A CRITICAL ANALYSIS OF INTERNET DIFFUSION IN AFRICA

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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.

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ABSTRACT

The research project assesses the Global Diffusion of the Internet dimensions (GDI), determinants of the GDI in Kenya and Africa and how these dimensions and determinants affect the state of the Internet diffusion by examining the various studies conducted in various African countries (Kenya, Egypt, Ethiopia, Togo, Ghana, Uganda, Cape Verde, South Africa and Mauritius) and performing a critical analysis of the findings in order to establish the state of the internet in Africa.

The project uses an exploratory model of Internet diffusion in a country called the Global Diffusion of the Internet. The model has been employed in various studies across many nations of the world. The project utilizes various studies performed in Africa as the source of information to realize its objectives.

The project finds out that the Internet Diffusion in Kenya is still low and only a small section of the population has access and can afford the costs. The factors, which determine this low penetration of the Internet, have been identified and used as part of the broader objective to come up with the state of Internet diffusion in Africa. An analysis of the Internet diffusion has been carried out to determine the factors that affect the rate at which the Internet is diffusing in Africa and why. The project lays a good foundation for future cross-continent research in the field of Internet Diffusion across continents and will prove useful to various Policy Making institutions in the countries concerned.

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Chapter 1 Introduction

1.1 Background to Research

Until the birth of the World Wide Web in 1990, the Internet was almost entirely unknown outside universities and research departments in corporate environments. The Internet industry in recent times has substantially grown from an exciting innovation in the early 1980s to a global communication tool both now and in the future, affecting almost every task we perform and integrating itself into our culture. Businesses have recognized that the Internet is a powerful medium not only for the promotion of their services, but also for the extension of their services.

Since 1990 it has grown to become an almost-ubiquitous aspect of modern information systems, becoming highly commercial and a widely accepted medium for all sorts of customer relations such as advertising, brand-building, and online sales and services. Its original spirit of cooperation and freedom has, to a great extent, survived this explosive transformation with the result that the vast majority of information available on the Internet is free of charge. The enthusiasm for this medium is today so great that its presence is unavoidable and inescapable; so pervading that we are now said to be in the Information Age or Digital Age.

A number of studies have sought to understand cross-country differences in the rate of Internet diffusion given that the diffusion of the Internet is considered to be antecedent to understanding the why of the digital divide. These studies argue that if Internet use has a substantial positive impact on the rate of productivity growth, then cross-country differences in Internet use can exacerbate existing income inequalities between countries. However, some authors have argued that adoption of ICTs such as the Internet can offer the opportunity for late-industrializing countries to catch up with richer countries (Kagami and Tsuji, 2001, Steinmuller, 2001). One of the most persistent findings in all of these studies is that the rate of Internet diffusion is correlated with per-capita income: Internet technology diffuses fastest in rich

countries (Comin and Hobjin, 2003; Beilock and Dimitrova, 2003; Chinn and Fairlee, 2004; Kiiski and Pohjola, 2002; Hargittai, 1999; Wong, 2002; Dewan et al., 2004). This is considered to be true even when one compares differences in adoption rates within groups of industrialized countries such as the OECD (Kiiski and Pohjola, 2002) and geographic regions such as Asia (Wong, 2002). However, a review of literature does not provide a basis for these conclusions given the little research that has been carried out with regard to Internet diffusion in the late-industrializing countries.

Antonelli (2003) provides one explanation for this finding, arguing that new technological change may be "biased" in that it may increase the productivity of inputs with relatively low factor prices in the country of origin; largely the case with most ICTs since they emanate from industrialized countries. Antonelli argues that ICT fits this profile, as it is a skilled-labor and capital-intensive technology that is unskilled-labor saving. Thus, he argues it is much better suited for developed countries such as the U.S. than for developing countries. Antonelli argues that ICT is complementary with many of the managerial and organizational changes that have been undertaken in the developed world. As a result, he argues that new innovations in ICT such as the Internet work to increase the competitive advantages of developed nations such as the U.S. However, these statements in a way may appear far fetched, since they are not based on facts from developing countries, but rather rely on theories or researches that have been undertaken in the west.

For instance, several studies have also sought to understand how a country's governmental institutions can encourage or discourage the diffusion of new ICT such as the Internet. Comin and Hobjin (2003) and Beilock and Dimitrova (2003) argue that ICT diffuses more quickly to democratic countries and those with political freedom, while Oxley and Yeung (2001) argue that rule-of-law plays a major role. Chinn and Fairlee (2004), Hargittai (1999), Kenney (2001), and Wallsten (2003) show that telecommunications and regulatory policy are also important in explaining cross-country diffusion rates. Some studies have argued that Internet use will diffuse more quickly to countries with higher education (Chinn and Fairlee, 2004, Kiiski and Pohjola, 2002; Dewan et al., 2004). While these 'blanket' statements may be assumed to apply across the

board, whether in developed or developing countries, the caution could be that location, history and environmental influences may provide alternative views. A case in point is where Kenya can be regarded as a democratic country within the developing world with a very dynamic telecommunications sector, but evidence may prove otherwise that other countries such as Togo may have higher diffusion rates of the various technological innovations.

Other studies have investigated how existing telecommunications infrastructure influences the rate of Internet diffusion (Beilock and Dimitrova, 2003, Chinn and Fairle, et al, 2004). Kiiski and Pohjola (2002) argue that Internet access prices are an important determinant of the rate of Internet diffusion, while Hargittai (1999) finds less of a role for them. Dewan et al. (2004) show that telephone costs influences the rate of Internet diffusion; and this is particularly true at low levels of Internet penetration. While these have largely focused on what determines the diffusion of the Internet, it may again be important to note that, these studies have not had a focus on Africa, let alone a country such as Kenya.

