetter access to training opportunities such as e-learning. From the table, it is the respondents' belief that this hypothesis is somewhat true, with 65% of them indicating that this is at least an important driver of Broadband Technology adoption. Only about 28% were of the opinion that this is not an impact at all.

Table 4.4.4 (viii) Impact 8		Frequency	Valid Percent	Cumulative Percent
	5	2	5	5
	4	3	7.5	12.5
	3	9	22.5	35
	2	16	40	75
	1	10	25	100
	Total	40	100	

The responding banks wee also asked how significant Broadband Technology adoption is in increasing sales of their organizations. The results are depicted in table (iix) above. It is evident that 65% were of the opinion that the technology did not directly influence the sales of the organization. On the other hand, only 8% of the banks believed that the technology directly affected the sales of the banks.

Table 4.4.4 (ix) Impact 9		Frequency	Valid Percent	Cumulative Percent
	5	2	5	5
	4	3	7.5	12.5
	3	10	25	37.5
	2	6	15	52.5
	1	19	47.5	100
	Total	40	100	

Impact 9, which focused on the reduced requirements for ICT skills as a result of adoption of Broadband Technology, had about 63% percent of the respondents indicating that this was not an impact. Only 13% indicating that this was at least an important impact of the uptake of this technology. This means that the responding banks may not have experienced this as an impact of their adoption of broadband. The results are shown in table (ix) above.

Table 4.4.4 (x) Impact 10		Frequency	Valid Percent	Cumulative Percent
Valid	5	2	5	5
	4	3	7.5	12.5
	3	4	10	22.5
	2	17	42.5	65
	1	14	35	100
	Total	40	100	

The last listed impact was no 10, which argued that Broadband Technology provides general organizational support making it an indispensable technology in the banks. Interestingly, only 13% considered this to be at least an important impact. On the other hand, 78% of the respondents considered it to be at least not important at all. This may be because a majority of the banks have not been using this technology for a long time, and therefore they may view this impact as not being very critical to their operations.

4.4.5 Barriers to Broadband Technology Adoption

In addition to exploring what banks perceived to be the impacts of Broadband Technology, the respondents were also asked about the barriers to obtaining a

broadband connection. The approach that was adopted was to allow the respondents to list these barriers. A list of the barriers cited is depicted in shown in table 4.4.5 below:

Table 4.4.5 Barriers to Broadband Technology Adoption	**No. Of Respondents**	%
Satisfaction with current connection	8	20
Poor communications infrastructure	8	20
Too expensive	6	15
Don't know enough about it	2	5
High costs of ISPs and other ICTs	5	12.5
Poor quality of technical support	1	2.5
Don't like choice of service providers	2	5
Employees lack of technical expertise	2	5
Lack of knowledge and need for Broadband use and benefits	2	5
High initial costs	2	5
Lack of an ICT infrastructure strategy	2	5
Total	40	100

Satisfactions with the current connection as well as an overall assessment of the poor communications infrastructure by far are the top barriers to organizations adopting Broadband Technology. The two barriers received a weighting of 20% after tallying how many of the respondents cited them. On the other hand, 15% cited the reason of expense generally whilst 12.5% indicated that the sources of these costs were the ISPs who have been providing these services. The perception of high prices if oft mentioned as a reason as a barrier, however, the costs barrier did seem to be the critical reason of concern to the banks.

Other reasons on the list include lack of knowledge about the benefits of broadband technology (5%), dissatisfaction with the choice of Broadband suppliers (5%), lack of technical knowledge relevant to Broadband Technology (5%), ignorance about the benefits and uses of broadband (5%), high initial costs of installation (5%), lack of a comprehensive ICT infrastructure (5%) and the current poor quality of technical support (2.5%).

5.0 SUMMARY AND CONCLUSIONS

A broad objective of the study was to investigate broadband technology adoption. It focused on broadband technology adoption, not only as a technology to increase efficiency and effectiveness of Internet access, but also as a technology that is enabling new possibilities, unfeasible before, especially through the interactive nature of the Internet.

The specific objectives of the study were to:

- To investigate the determinants of broadband technology adoption;
- To investigate how broadband technology is viewed (conceptualized);
- To determine the impacts of use of broadband technology within the Kenyan Banking context and lastly,
- To highlight the barriers to Broadband Technology adoption.

The approach to this study was to confirm the research framework highlighted in part three of this thesis, as well as to highlight other issues that were not captured in the research framework. The framework adopted for this study proposed three constructs for the Broadband Technology adoption which formed the basis for derivation of the objectives and the hypotheses to be tested.

The literature review focused mainly on an understanding of the technologies of Broadband Technologies, review of literature on adoption models, a snap-shot of the Kenyan Banking industry as well as provide a theoretical grounding to the major construct of Broadband Technology adoption, that is, the determinants, views and impacts of these technologies.

This study is not a replica of another study but is based on the conceptual framework as outlined in other earlier sections of this study. It set out to test the

hypotheses that were established from the propositions of the Broadband Technology adoption framework outlined earlier.

5.1 Discussions

From the research findings as presented in part four of the study, several conclusions can be drawn in support of the adopted framework. These are discussed in light of the objectives of the study.

5.1.1 Objective 1: Determinants of Technology Adoption

The framework that was adopted in this research grouped the determinants that were to be considered into five factors. These factors were:

- *Organizational Support factors*, which consisted of the three variables of OBTEO (perception of effective support for operations), PUCOMM (the need for improved communications), PUIOP (the need for improved productivity).
- *Compatibility factors*, which consisted of the three variables of COMPCUL (compatibility of the technology with the culture of the organization), COMPVAL (compatibility of the technology with organizational values), and COMPWP (compatibility of the techno'ogy with organizational work practices).
- Organizational readiness factors, which consisted of the variables of FINRE (the influence of financial resources on the decision to adopt) and TECHRE (the influence of technological resources on the decision to adopt).
- External Pressure factors, which consisted of the five variables of COMPE (the perception that adoption leads to enhanced competitiveness), SOCFA (the perception of the influence of social factors on the decision to adopt), INDUSPRE (industry pressure), GOVTPRE (government pressure), INTERA (influence from interaction with other firms using broadband).