Some researchers have even fronted the influence of language, especially with regard to the influence of the English language. That since most web sites are in English, English language countries may have an advantage in Internet use. Several cross-country studies of the Internet have explored the role of English language use in diffusion (Hargittai, 1999, Kiiski and Pohjola, 2002); however these studies have generally been unable to uncover a systematic role for language on a global basis. The role of English in Internet adoption remains therefore an open question, since while English may originally be a language from Britain; the USA has consistently been regarded as one of the top countries in terms of the rate of Internet diffusion and other related technologies. Thus, whilst the researches quoted seem to indicate that the rate of diffusion as well as its determinants to a large extent depends on the level of industrialization, there appears to be some gap in terms of reliance on factual information emanating from developing countries.

Thus while the overall empirical evidence supports the view that, in the short run at least, Internet technology has diffused fastest to industrialized nations

with greater income, more open political institutions, and with more-developed telecommunications infrastructures, the basis of this inquiry is that the purported evidence is to say, the least partial. While it may be correct to state at an aggregate level of analysis that an international digital divide exists between rich and poor countries, very little in terms of empirical evidence from developing countries have been used to support this position. In fact, some authors such as (Dewan, 2004) have even argued that if a digital divide exists, it is diminishing over time. This is the more reason why there is need for knowledge accumulation, especially with regard to the diffusion of technologies such as the Internet, which are considered critical for narrowing the digital divide.

So while researchers are being coaxed subtly of the need to focus on Internet diffusion in developing countries, one challenge faced by researchers in studying this is the difficulty in controlling for unobserved cross-country differences. Countries differ in complex *political*, *cultural*, and *economic* ways that are impossible to control. Recognizing these differences may aid in avoiding a 'blanket banding' of countries and therefore tag them in a certain way.

Researchers have attempted to address the problem of unobserved country-level differences in other ways. For one, as noted above, several recent studies have compared countries within similar global regions or demographics. Kiiski and Pohjola (2002) examine OECD countries, while Wong (2002) and Kraemer and Dedrick (2002) show there exists significant variation in Internet use among Asian countries. Kauffman and Techatassanasoontorn (2005) have found evidence of multinational regional contagion in the diffusion of wireless technology. Other studies have sought to understand how income and other factors affect the use of Internet technology along different points in the distribution of diffusion (Dewan et al., 2004). However, even though the effort to study different regions is apparent, little is reported on Africa. From preliminary literature search, only about five countries in Africa (South Africa, Ghana, Uganda, Ivory Coast and Togo) have carried out Internet diffusion studies. For instance, whilst it was noted that the Governments of South Africa and Ghana play a very key role in the growth of

the Internet in the country (Brown, et al, 2005; Forster et al, 2004), the situation in Togo is different where the commercial sector has taken a lead role (Bernstein & Goodman, 2005).

Thus even amongst these few studies on the diffusion of the Internet in Africa and other parts of the world, there seems to be *evidence of variance in Internet use across countries*, suggesting the presence of what some authors have titled an international digital divide. Though *differences in income* explain most of this variance, a variety of other factors have been found to explain the residual not explained by income differences. Researchers have begun to use a number of approaches to sort through this conflicting evidence and to extend the early important work on cross-country Internet use. This has included focused empirical approaches that look at similar countries or that look at Internet use within a particular country, or case studies that are able to explain in detail how the Internet is used within a country.

The vast digital divide between Kenya's citizens can be attributed to a number of cultural and economic causes, the majority of which originate from Kenya's existing policies of the telecommunications sector. As a result a large economic gap still exists between the more affluent and the previously disadvantaged citizens of the country.

The Internet first became available in Kenya to a small group of technical enthusiasts in 1993. The only means of accessing the Internet then was through a service known as Gopher which offered access to text based information. The access then was through either international leased lines or through dial-up connections to server networks abroad.

The African Regional Centre for Computing (ARCC), an NGO based in Nairobi, Kenya, became the first provider of web-based Internet service. This they did by providing their subscribers with the first-ever web browser software-Mosaic. The connection to the global Internet backbone was via an analogue leased line.

The first commercial ISP, Form-net began operating in 1995. Soon competition increased with the entry of three other ISPs. All the ISPs would lease analogue or digital data lines from Telkom Kenya to the US to access the Internet backbone. (Francisca Mweu, Telkom Kenya Limited 2004). This study will make reference to Kenyan economy as a whole where required.

As the number of ISPs grew so did the pressure for bandwidth. At this point the Kenya Posts & Telecommunications Corporation (KPTC) realized that there was a need for an Internet access backbone in the country. This would also bring down the cost of access to the Internet for ISPs, since the backbone would be accessed locally. The backbone, EAFIX, was launched in December 1998, and together with it JamboNet, an access service for ISPs.

In July 1999 the government officially liberalized the telecommunications market in Kenya. The Communication Commission of Kenya (CCK) was formed to regulate the sector. The ISPs which had never been officially acknowledged were now authorized to operate after obtaining a licence from CCK. However, Telkom Kenya, formed from the telecommunications arm of the former KPTC (Kenya Posts and Telecommunications), was allowed a monopoly to operate an Internet backbone for five years. With the liberalization, the number of ISPs has grown to from 43 in 2000 to 72 in 2005 (CCK, 2005).

Telkom Kenya also operates as an ISP following licensing by CCK despite consternation of ISPs who have protested to CCK, demanding also to be allowed to operate an Internet backbone if Telkom ISP is licensed. There are currently about 500,000 Internet users in Kenya, according to CCK, 2005.

1.2 Statement of the Problem

The Internet can powerfully influence individuals, societies, and economies and these effects are likely to grow over the foreseeable future. For that reason, understanding the level and determinants of Internet diffusion is of interest. To date, the majority of within country studies in this area has been limited to the OECD countries. This focus is understandable both due to data limitations in developing countries and given the very small share of Internet usage in these countries. Additionally, the few studies that have focused on developing countries cannot be regarded to be representative of the situation in these countries. Thus the determinants of Internet diffusion in South Africa, Ghana and Togo (Brown, et al, 2005; Forster et al, 2004; Bernstein & Goodman, 2005) cannot be used as the only basis to understand Internet diffusion in Africa.

In particular, the Communications Commission of Kenya in March 2006 put up a tender notice seeking to conduct a comprehensive market analysis of the Internet market in Kenya. The objective of this tender was to conduct a comprehensive market analysis of the internet sub-sector leading to the definition and articulation of the service penetration levels and factors affecting internet development in the country. It is clear that there is a gap and this provides an opportunity for a study of this nature, not only in Kenya, but also in other African countries.

The adoption of the Internet depends on a number of factors relating to the environment in which it exists. However, increasing numbers of people are gaining access to the Internet and as a result it has had a significant impact on the way organizations and institutions conduct their daily operations (Cheung et al, 2003). The proposal therefore aimed at carrying out an empirical research in order to gain an understanding of Internet diffusion within Kenya and Africa.

This empirical study focused on the state of Internet diffusion in Kenya and Africa by answering the following questions:

- What is the current level of Internet diffusion in the Kenya and Africa?
- What are the characteristics of the Internet environment?
- What are the determinants of Internet diffusion in Kenya and Africa?
- What implications do these determinants have on the Internet Environment?

1.3 Research Objectives

The objectives of this study were to answer the questions stated above in order to compile a report highlighting the following primary objectives:

1. Determine the level of Internet diffusion in Kenya and Africa
2. Provide a longitudinal analysis of Internet growth in Kenya and in Africa
3. Critically analyse the determinants of Internet diffusion in Africa

1.4 Importance of Research

A study of the Internet provides important policy making benefits. The increase in the amount of frameworks and indexes available to researchers, including the willingness of the World Bank's InfoDev unit to fund such studies (Intelecon Research & Consultancy (2002), indicates policy makers' and business people's interest in such research. An understanding of Internet diffusion in a particular country can assist policy makers in policy creation to bring about change in their nations social and economic systems (Okoli 2003).

In Kenya, particularly, certain policy interventions are necessary to bridge the 'digital divide' between its technologically proficient, and its technologically deficient, many of whom have never seen a computer.

The study will capture the perishable history of the internet in Kenya, provide business professionals with an awareness of the Internet diffusion in Kenya to aid them in making investment decisions while assisting future researchers in their understanding of Internet diffusion, highlighting the importance and relevance of considering its determinants.

The study will also add to the academic body of knowledge of Internet diffusion to aid future research.

The study will also 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 in Africa is collected and studied.

CHAPTER 2 LITERATURE REVIEW

2.1 Plan of Development

This empirical research project begins by exploring the Global Diffusion of the Internet (GDI) framework that I have considered to aid the research and the reasons why the GDI framework was chosen are discussed.

In particular much research has been focused on the diffusion of the Internet throughout the world. Studies into diffusion have been conducted by organisations such as the World Bank, ITU, World Economic Forum and the Harvard Centre of International Development (CID). Many of these organisations have developed their own frameworks to aid researchers with similar objectives to their own. After an in-depth review of the major frameworks, this study will make use of the Global Diffusion of the Internet (GDI) framework developed by MOSAIC (Wolcott et al, 2001).

2.2 The GDI Framework

The Mosaic group initially undertook the Global Diffusion of the Internet (GDI) project in 1997 to assess a countries preparedness to engage in Internet and e-Business activities (Okoli, 2003). The project encompassed an extensive investigation into the spread of the Internet around the world (Wolcott et al., 2001). In order to aid the Mosaic group's research a framework was developed to provide a standardized means for comparing countries' preparedness to engage in Internet activities. The framework has been a work in progress since its inception in 1997 and as of 2004 extensive studies in 40 countries, representing every continent and socio-economic group, have been conducted (Foster et al., 2004). The reports using the framework are also well respected and have been published in many of the top ICT journals such as the CAIS and JAIS.

Briges.org (2001) and Wolcott et al (2001) defines the goals of the GDI framework as encouraging research that captures the state of the Internet within one or more countries, regions, or ethno-cultural areas over time, as

well as helping to determine the factors shaping its diffusion. The frameworks methodology is designed to permit comparisons of the diffusion of the Internet amongst differing areas of the world as well as allowing policy makers to gain insight into the diffusion of the Internet in a particular region.

Tracking the diffusion of the Internet is an onerous task. Many previous studies have used simple metrics such as *number of hosts, number of hosts per capita, number of users, or whether TCP/IP connectivity exists.* These are often useful statistics as they are *easy* to grasp, however they do not capture the richness of a country's experiences with the Internet. The GDI framework is unique in that it has two emphases. It looks at how extensive the Internet is used by measuring *Connectivity Infrastructure, Organisational Infrastructure, and Sophistication of use.* The framework then also examines how widely the Internet is used geographically amongst individuals and organisations measured by *Pervasiveness and Sectoral Absorption* (Okoli, 2003).