- Perception of Ease of Use factors, which were indicated by the following variables: EASELE (ease of learning broadband), FLEXINT (the flexibility of interacting with the technology), OININT(the interaction of the technology with the organization and the individual is clear and understandable), EASESK (the ease of becoming skillful at using broadband), BTJEP (the perception that Broadband improves job performance), PUEEO (the perception that broadband enhances job effectiveness)

This research sought to confirm these propositions that were derived from the literature. As was presented in part four of the research, the framework of Broadband Technology adoption determinants was not confirmed as proposed. The results, as presented earlier are discussed below:

From the factor analysis presented earlier in the pattern matrices, the differences that emerged from the empirical evidence showed the following:

Factor 1: Unconfirmed from the adopted framework

This factor was highly loaded with the following: COMPWP, FLEXINT, and PUCOMM. From the research framework as highlighted above, all the three variables shown under this factor belonged to different factors. It is therefore difficult to confirm the identity of this factor through recourse to the adopted framework of this study.

Factor 2: This factor may be named External Pressure

The factor was highly loaded with the variables of SOCFA, INTERA, and PUIOP. The variables that were in the initial framework were SOCFA and INTERA, whilst PUIOP was considered as an organizational support factor. In naming this factor external pressure, the argument has considered the influence of the other variables under external pressure. From an earlier analysis, the other variables such as GOVTPRE and INDUSPRE were not considered critical from the mean

rankings. It may also be important to look at the Kenyan context where external pressure especially from the government has rarely taken note of the new emerging technologies such as the Internet.

Thus it may suffice, within the context of the Kenyan banking sector, that the factor of external pressure as one of the drivers of Broadband Technology adoption, may be theorized to consist of the two variables of SOCFA, INTERA and an additional variable of PUIOP.

PUIOP may be regarded as external since a lot of ICT solutions are regarded to emanate from external sources such as technology vendors, connectivity providers, Internet service providers etc. The perception is therefore that the concept of organizational support, especially with regard to Broadband Technology comes from outside the organization.

This factor may therefore be considered confirmed; with contextual reasons influencing the predominant variables loading.

Factor 3: This factor may named Ease of Use

This factor had six components in the research framework. However, only three were confirmed from empirical evidence within the banking sector in Kenya. The variables which loaded on this factor were EASESK, PUIJP, and PUEEO. Again it may suffice to claim this partial confirmation of this factor of the construct of determinants of broadband technology adoption if this is assessed within the context of the Kenyan banking sector. For instance, many of those that were interviewed were those in charge of the IT function in their organizations. Most of those in IT are partly charged with handling the communications function in their organization. A majority has not only been doing this internally over the years, but are not handling external communication as well. Thus EASESK, PUIJP, and PUEEO, appear to be supportive of each other and thus correlated.

The other components which were hypothesized to be part of this factor were not evident in the Kenyan context. This factor was therefore presumed partially confirmed based on the high loadings of the factors, and again taking into account the Kenyan context.

Factor 4: This factor may be named Organizational Readiness

The naming of this factor is based the type of components that coalesced around it. For instance, this factor received high loadings of FINRE, TECHRE, INDUSPRE, COMPCUL, and BTJEP. Only two of these components (FINRE, TECHRE) were found in the original research framework. However, it is the argument of this thesis that a component such as COMCUL is not necessarily misplaced if considered under this factor. This is because; the readiness or the preparedness of an organization is also evident in the compatibility with its culture.

So while it may be easy to argue that this factor did not have a majority of the variables loading on it, the two key factors which are considered especially critical in the context of a developing country were capture. These were FINRE and TECHRE, which were even mentioned as barriers to adoption.

This factor may therefore be confirmed, of course with certain caveats.

Factor 5: Unconfirmed from the factor loadings, but may be named Operational and Learning Support Environment

The fifth factor revealed from the pattern matrices was loading with these variables: EASELE and OBTEO. The two variables were considered to belong to different factors in the adopted research framework. For instance EASELE was considered to belong to the Ease of Use construct whilst OBTEO was considered to belong to the Organizational Support construct.

However, a critical look at these two variables may reveal certain insights. For instance, the variable of OBTEL, which consider that Broadband Technology is useful for the operations of the organization; and the variable of EASELE, which considers the ease of learning how to implement, operate and maintain Broadband Technology. Their connection are perhaps illuminating when looked at within the banking sector: in that, in terms of operations, the bank is largely concerned with the input of data, conversion of this data into information useful for decision making. The manipulation of this technology for a banks operation requires continuous update of skills, which has largely moved to the Internet domain. Access to this domain, where these relevant skills are based requires reliable, all-the-time connectivity which is only possible with broadband. It is therefore sufficient, based on the current analysis, that an argument can be put forth for the 'lumping' of EASELE and OBTEL together, especially with regard to the dynamic environment of IT management within the banking sector.

Thus this factor may be named, in a preliminary sense, as perceived Operational and Learning Support provided by Broadband Technology adoption.