Wolcott et al (2001) believe that when enough countries have been analysed using the framework a much clearer indication of global Internet diffusion will be available illustrating its sophistication. One of the objectives of this research is also to assist global research into Internet diffusion and the most valuable framework to use in order to achieve this is the GDI framework. Wolcott et al (2001) believe that a concerted effort by many researchers around the world could result in the rapid characterization of the Internet status.

The measures that the GDI framework uses are sufficiently clear and easy to understand that they may be applied by a variety of potential users such as policy makers, businessmen and historians. Results of this research should therefore prove useful to many different stakeholders. Those in business should get a clear picture of what they can expect to find when investing in a given country. Internal and external policymakers will also get an improved understanding of what is required to push Internet development further to make it a more valuable resource for the country concerned.

Using this framework I hope to contribute to the debate over what levers are available to policy-makers at the national and international level to shape and positively (or negatively) influence the Internet's development.

2.2.1 The GDI Dimensions

The GDI framework encompasses ***six*** dimensions, each of which describes a measurable aspect of Internet use in the respective country (Wolcott et al., 2001). Collectively the six dimensions cover all aspects that may be of interest when measuring Internet use. The framework also encompasses researching the determinants of the dimensions, which attempts to provide an intuitive look at what the base causes of a dimension is (Wolcott et al., 2001).

Each dimension may be assigned one of five ordinal values ranging from zero (non-existent) to four (highly developed). These levels indicate the state of the Internet in a particular country at a given point in time.

Okoli (2003) and Wolcott et al (2001) describe the six dimensions as:

a) **Pervasiveness:** measures the number of Internet users per capita. This data is difficult to retrieve and considerations must be made that in many developing countries users may access the Internet in many ways such as from Internet cafes, kiosks, home, organisations or from academic institutions and home.

b) **Geographical Dispersion:** describes the physical dispersion of the Internet within a country. I.e. is it only available in the urban cities or is it accessible in the rural areas as well? Widespread geographic dispersion of the Internet is necessary to transform the country in totality, and not just access in a few of the urban centres.

c) **Organisational Infrastructure:** refers to the organisational environment that ISP's are a part of. This includes the level and nature of privatisation of the national telecommunications operators in the relative countries. The more competitive the environment the higher a countries rating will be based on this dimension.

d) **Sophistication of Use:** measures how innovatively the Internet is used in a country and how it has helped citizens automate or improve certain manual tasks. To determine the Internet capability of a country it is necessary to understand how the Internet is used and sophistication of use measures this (Wolcott et al, 2001).

e) **Connectivity Infrastructure:** deals with an assessment of the physical structure of the network supporting the Internet. Some of the metrics used are the domestic backbone, international links, Internet exchanges, and methods of accessing the Internet.

f) **Sectoral Absorption:** captures the extent of Internet use amongst four major Internet sectors in a country. The sectors considered are that of *academia, commerce, healthcare and government*. Sectoral absorption is meant to indicate how the Internet is perceived by different sectors of the economy.

There are three milestones that this dimension considers:
The first milestone is that of determining when the Internet attracted use outside that of specialists.
Secondly, determining when communities integrated the Internet into business practices.
And finally, when communities advance from not only using the Internet, but to adding value to it. This phase is described as "re-invention" by Rogers (1995).

Using an order of magnitude differential between levels increases the probability that two observers looking at the same country at the same point in time will assign the same value, even though data about the Internet is rapidly changing, and of variable credibility. While the "state" of the Internet at a given point in time within a given country can be captured using the dimensions given in Table 1, the analysis is accompanied by a discussion of the political, technological, social, economic, and historical factors that shaped the evolution of this complex phenomenon.

In summary, the analytical framework captures the state of the Internet within a country in a rich, multifaceted, yet relatively straightforward way through the

use of dimensions. Together, the dimensions and the discussion of factors shaping the Internet's evolution provide an analytical tool that can be used to conduct longitudinal studies, for multi-country comparisons, and for formulating policy recommendations.

In addition, while the measure is fundamentally quantitative, there is a qualitative aspect to the levels. When a country progresses from one level to another, the change is substantial enough that one is likely to observe a significant change in the impact of the Internet and a shift in its use.

The six dimensions of Internet Diffusion levels are shown in the table 1 below.

Table 1: levels of the six Internet dimensions

	The Pervasiveness of the Internet
Level 0	***Non-existent***: The Internet does not exist in a viable form in this country. No computers with international IP connections are available. There may be some Internet users in the country; however, they obtain a connection via an international telephone call to a foreign ISP.
Level 1	***Embryonic***: The ratio of users to total population is on the order of magnitude of less than one in a thousand (less than 0.1%).
Level 2	***Established***: The ratio of Internet users to total population is on the order of magnitude of at least one in a thousand (0.1% or greater).
Level 3	***Common***: The ratio of Internet users to total population is on the order of magnitude of at least one in a hundred (1% or greater).
Level 4	***Pervasive***: The Internet is pervasive. The ratio of Internet users to total population is on the order of magnitude of at least one in 10 (10% or greater).
	Geographic Dispersion of the internet
Level 0	***Non-existent***: The Internet does not exist in a viable form in this country. No computers with international IP connections are located within the country. A country may be using UUCP connections for e-mail and USENET.
Level 1	***Single location:*** Internet points-of-presence are confined to one major population centre.
Level 2	***Moderately dispersed***: Internet points-of-presence are located in multiple first-tier political subdivisions of the country
Level 3	***Highly dispersed***: Internet points-of-presence are located in at least 50% of the first-tier political subdivisions of the country.
Level 4	***Nationwide***: Internet points-of-presence are located in essentially all first-tier political sub-divisions of the country. Rural access is publicly and commonly available.
	Organisational Infrastructure of the Internet
Level 0	***None***: The Internet is not present in this country
Level 1	***Single***: A single ISP has a monopoly in the Internet service provision market. This ISP is generally owned or significantly controlled by government
Level 2	***Controlled***: There are only a few ISPs and the market is closely controlled through high barriers to entry. All ISPs connect to the international Internet through a monopoly telecommunications service provider. The provision of domestic infrastructure is also a monopoly
Level 3	***Competitive***: The Internet market is competitive. There are many ISPs and low barriers to market entry. The provision of international links is a monopoly, but the provision of domestic infrastructure is open to competition, or vice versa.
Level 4	***Robust***: There is a rich service provision infrastructure. There are many ISPs

	and low barriers to market entry. International links and domestic infrastructure are open to competition. There are collaborative organizations and arrangements such as public exchanges, industry associations, and emergency response teams.
Sophistication of Use of the Internet	
Level 0	***None***: The Internet is not used, except by a very small fraction of the population that logs into foreign services
Level 1	***Minimal***: The user community struggles to employ the Internet in conventional, mainstream applications
Level 2	***Conventional***: The user community changes established practices somewhat in response to or in order to accommodate the technology, but few established processes are changed dramatically. The Internet is used as a substitute or straightforward enhancement for an existing process (e.g. email vs. post). This is the first level at which we can say that the Internet has "taken hold" in a country.
Level 3	***Transforming***: The use of the Internet by certain segments of users results in new applications, or significant changes in existing processes and practices, although these innovations may not necessarily stretch the boundaries of the technology's capabilities.
Level 4	***Innovating***: Segments of the user community are discriminating and highly demanding. These segments are regularly applying or seeking to apply, the Internet in innovative ways that push the capabilities of the technology. They play a significant role in driving the state-of the-art and have a mutually beneficial and synergistic relationship with developers.

Connectivity Infrastructure of the Internet

		Domestic Backbone	International Links	Internet Exchanges	Access Methods
Level 0	Nonexistent	**None**	**None**	**None**	**None**
Level 1	Thin	**<=2 Mbps**	**<=128 Kbps**	**None**	**Modem**
Level 2	Expanded	**> 2Mbps -200 Mbps**	**> 128 Kbps - 45 Mbps**	1	**Modem 64 Kbps leased lines**
Level 3	Broad	**> 200 Mbps - 100 Gbps**	**> 45 Mbps - 10 Gbps**	**More than 1; Bilateral or Open**	**Modem > 64 Kbps leased lines**
Level 4	Extensive	**> 100 Gbps**	**> 10 Gbps**	**Many; both Bilateral and Open**	**< 90% modem > 64 Kbps leased lines**

Sectoral Absorption of the Internet

Sector	Minimal (1 point)	Medium (2 points)	Great Majority (3 points)
Academic	0% -10% have leased line Internet connectivity	10% -90% have leased line Internet connectivity	90% have leased line Internet connectivity
Commercial	0% - 10% have leased line Internet connectivity	10% - 90% have leased-line Internet connectivity	90% have leased line Internet connectivity
Health	0% - 10% have leased line Internet connectivity	10% - 90% have leased-line Internet connectivity	90% have leased line Internet connectivity
Public	0%-10% Have Internet Servers	10% - 90% have Internet Servers	90% have Internet Servers

Sectoral Absorption of the Internet Scale

Sectoral Point Total	Sectoral Absorption	Dimension Rating
0	Level 0	Non-existent

1-3	Level 1	Rare
4-6	Level 2	Moderate
7-9	Level 3	Common
10-12	Level 4	Widely Used

2.2.2 The GDI Internet Determinants

The GDI framework includes a section devoted to determinants0 which according to Wolcott et al (2001) may be thought of as proximate causes resulting in the current nature of the Internet environment. By researching and examining the relationship between the determinants and dimensions of a country the evolution of the Internet will be understood.

Determinants reflect the factors that led to the observed state and which will likely influence future development. This will enable policy makers to make educated decisions based on the findings of the determinants to promote Internet use. It should also provide guidance on how to make the Internet more valuable to particular countries' citizens. Evaluating the determinants therefore highlights key levers for policy intervention.

Table 2 below provides a description of the different determinants that are required to be researched according to the GDI framework `(Wolcott et al., 2001).

Table 2: The Determinants of Internet Diffusion (Source: Wolcott et al., 2001)

QUALITIES OF THE TECHNOLOGY ITSELF	
1. Perceived value	Value the Internet provides.
2. Ease of use of the Internet	Entails looking at literacy and availability of local-language content
3. Cost of Internet access	Entails looking at Internet costs (dial-up, ISP, etc.) relative to income levels
INTER-RELATIONSHIPS WITHIN THE TECHNOLOGY CLUSTER	
4. Access to constituent technologies	Looks at the balance between all the technologies that must be present for various levels of use
5. Demand for capacity, multiplicity of ISPs, services provided	How demand at various levels of the cluster is driving the connectivity infrastructure development
EXTERNAL/SURROUNDING FORCES	
6. Geography	How physical geography influences Internet development
7. Adequacy and fluidity of resources	A broad category considering financial, informational, human, technological or capital, and material resources and the ease with which they can flow from where they are to where they are needed
8. Ability to execute	The ability to develop a sound strategy and a suitable design given opportunities and constraints, and the ability to manage plans through to completion
9. Culture of entrepreneurship	How entrepreneurship is rewarded, both at the organisational and individual level
10. Regulatory/legal framework	Specific laws and regulations influencing Internet diffusion
11. Forces for change	Such things as competitive environment, presence of demanding domestic customers, rate of creation of new organisations, presence of champions
12. Enablers of change	Conditions that allow a community to accept and incorporate change, including institutional, historical, cultural, and educational factors