5.1.2 Objective 2: Views of Broadband Technology Construct

According to Orlikowski and Iacono (2001) and Sawyer (2004), the view of an Information Technology such as Broadband Technology can be conceptualized to have tool view, proxy view, ensemble view, computational view as well as the nominal view. The conceptualization of Orlikowski and Iacono (2001) was adopted in this study. The following variables were regarded as the indicators of these views of IT (and specifically Broadband Technology):

- Tool View (VAR1, VAR2, VAR3, VAR4)
- Proxy View (VAR5, VAR6, VAR7)
- Ensemble View (VAR8, VAR9)
- Computational View (VAR10, VAR 11)

- Nominal View(VAR11)

A summary of the description of these variables are shown in the table below:

Table 5.1.2 Conceptualization	**Representation**	**Description**
Tool View	• VAR 4	Broadband Technology provides opportunities for organizations to convey social presence which enables it to alter its effectiveness and its communications behaviour
	• VAR 1	Broadband Technology is a tool that enables organizations enhance their organizational performance more cheaply and efficiently
	• VAR 2	Performance capabilities of Broadband Technology is designed in the technical features of the technology used during implementation
	• VAR 3	Broadband Technology alters and enhances the way that individuals within organizations process information
Proxy View	• VAR 5	Broadband Technology is largely represented by measures of users' perceptions of the technologies that have been adopted.
	• VAR 6	Measures of diffusion and penetration of technologies such as Cable Models, ADSL, internet, Intranets, Extranets, Mobile computing and Mobile telephony are indicative of Broadband Technology
	• VAR 7	The impact that Broadband technology has on productivity of staff is dependent on the monetary resources allocated to Broadband Projects
Ensemble View	• VAR 8	broadband Technology is a social process that is largely determined by the roles of various stakeholders during its design, development and implementation
	• VAR 9	Conditions of use of the Broadband Technology within a particular social context determine it as a continuously evolving system embedded in a complex and dynamic social context.
Computational View	• VAR10	Broadband Technology is a set of rules and procedures that is used by organizations to build new or enhance systems that enhance their service delivery
	• VAR 11	Broadband Technology is regarded as technology used for representing organizational processes, structures, events, knowledge as accessible database through the use of data modeling or simulation
Nominal View	• VAR12	Broadband Technology is absent and cannot be described, conceptualized or theorized

Again this research sought to confirm these propositions from the review of literature. From the data analysis as presented in part four of this study, the following discussion emerges based on the earlier findings:

Factor 1: This variable is partially confirmed and can be named Computational View

This factor, as reported in part four was highly loaded with the following variables: VAR 7, VAR 10, VAR 11. According to Orlikowski & Iacono's (2001) model, the computational view consists of VAR 10 and VAR 11. From empirical evidence, the two variables, 10 and 11 were captured. However, VAR 7 was captured as an additional variable of this construct of conceptualization of Broadband Technology. According to the adopted model, VAR 10 considers that Broadband Technology is conceptualized to be a set of rules and procedures that is used by organizations to build new or enhance systems that enhance their service delivery. This is regarded by Orlikowski and Iacono (2001) as a perception of technology as an algorithm. VAR 11 regards the conceptualization of technology as representing organizational communication processes, structures, events, knowledge as to enable accessibility to databases. This is considered as a view of technology as a model. The two conceptualizations are sufficient in regarding Broadband Technology using the computational view.

The only indicator that can be considered incongruent with the adopted model is VAR 7, which according to the research framework considers technology conceptualization as the impact this technology has based on the monetary resources an organization has allotted to it. This was considered to be part of the proxy view of a particular information technology.

Factor 2: This factor was unconfirmed

This factor was highly loaded by the following variables: VAR 4, VAR 5, and VAR 9. In terms of the empirical evidence gathered, this factor is unconfirmed since all the variables associated with the data gathered belonged to different factors on the adopted research framework. It is therefore worthwhile to undertake a further analysis to provide insight as to why these three, which theoretically belong to different factors, correlate.

Factor 3: This factor can be named the Nominal View.

This factor had the following sub-tests highly loading on it: VAR 12. According to the adopted framework, this is the only variable that may be used to explain the conception of any information technology such as Broadband. According to Orlikowski and Iacono (2001), VAR 12 considers Broadband Technology as absent and cannot be described, conceptualized or theorized. Broadband Technology is therefore regarded as absent.

Factor 4: This factor may be considered to point to the Tool View of conceptualization of a Technology.

However, the reiteration is that only one of the variables loaded significantly as opposed to a total of four that are expected to load significantly. The variable which loaded significantly was VAR 2, which regarded the technology view specifically to mean that conceptualization is based on the performance capabilities of Broadband Technology is designed in the technical features of the technology used during implementation.

This, according to Orlikowski and Iacono (2001) regards a technology as a productivity tool. The other indicators, such as Broadband Technology as a social relations tools, labor substitution tool as well as an information processing tool was not empirically discernable.

Factor 5: This factor may be partially confirmed and named the Ensemble View of Broadband Technology

According to empirical evidence from the respondents, the factor was highly loaded with only VAR 8. The other relevant indicator according to the adopted model, VAR 9, was not evident. Thus according to the ensemble view, an Information Technology such as Broadband, VAR 8 regards a technology as a social process that is largely determined by the roles of various stakeholders during its design, development and implementation. Again, according to the adopted framework, the conceptualization, as revealed by VAR 8, considers Broadband Technology largely as a development project.

However, while these views as revealed by the pattern matrices are illuminating, of value to the thesis was also a need to understand how these Kenyan banks rank the various conceptualizations. According to the empirical evidence presented in part four in table 4.4.3 (c), the views that appeared predominant VAR1, VAR3, VAR11, and to some extent VAR 6.

So whilst the pattern matrices gave an indication of the confirmation or not of the prior hypotheses, of value then is to understand their ranking. VAR 1, as was highlighted earlier, is part of the tool view construct. The perception of this view is that Broadband Technology is tool that enables organizations to meet their objectives more cheaply and efficiently. This is referred to by Orlikowski and Iacono (2001) as the view that regards technology as a labor substitution tool, even though it was not captured by the respondents as a construct of the tool view. This may therefore call for an in-depth analysis.