2.2.3 Why the GDI Framework?

Bridges.org (2001) compared a few e-readiness frameworks in order to determine which frameworks are best for which goals. They determined that the GDI framework is best suited for the following objectives:

- To assess the current level of technology in a region as a basis for a forecast
- To understand the relative roles of political, economic, and social factors in the Internet's growth and usage
- To understand why particular countries progress differently

The reason for the study into the diversification will include gaining an understanding of the *political*, *economic* and *social* factors affecting internet diffusion. Hence, the conclusion that the GDI framework will be most suitable in meeting the objectives of the empirical research. This framework will enable a valid longitudinal and qualitative analysis of the Internet, taking into account the unique environment surrounding it in Kenya, hence enabling me to carry out a critical analysis of Internet diffusion in Africa. Critical Theory will be applied in the analysis across Africa.

Four other well know frameworks (NRI, MIT, APEC and GDI) are introduced below while a comparison of the various frameworks is indicated on Table 3 below:

a) The APEC Framework:

The Asian Pacific Economic Cooperation (APEC) E-commerce Readiness Assessment Guide is a self-assessment tool developed by the APEC Electronic Commerce Steering Group. It was first published in 2000. The APEC E-Commerce Readiness Assessment Guide is a good tool to assess countries preparedness for e-commerce however it provides limited coverage of *actual diffusion* of the Internet within a country. The guide is therefore unable to accurately measure inequality in the use of e-commerce and the Internet. The major draw back to the framework, however, is that it is intended to be used as an internal analysis of an economy. No measurable score is

created by the framework and it is also inadequate for analysing and comparing Internet diffusion between countries (Bridges.org, 2001). This guide is therefore not adequate for the longitudinal objectives of this study and will not be considered.

b) The NRI Framework:

The Network Readiness Index (NRI) framework was initially created by the Centre of International Development (CID) at Harvard University in collaboration with The World Economic Forum, INSEAD and The World Bank. The NRI report is best used as a quick and rough gauge of current and future technology usage. It provides a wider range of statistics and has more coverage of e-Commerce than the GDI framework. The NRI framework however requires condensing the values measuring Internet diffusion into a single index. Bridges.org (2001) therefore argues that it provides an oversimplified view of a nation's Internet diffusion. The NRI framework therefore does not provide enough scope for measuring the determinants of Internet diffusion within a particular country and is considered unsound for the research to be undertaken.

c) The MIT Framework:

The MIT framework is meant to be an aid in assessing the 'e-Readiness' of a particular country. The framework defines 'e-Readiness' as the ability to pursue value creation opportunities facilitated by the use of the Internet (Choucri et al (2003). More specifically it is designed to measure the *degree* of *ability*, and the *capacity* to *pursue*, in the *context* of specific opportunities identified. Ultimately, the MIT framework seeks to formulate a 'map of e-Readiness' to help guide potential investment and policy directions in a productive manner. It therefore does enable us to use it to research operational variables for the purposes of analysis and measurement.

The MIT framework is very adaptable to any research and is particularly useful when researching specific opportunity areas such as the use of e-commerce by government and what is required to promote it. When using it to research Internet diffusion, the MIT framework is very similar in structure to the GDI framework as many of the same variables are considered. The MIT

framework was actually built upon frameworks such as the GDI, NRI and APEC (Asian Pacific Economic Cooperation) frameworks (Choucri et al., 2003). My research, however is attempting to add to the body of knowledge on Internet diffusion and the MIT framework is relatively immature in that it was only established in 2003. Therefore due to its lack of exposure as opposed to other frameworks such as the GDI, NRI and APEC frameworks it will not be considered a viable option for this study.

Table 3: Internet Diffusion Models (Choukri et al., 2003)

Model	Type	Author	Description	Focus
Readiness for the Networked World	Statistical or questionnaire based ready-to-use tools	Center for International Development at Harvard University	Rates communities along 4 progressive stages of development in 19 indices. , Based on communities self-estimation. No prescription for improvement.	Access, Learning, Society, Economy, Policy.
E-Readiness Rankings	Statistical or questionnaire based ready-to-use tools	The Economist Intelligence Unit and Pyramid Research	Tallies scores across 6 categories, five of which include a total of 29 indicators. Combines business environment rankings (70 separate indicators) with connectivity scores. Brief explanation of the results and the changes since last ranking.	Connectivity and technology infrastructure (25%), Business environment (20%), Consumer and business adoption (20%), Social and cultural infrastructure (15%), Legal and policy environment (15%), Supporting e-services (5%)
Global Diffusion of the Internet: Case Studies	Country case studies	The Mosaic Group	Indicates stages of Internet growth and usage through combination of statistics, narrative description and comparison. Focuses on 6 Internet statistics.	Pervasiveness, Geographic dispersion, Sectoral absorption, Connectivity infrastructure, Organizational infrastructure, Sophistication of use.
International Survey of E-Commerce	Interview and survey based reports	World Information Technology and Services Alliance	Report based on a survey to technology companies on their experience with e-barriers and asking for recommendations. Provides charts and narrative accounts of the answers. Only general conclusions, no country-by-country assessment.	How ready are world markets for electronic commerce? Economic factors, Regulatory environments.