VAR 3, which views Broadband Technology as a tool which alters and enhances the way that organizations and their employees process information, was ranked second. According to the adopted framework, this sub-test of the tool view is referred to as Broadband Technology as an information processing tool.

However, just like VAR 1, this view did not load heavily on the construct of the tool view and may call for a further analysis.

The third ranked view which was considered at least important was VAR 11, which perceived Broadband Technology as te :hnology used for representing organizational communication processes, structures, events, knowledge as to enable accessibility to databases. This should be a sub-test of the computational view of Broadband Technology.

Therefore according to the descriptive statistics as revealed by the mean, the view that appeared predominant amongst banks in Kenya is the tool view of Broadband Technology as indicated by the high rankings of VAR 1, and 3 respectively.

The other impacts of Broadband Technology adoption were presented in section four of the study and their ranking give an indication that at least at the moment, are not considered critical by banks adopting Broadband Technologies. A summary of these impacts are shown below, including those that were listed individually by the respondents:

5.1.3 Objective 3: Impacts of Broadband Technology Adoption

From the analysis presented in part four of this study, there are a number of impacts of Broadband Technology that are considered by banks in Kenya. Most banks consider adoption of Broadband Technology since there is the presumption that this improves the effectiveness of Internet communications. This may be considered consisted, especially when looked at within the current competitive environment of the Internet in Kenya, where there are currently over 40 banks, Thus a majority of the banks have even started introducing Internet banking services to their customers, which requires faster and 24* 7 connectivity

to ensure availability of their services. Thus this may explain the impact of effective Internet communications being ranked as the critical impact of Broadband Technology adoption.

In addition, a majority of the banks have adopted or are intending to adopt Broadband Technology ion order to reduce communication costs (Impact 3). This was ranked number 6, and again, most banks have always attempted to remain competitive by focusing on cost reduction in order to shore up their profits. Thus Broadband Technology is providing one avenue for focusing on this cost reduction strategy.

The other highly ranked impact as per the means indicates that a majority of the banks in Kenya focus on Broadband Technology adoption in order to increase their sales (Impact 8). This may be explained in terms of the wider regional initiatives. For instance, there is currently a move to integrate the three East African states of Kenya, Uganda and Tanzania, which shall eventually include, at least in the medium term Rwanda and Burundi. This calls for the need to have an efficient communications infrastructure to support business in the region. There has also been a move by most banks in Kenya to set up in neighbouring countries, of which the latest one has been Sudan. Again this has necessitated the need for a communications infrastructure that can support these banks to enable them increase their sales in these regions. Thus from the analysis, it is noticeable that increased sales as an impact received a very high ranking as an impact of Broadband Technology adoption.

5.1.4 Objective 4: Barriers of Broadband Technology Adoption

Table 4.4.5 identified 11 factors that were considered as barriers to the successful adoption of Broadband Technology in Kenya by the respondent banks. Some of the key barriers included the following:

(a) Satisfaction with the Current Connectivity

20% of the respondents indicated this as a major barrier to the adoption of Broadband Technology in Kenya. This may be as a result of the perception that continuously online faster speeds may be as unnecessary due to the limited number of products available to bank clients which they can access online. Thus the current connectivity appears adequate because there seems to be a lack of customer push for the introduction of Internet-based banking services. These largely emanate from the banks themselves.

(b) Poor communications infrastructure

20% of the respondents also felt that communications infrastructure was a major barrier to Broadband Technology adoption in Kenya. The infrastructure includes the public road, rail and telecommunications network in addition to restrictive airwaves. Specifically, issues that revolve around poor communications infrastructure include limitations in technology deployed, low bandwidth, monopoly by one infrastructure provider, lack of logistics support, poor physical infrastructure and high ISP charges.

(c) The perception that Broadband Technology adoption is too expensive

This barrier was captured by 15% of the respondents with the perception that the adoption of this technology is generally too expensive. This may be in terms of the costs paid to a myriad of suppliers such as equipment vendors, national telecommunications operators, Internet Service Providers, maintenance contracts with equipment vendors as well as the cost of personnel involved in internal maintenance.

(d) The High Costs of ISP services

12.5% of the respondents considered that ISP costs in Kenya are rather too high. This is especially so given the fact that organizations, apart from shouldering other costs, have to, on monthly basis meet ISP costs typically, website hosting costs, security costs, connectivity costs, maintenance costs, etc.

(e) Other Barriers to Broadband Technology Adoption include:

- Poor quality of technical support available in the country
- Dissatisfaction with current service providers
- Lack of technical expertise by the internal employees
- Ignorance amongst bank managers on the benefits of Broadband Technology adoption
- High initial costs of adoption and
- Lack of a comprehensive ICT infrastructure which considers Broadband Technology

5.2 Conclusions of the Study

This research was an initial and exploratory study of an emerging issue related to broadband adoption in the context of the banking sector in Kenya. The study's focus on three issues that were assumed to be part of the Broadband Technology adoption construct i.e. factors that influence the decision to adopt, the views or conceptualization of this technology by the decision makers, the perceived impact of this technology as well as the barriers to Broadband Technology adoption.