2.3 Theoretical Foundation for Critical Paradigm

According to McGrath (2005), critical research, unlike positivism and interpretivism depend on a particular cause of the researcher. This maybe feminism, environmentalism, emancipation, focus on developing countries or contexts, etc. This revolves around power relations and politics of domination which are historically and culturally contingent. Adorno (2004) talks of 'critical subjectivity' where he gives an insight into how a critical theorist should

conduct a critical inquiry: *the critical theorist has to begin critically with an inquisitive approach to the viewpoints expressed in a given situation.* This requires that the researcher adopt a stance in order to examine a situation critically. In this case, the cause underpinning this research is its focus on developing countries, especially the region of Africa. This is because the problem under consideration has received scant attention globally.

A critical stance is appropriate for this research in order to question the given for granted determinants of Internet diffusion especially in the case of developing countries. It is a predominant view for instance that low levels of education in Africa, poor infrastructure, bad government policies etc, are the bane of technology diffusion in Africa (Mbarika, 2001). However, a recourse to critical theory research may be much more illuminating given its special focus on the context by considering social, political, technological, legal and economic environments.

In order to align the problem of Internet diffusion and its determinants to the Critical research paradigm, there is need to consider themes that have been used under critical theory not only in management studies, but more specifically in Information Systems (IS) research. Therefore the arguments for use of Critical Theory in Internet research in developing economies will be discussed in light of these relevant themes below (Howcroft and Trauth, 2005):

a) Emancipation

This theme has a commitment of "freeing individuals from power relations around which social and organizational life are woven" (Howcroft and Trauth; 2005; Muganda, 2005). This can be extended to concepts of Internet diffusion, which if looked at in a wider context, then aspects of power relations are clearly visible. For instance, if approached through the lens of transition economies, it maybe presumed that developed economies influence what and how policies of Internet are implemented in these countries. They can achieve these through for instance technologies of their choice, which they transfer to developing nations. In studying Internet adoption in transition economies, it

may be impossible not to consider power relations, which may be visible in the form of the digital divide thus critical research is well worth considering.

b) Critique of Tradition

This theme need to be considered in light of the above theme, since it seeks to 'disrupt' the status quo in terms of the taken for granted assumptions by recourse to a "wider social, political, historical, economic and ideological context" (Doolin, 1998).

If looked at within the context of the problem domain of Internet diffusion research in developing countries, the theme aptly advocates for the use of critical research. For instance, many developing countries use developed countries experiences as benchmark of successful adoption of technologies, Internet included. One of the foci of critical research questions the deterministic approach to technology adoption, making it suitable for critical research.

c) *Critique of Technological Determinism*

This theme is probably the most important of them all. It challenges the discourse surrounding socio-economic changes that have been occurring. Technological determinism assumes that "technological development is autonomous and that societal development is determined by the technology" (Howcroft and Trauth, 2005).

If this theme is considered, its relevance to Internet diffusion research is illuminating. For instance, literature about Internet diffusion is replete with examples of how Internet adoption will result in benefits to the society at different levels. The assumption is that any country, organization, or individuals who adopt the Internet ostensibly will experience certain benefits. However, the theme of critique of technological determinism questions this deterministic approach.

CHAPTER 3 RESEARCH METHODOLOGY

3.1 Introduction

This study focused on the use of the Global Diffusion of the Internet (GDI) framework to analyse Internet diffusion in Kenya. This was done along six dimensions of the GDI Framework: *Pervasiveness, Geographic Dispersion, Sectoral Absorption, Connectivity Infrastructure, Organisational Infrastructure and Sophistication of Use*. The study aimed at finding out how Internet diffusion has progressed within the last 10 years (1995 to 2005) since the first ISP was started in Kenya in the mid 1990s. The results of the study of the Internet diffusion in Kenya yielded a Kiviat diagram, which is a type of pie chart, which was then used alongside others from studies done in Africa to carry out a critical analysis of the Internet diffusion in Africa. The study will also enable the reader to see how government policies on liberalisation of the Telecommunications industry affect infrastructure and access costs hence affecting the diffusion of Internet in Kenya and other African countries. The study also tries to show the importance of an increase in rural Internet access as well as the effect of the provision of affordable value added services such as VoIP.

3.2 The Research Philosophy & Framework

This research adopted qualitative research methodology, which is becoming a very important approach in the field of Information Systems (IS). Qualitative research involves the use of qualitative data, such as interviews, documents, and participant observation data, to understand and explain social phenomena. Qualitative researchers can be found in many disciplines and fields, using a variety of approaches, methods and techniques. In Information Systems research, there has been a general shift away from technological to managerial and organizational issues, hence an increasing interest in the application of qualitative research methods.

Examples of qualitative methods are action research, case study research and ethnography. Qualitative data sources include observation and participant observation (fieldwork), interviews and questionnaires, documents and texts, and the researcher's impressions and reactions.

The GDI Framework is such that it tries to develop a mental model of which factors play the most important role in determining how and why the Internet is diffusing. The study therefore uses the determinants described by Wolcott et al (2001) in the GDI framework as my propositions. The propositions contained in the interview schedule are the statements this research analysed in order to determine which factors play important roles in determining Internet diffusion, the strengths of which were also analysed. The propositions however were not tested, per se, due to the qualitative nature of the research. The methodology of the research involves retrieving data based on the dimensions and determinants of the GDI framework as provided by Wolcott et al (2001).

An example of a determinant is the cost of Internet access. Analysing this determinant will involve gathering data on the costs of Internet access and comparing it to the average incomes of Kenyans to determine if they are excessive or not. Data regarding this determinant can be sourced wholly from the World Wide Web, as costs are easily obtainable from ISP's and national telephone operators. Average earnings are also easily obtainable from governmental census databases.