From this research it was discovered that the adoption of broadband in banks are influenced by multiple determinants, which are in themselves considered to be multiple constructs. Specifically, the research showed that there are a few critical factors that are considered important. The determinants include:

- That the decision to adopt Broadband Technology is highly influenced by the perception that decision makers have of the technology's usefulness in accomplishing communication tasks in the organization. This, according to the research framework falls under the broad construct of organizational support which is explained by several others. However, within the context of the Kenyan banking sector, a desire to improve communications, as part of organizational support, provides the critical influencer of Broadband Technology adoption.
- The other critical driver of Broadband Technology adoption concerns the perception that decision makers have with regard to the ease of use of Broadband Technologies. The majority of those charged with the decision to adopt Broadband Technology consider that it is easy to use, thus ensuring that this perception actually acts as a driver to the adoption decision. This driver was part of the broader construct of Ease of Use which had several other indicators, but which were not revealed as critical by the banks.
- Another critical determinant of the adoption decision concerned the perception that Broadband Technology is useful in improving organizational productivity. Organizational productivity as a determinant was part of the construct of influencers grouped under organizational support.
- Compatibility of Broadband technology with work practices, as part of the broader compatibility construct, was also identified in the survey. Thus adopting banks in the Kenyan context regard this technology as compatible with the already existing work practices.
- Lastly, financial resources capability was also identified as a key determinant of broadband technology adoption. Financial resources as per the framework of this study were under the organizational readiness construct.

From the above, and in tandem with the revelations of the pattern matrices presented in part four, it is sufficient to state in a preliminary sense, that there are several factors at play in the decision to adopt Broadband Technology in the context of Kenyan banking sector. It is also evident that the concept of determinant, is multi-dimensional, but with an indication that its components may differ from one context to the other.

Another part of the Broadband Technology adoption looked at its conceptualization or view prior to the decision to adopt. From the discussions, it is evident that the predominant conceptualizations of Broadband Technology, in terms of what the banks understand Broadband to be were:

- Broadband Technology is a tool that enables organizations to meet their objectives more cheaply and efficiently. The focus of this is the regard of this technology by banks as one of those tools used for achieving cheap and efficient operations. This is under the l roader tool view of technology.
- Broadband Technology alters and enhances the way that organizations and their employees process information. Thus one of the predominant views is that this is a technology for enhancing the processing of information. This again is under the tool view of technology.
- Broadband Technology is regarded as technology used for representing organizational communication processes, structures, events, knowledge as to enable accessibility to databases. This conceptualization is under the broader construct of the computational view of technology.

Thus, as was revealed by the pattern matrices, it has been confirmed that the conceptualization of Broadband Technology is multi-faceted within the banking sector in Kenya. However, it can be stated, again, in a preliminary sense that the predominant view of the tool view of technology as shown above.

Another illuminating conclusion concerning Broadband Technology adoption concerned its use in the banking sector. Given the assumption that the conceptualization and the determinants influence the way the technology is used, and thus the impact it would have, the study would not have been complete without this consideration. The following were revealed as some of the critical impacts of Broadband Technology adoption within the banking sector in Kenya:

- That Broadband Technology largely has an impact in making Internet communications more effective within the banking sector as well as
- Reducing overall communications cost of the banks that adopted this technology.

So whilst there were several other impacts that were identified, only these two impacts were considered to be significant by the adopting banks. This may point to general strategic trend of most banks in Kenya which largely focus on cost reduction strategies. Thus adoption of Broadband provides one of the avenues for ensuring this by either improving the effectiveness of communications through the Internet, or directly aiding in cost reduction.

The study also identified several challenges to Broadband Technology adoption as has been highlighted above. However what is instructive to note is that the critical barriers that were cited largely concern perception issues, especially within the environment that the organization and the decision maker find themselves in.

5.3 Limitations of the Study and Suggestions for Further Research

These sections of the research consider the limitations of this study as well as suggestions for future research.

5.3.1 Limitations

The limitations of the study can be summarized as below:

a) Sectoral Limitations

The generalization of this study required collecting data from the banking sector only. This cannot be considered representative of the Kenyan situation since the different sectors of the economy may reveal unique characteristics.

b) The mode of responses

The questionnaires were all sent by electronic email. Thus with regards to the questionnaire findings, these would have been strengthened had it been possible to also supplement them using interviews. This supporting tool had to be abandoned due to the limitations of time and manpower. The findings could also have been reinforced if the research had been a longitudinal one. However, this can be expanded over a longer period of time to offer a longitudinal study.

c) Financial Constraints

Limited finances and time constraints were also a factor in this study. This affected the study design such as the data collection technique that was adopted.

d) Lack of Local Studies

In addition, there are no locally known studies of the Broadband Technology adoption among firms in Kenya. The study therefore relied mainly on empirical studies from other countries, which operate in different cultural, economic and socio-political contexts.

5.3.2 Suggestions for Further Research

Since this was a study of perception of Broadband Technology adoption decisions, a larger sample of at least 200 respondents is required to make the empirical results more generalizable. This should involve the consideration of other stakeholders involved in the adoption decision such suppliers of Broadband Technology and other decision makers within the organization.

It would also be important to carry out a purely empirical research without reliance on a prior model, as was the case with this study.

However, despite the limitations, and given the increasing acceptance of Broadband Technology - the study should be considered as a first step towards a deeper understanding of Broadband Technology within the Kenyan context. This work therefore sets up future contributions that will enable academicians; managers and Broadband Technology investors to better understand different issues surrounding Broadband Technology which is increasing becoming indispensable to organizations.

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APPENDICES

Appendix A: Letter to the Respondents

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2

3 **DEAR SIR/MADAM,**

RE: An Investigation of Broadband technology Adoption in Kenya

I am a Postgraduate student undertaking a Master of Business Administration (MBA) degree at the School of Business, University if Nairobi. I am currently carrying out research on Broadband Technology adoption amongst banks in Kenya. This is a requirement to complete my MBA course project at the University of Nairobi.

I intend my approach to this survey to be both consultative and ensure that it is not disruptive to your schedule of activities. I kindly request you to provide the required information by responding to the questions in the questionnaire. The information required is purely for academic purposes and will be treated in the strictest manner. Your name or the name of your company will not be mentioned in this research.

A copy of this research project will be made available to you upon request. I will appreciate your cooperation in this academic exercise.

Thanking you in advance,
Yours faithfully,

Nicholas Gumbo
Postgraduate Student
Student Number: D61/P/7927/01

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APPENDIX B: STUDY QUESTIONNAIRE

Survey of Broadband Technology Adoption in Kenya

Thank you for taking the time to complete this questionnaire.
Please ensure that you complete all questions by ticking all that apply.
Completion of this questionnaire is voluntary and all responses will remain confidential.

Section A: Demographic and Broadband Applications Access Details

1. Name of the organization (Optional) _____
2. How can you describe the ownership of your organization _____
    a) Local [ ]
    b) Foreign [ ]
    c) Both [ ]
3. Which (if any) of the following Broadband Application technologies does the organizations plan to use or currently use (Tick all that apply)

Technology	Currently Use	Plan to Use	Don't know/Not applicable
Internal e-mail			
External e-mail			
Internet			
Company Website			
Intranet(Internal Private Website)			
Extranet (provides			

external web access to part of the organizations network for a restricted group of users)			
Wide Area Network			
Local Area Network			
WiFi or Wireless LAN (Allows for wireless access to local area networks or internet)			
Electronic Data Interchange or EDI (Allows for transmission of orders, invoices and payments electronically from different locations via private network)			

Internet Protocol or IP Telephony (Allows for data, voice, image and video to be transmitted over a single network infrastructure)			

Section B: Determinants, Views and Impacts of Broadband Technology Adoption. Please answer questions below.

I. Determinants of Broadband Technology Adoption	strongly disagree	Disagree	indifferent	Agree	strongly agree
	1	**2**	**3**	**4**	**5**
1) Financial Resources of an organization are a key factor in Broadband Technology Adoption (FINRE)					
2) 2.1 Technological Resources of an organization are critical in Broadband Technology adoption(TECHRE)					
3) Competition is a factor in the decision to adopt broadband technology (COMPE)					
4) Social factors are important in the decision to adopt broadband technology (SOCFA)					
5) Interaction with firms that are already using Broadband Technology influences the decision to adopt (INTERA)					
6) The industry pressure is critical in the decision to adopt broadband technology(INDUSPRE)					
7) Government pressure influences decision to adopt (GOVTPRE)					
8) The decision to adopt Broadband Technology is influenced by the compatibility of the technology with organizational culture (COMPCUL)					
9) The decision to adopt Broadband Technology is					

influenced by the compatibility of the technology with organizational values(COMPVA)					
10) The decision to adopt Broadband Technology is influenced by the compatibility of the technology with organizational preferred work practices (COMPWP)					
11) The ease of learning how to implement, operate and maintain Broadband Technology influences the decision to adopt (EASELE)					
12) The flexibility of Broadband Technologies make it easier to interact with, thus making it easy to use (FLEXINT)					
13) Organizational and individual interaction with Broadband Technology is clear and understandable(ORGINDINT)					
14) The ease of becoming skilful at using Broadband Technology influences the decision to adopt (EASESKI)					
15) Ease of use of Broadband Technology influences the decision to adopt (EASEUSE)					
16) The decision to adopt is influenced by the perceived usefulness of Broadband Technology to accomplish communications tasks more quickly (PUCOMM)					
17) The perceived usefulness of Broadband Technology in improving job performance of employees influences the decision to adopt (PUIJP)					
18) The perceived usefulness of Broadband Technology is in improving overall productivity in the organization (PUIOP)					
19) The perceived usefulness of Broadband Technology is in enhancement of the overall effectiveness of the organization (PUEEO)					
20) Broadband Technology adoption is influenced by its ability to make jobs easier to perform (BTJEP)					
21) Organizations find Broadband Technology useful in operate (OBTEO)					

43) Please indicate other factors for implementing Broadband Technology in you organization.

a) _____

b) _____

c) _____

d) _____

SECTION B: II. Views/Conceptualizations of Broadband Technology

1) How do the Decision Makers of Broadband Technology conceptualize Broadband Technologies? (Tick all that apply)

Broadband Technology Views	Strongly Disagree 1	Disagree 2	Neutral 3	Agree 4	Strongly Agree 5
1. Broadband Technology is a tool that enables organizations to meet their objectives more cheaply and efficiently					
2. Performance capabilities of any Internet access method such as Broadband Technology is designed in the technical features of the technology used during implementation					
3. Broadband Technology alters and enhances the way that organizations and their employees process information					
4. Broadband Technology provides opportunities for the organizations to convey social presence (reputation) which enables it to alter its effectiveness and its communications behaviour					
5. Broadband Technology is largely represented by measures of users' perceptions of the technologies that have been adopted.					
6. Measures of diffusion and penetration of technologies such as e-mail, Internet, Intranets, Extranets, Mobile computing and Mobile telephony are indicative of Broadband Technology					
7. The impact that Broadband technology on the productivity of employees is dependent on the monetary resources allocated to these projects					
8. Broadband Technology is a social process that is largely determined by the roles of various stakeholders during its design, development and implementation					
9. A condition of use of the Broadband Technology within a particular social context determines Broadband Technology as a continuously evolving system embedded in a complex and dynamic social context.					
10. Broadband Technology is basically a set of rules and procedures that is used by organizations to build new or enhanced communication systems that enhance their service delivery					
11. Broadband Technology is regarded as technology used for representing organizational communication processes, structures, events, knowledge as to enable accessibility to databases					
12. Broadband Technology is absent and cannot be described, conceptualized or theorized					

SECTION B: III. Impacts of Broadband Technology

This section focuses on the impacts of Broadband Technology adoption. Indicate what you consider has been the impacts of adopting broadband in your organization (Tick all that apply)

Broadband Technology Impacts	**Strongly Disagree**	**Disagree**	**Neutral**	**Agree**	**Strongly Agree**
1. More effective Internet Communications					
2. Improved Business Productivity					
3. Reduced Communications Costs					
4. Flexible Working					
5. More Efficient Procurement					
6. Competitive Advantage					
7. Better Access to training opportunities such as e-learning					
8. Increased Sales					
9. Results in reduced requirements for ICT skills in the organization					
10. Provides general organizational support making it an indispensable technology					

11) Please indicate other impacts organizations have or expect to experience by implementing Broadband Technology.

e) _____

f) _____

g) _____

h) _____

12) What do you consider are some of the barriers to Broadband Technology adoption:

a) _____

b) _____

c) _____

d) _____

APPENDIX C: SPSS RESULTS

Factor Analysis

Communalities

	Initial	Extraction
FINRE	1.000	.708
TECHRE	1.000	.500
COMPE	1.000	.340
SOCFA	1.000	.426
INTERA	1.000	.783
INDUSPRE	1.000	.560
GOVTPRE	1.000	.257
COMPCUL	1.000	.557
COMPVAL	1.000	.331
COMPWP	1.000	.547
EASELE	1.000	.540
FLEXINT	1.000	.653
OININT	1.000	.204
EASESK	1.000	.363
EASEUSE	1.000	.426
PUCOMM	1.000	.674
PUIJP	1.000	.546
PUIOP	1.000	.634
PUEEO	1.000	.566
BTJEP	1.000	.444
OBTEO	1.000	.596

Extraction Method: Principal Component Analysis.

Total Variance Explained

	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
Component	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	2.697	12.844	12.844	2.697	12.844	12.844	2.494	11.875	11.875
2	2.593	12.346	25.190	2.593	12.346	25.190	2.420	11.522	23.397
3	1.932	9.201	34.391	1.932	9.201	34.391	1.947	9.270	32.667
4	1.815	8.642	43.033	1.815	8.642	43.033	1.936	9.218	41.886

5	1.619	7.707	50.741	1.619	7.707	50.741	1.860	8.855	50.741
6	1.427	6.797	57.538						
7	1.245	5.930	63.467						
8	1.195	5.689	69.156						
9	1.040	4.950	74.106						
10	.981	4.670	78.776						
11	.803	3.825	82.602						
12	.730	3.475	86.077						
13	.625	2.976	89.053						
14	.541	2.577	91.630						
15	.450	2.144	93.774						
16	.333	1.588	95.362						
17	.294	1.399	96.761						
18	.228	1.086	97.847						
19	.205	.975	98.822						
20	.132	.630	99.452						
21	.115	.548	100.000						

Extraction Method: Principal Component Analysis.

Component Matrix(a)

	Component				
	1	**2**	**3**	**4**	**5**
FINRE	.556	-.414	-.129	-.352	.294
TECHRE	.146	9.225E-02	-5.309E-02	.345	.590
COMPE	-2.313E-02	-.320	.174	.416	-.182
SOCFA	.478	-.196	-4.639E-02	-9.574E-02	-.385
INTERA	-.695	-.262	.228	4.322E-02	.421
INDUSPRE	.484	-.254	.397	.246	.208
GOVTPRE	.341	.293	3.599E-03	-.188	-.140
COMPCUL	.534	.283	6.319E-02	-.274	.336
COMPVAL	.254	-4.538E-02	.500	.117	1.855E-02
COMPWP	-.172	.690	-.145	.141	2.544E-02
EASELE	.477	-.119	7.474E-02	.509	-.184
FLEXINT	-.106	.794	2.773E-02	7.475E-02	6.484E-02
OININT	-.222	.116	.373	-4.440E-02	1.538E-02
EASESK	.115	4.486E-02	.551	-3.972E-02	-.205
EASEUSE	.248	-3.241E-02	1.288E-02	-.585	-.145
PUCOMM	.262	.681	-.180	-3.522E-02	.329

PUIJP	-2.648E-02	.398	.491	-.190	-.331
PUIOP	.620	.107	-.428	.222	-7.501E-02
PUEEO	.147	.212	.600	-.344	.144
BTJEP	.173	-.255	.225	-3.204E-02	.545
OBTEO	.238	.299	.282	.605	-6.903E-02

Extraction Method: Principal Component Analysis.

a 5 components extracted.

Rotated Component Matrix(a)

	Component				
	1	**2**	**3**	**4**	**5**
FINRE	-.338	.378	-.155	.595	-.269
TECHRE	.292	-.170	-.240	.505	.271
COMPE	-.336	-.101	1.257E-02	-9.029E-02	.456
SOCFA	-.308	.570	4.735E-02	-4.170E-02	5.124E-02
INTERA	-.139	-.863	5.798E-03	9.286E-02	-9.796E-02
INDUSPRE	-.224	.142	.216	.524	.410
GOVTPRE	.209	.419	.170	1.059E-02	-9.282E-02
COMPCUL	.313	.375	.150	.516	-.174
COMPVAL	-.104	5.723E-02	.422	.243	.282
COMPWP	.697	-5.322E-02	-2.326E-02	-.238	4.299E-02
EASELE	-.136	.354	-2.871E-02	9.138E-02	.622
FLEXINT	.774	-3.040E-02	.170	-.154	2.905E-02
OININT	6.196E-02	-.259	.362	-4.325E-02	-4.893E-03
EASESK	-.101	6.634E-02	.573	-6.892E-03	.142
EASEUSE	-.138	.369	.204	5.153E-02	-.476
PUCOMM	.751	.218	-5.405E-02	.233	-7.379E-02
PUIJP	.193	9.116E-02	.660	-.252	-3.701E-02
PUIOP	.148	.629	-.373	.126	.246
PUEEO	.117	7.170E-03	.662	.292	-.171
BTJEP	-.126	-.174	4.251E-02	.629	1.414E-03
OBTEO	.277	9.239E-02	.193	2.035E-02	.688

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.

a Rotation converged in 9 iterations.

Component Transformation Matrix

Component	1	2	3	4	5
1	-.024	.839	.053	.497	.214
2	.943	.134	.233	-.196	-.022
3	-.143	-.241	.908	.200	.238
4	.099	-.181	-.264	-.065	.940
5	.283	-.433	-.220	.819	-.118

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.

Frequencies

Statistics

		FINRE	TECHRE	COMPE	SOCFA	INTERA	INDUSPRE	GOVTPRE	COMPCUL	COMPVAL	COMPWP	EASELE	FLEXINT	OININT	EASESK	EASEUSE	PUCOMM	PUIJP	PUIOP	PUEEO	BTJEP	OBTEO
N	Valid	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40
	Missing	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Mean		4.03	2.80	3.28	1.88	3.98	2.05	1.63	2.83	2.80	4.03	2.40	3.18	3.88	3.75	4.20	4.40	3.93	4.08	3.93	2.50	3.90
Mode		4	3	4	1	4(a)	2	1	3	3	4	2	3	4	4	5	5	5	4	4	2	4
Std. Deviation		.768	.992	1.109	1.017	1.074	.986	.838	.874	.939	1.025	.955	.781	1.067	1.056	1.018	.841	1.328	.859	.859	.987	.841

a Multiple modes exist. The smallest value is shown

Frequency Table

FINRE

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	2	1	2.5	2.5	2.5
	3	8	20.0	20.0	22.5
	4	20	50.0	50.0	72.5
	5	11	27.5	27.5	100.0
	Total	40	100.0	100.0	

TECHRE

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1	4	10.0	10.0	10.0
	2	11	27.5	27.5	37.5

	3	15	37.5	37.5	75.0
	4	9	22.5	22.5	97.5
	5	1	2.5	2.5	100.0
	Total	40	100.0	100.0	

COMPE

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1	1	2.5	2.5	2.5
	2	11	27.5	27.5	30.0
	3	10	25.0	25.0	55.0
	4	12	30.0	30.0	85.0
	5	6	15.0	15.0	100.0
	Total	40	100.0	100.0	

SOCFA

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1	20	50.0	50.0	50.0
	2	8	20.0	20.0	70.0
	3	9	22.5	22.5	92.5
	4	3	7.5	7.5	100.0
	Total	40	100.0	100.0	

INTERA

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1	1	2.5	2.5	2.5
	2	4	10.0	10.0	12.5
	3	5	12.5	12.5	25.0
	4	15	37.5	37.5	62.5
	5	15	37.5	37.5	100.0
	Total	40	100.0	100.0	

INDUSPRE

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1	12	30.0	30.0	30.0
	2	19	47.5	47.5	77.5
	3	5	12.5	12.5	90.0

	4	3	7.5	7.5	97.5
	5	1	2.5	2.5	100.0
	Total	40	100.0	100.0	

GOVTPRE

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1	23	57.5	57.5	57.5
	2	10	25.0	25.0	82.5
	3	6	15.0	15.0	97.5
	4	1	2.5	2.5	100.0
	Total	40	100.0	100.0	

COMPCUL

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1	2	5.0	5.0	5.0
	2	12	30.0	30.0	35.0
	3	18	45.0	45.0	80.0
	4	7	17.5	17.5	97.5
	5	1	2.5	2.5	100.0
	Total	40	100.0	100.0	

COMPVAL

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1	2	5.0	5.0	5.0
	2	14	35.0	35.0	40.0
	3	16	40.0	40.0	80.0
	4	6	15.0	15.0	95.0
	5	2	5.0	5.0	100.0
	Total	40	100.0	100.0	

COMPWP

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1	2	5.0	5.0	5.0
	2	1	2.5	2.5	7.5
	3	5	12.5	12.5	20.0
	4	18	45.0	45.0	65.0

	5	14	35.0	35.0	100.0
	Total	40	100.0	100.0	

EASELE

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1	6	15.0	15.0	15.0
	2	18	45.0	45.0	60.0
	3	11	27.5	27.5	87.5
	4	4	10.0	10.0	97.5
	5	1	2.5	2.5	100.0
	Total	40	100.0	100.0	

FLEXINT

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1	1	2.5	2.5	2.5
	2	5	12.5	12.5	15.0
	3	21	52.5	52.5	67.5
	4	12	30.0	30.0	97.5
	5	1	2.5	2.5	100.0
	Total	40	100.0	100.0	

OININT

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1	2	5.0	5.0	5.0
	2	2	5.0	5.0	10.0
	3	7	17.5	17.5	27.5
	4	17	42.5	42.5	70.0
	5	12	30.0	30.0	100.0
	Total	40	100.0	100.0	

EASESK

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1	1	2.5	2.5	2.5
	2	5	12.5	12.5	15.0
	3	7	17.5	17.5	32.5
	4	17	42.5	42.5	75.0

PUEEO

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1	1	2.5	2.5	2.5
	3	10	25.0	25.0	27.5
	4	19	47.5	47.5	75.0
	5	10	25.0	25.0	100.0
	Total	40	100.0	100.0	

BTJEP

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1	6	15.0	15.0	15.0
	2	16	40.0	40.0	55.0
	3	10	25.0	25.0	80.0
	4	8	20.0	20.0	100.0
	Total	40	100.0	100.0	

OBTEO

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	2	2	5.0	5.0	5.0
	3	10	25.0	25.0	30.0
	4	18	45.0	45.0	75.0
	5	10	25.0	25.0	100.0
	Total	40	100.0	100.0	