Once data on the Kiviat diagram for the Internet diffusion in Kenya was obtained, a critical analysis was carried out on the GDI in Africa in order to achieve the objectives of this study.

This methodology focus was therefore on the qualitative analysis of secondary data obtained from existing sources.

3.3 Data Collection Techniques

The GDI framework has been applied by MOSAIC group members and others to study the Internet in over 40 countries and the methodology used has been fundamentally qualitative. The researcher can therefore gather data from many diverse sources (Wolcott et al., 2001).

Below are some of the recommended sources by Wolcott et al. (2001)

- Collecting any available data from existing sources, including other studies, press reports, net-based collections methods, etc.
- Collecting primary data from the Internet/WWW itself. For example, surfing web pages of ISPs can be quite helpful
- Opinions from Stakeholders in the industry
- Information from ISP's and communications providers

Therefore the primary source of information for this study was secondary data from existing sources. The GDI framework (Wolcott et al., 2001) developed by the Mosaic Group was the primary instrument.

This research adopted the recommended sources of data collection as well the interviewing guideline attached which contains propositions to be analysed, where data was not available from the recommended sources mentioned above.

3.4 Mode of Data Analysis Techniques

Data analysis involved a longitudinal analysis of Internet diffusion from 1995 to 2005 in Kenya. The levels of measurement of the six dimensions presented in section 2.2.1 above was used to analyse the dimensions in order to come up with a Kiviat diagram, which is a type of pie chart. It was the primary instrument of displaying the longitudinal data pertaining to the particular dimensions with one of six spokes representing each of the dimensions (Kolence and Kiviat 1973, Wolcott et al 2001).

The Kiviat diagram allows for the easy analysis of the Internet environment over a particular time period. The values of the metrics for different time periods are displayed on the same diagram to be analyzed longitudinally. In this study, this will provide the reader with an easy and understandable diagram of Internet diffusion over the past ten years. This will then be used alongside others from studies done in Togo, Ghana, Uganda, Ethiopia, Cape Verde, Mauritius, South Africa and Egypt

An example of a Kiviat diagram is shown below and it illustrates the status of Internet diffusion for India between 1988 and 2002.

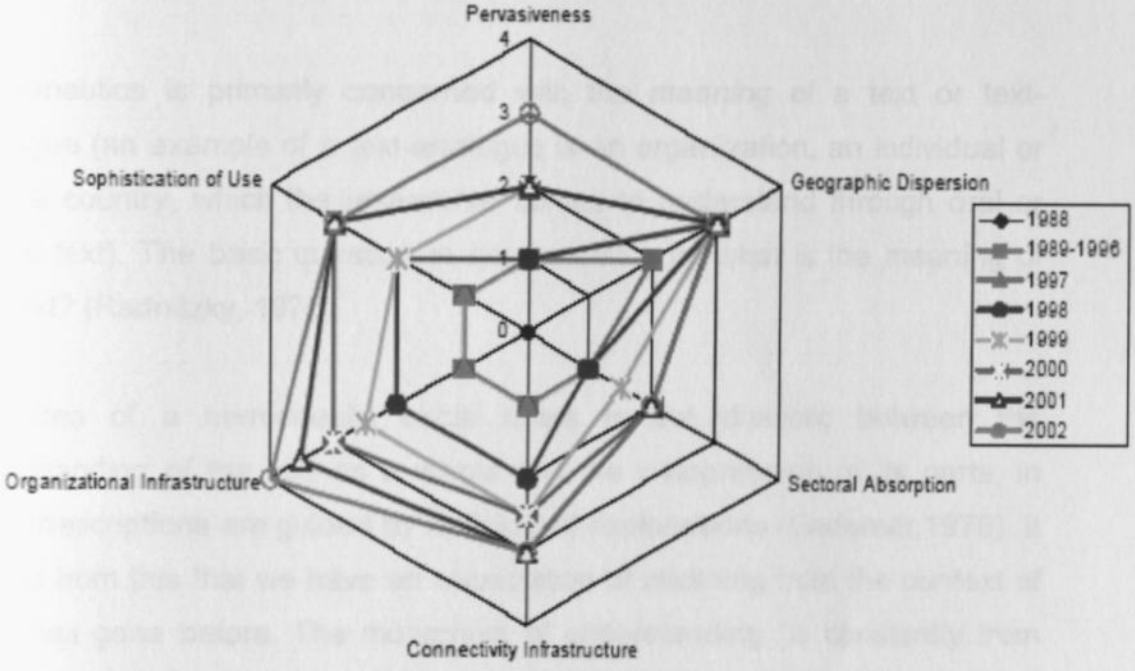


Figure 1 Kiviat diagram of the dimensions for India (Wolcott et al., 2003)

Sophistication of Use, Geographic Dispersion, and Connectivity Infrastructure, all reached a very solid Level 3, with Pervasiveness barely reaching a Level 3 in 2002, and Organizational Infrastructure reaching Level 4 in the same year. As in many countries, Sectoral Absorption is likely to lag behind the other dimensions due to the large number of organizations, many in rural areas, which need to "come on-line" for a country to reach Levels 3 and 4.

3.4.1 Hermeneutics

Although a clear distinction between data gathering and data analysis is commonly made in quantitative research, such a distinction is problematic for many qualitative researchers. The common thread is that all qualitative modes of analysis are concerned primarily with textual analysis (whether verbal or written). The mode of analysis that was adopted in this study is hermeneutics. Hermeneutics can be treated as both an underlying philosophy and a specific mode of analysis. As a mode of analysis, it suggests a way of understanding textual data. The following discussion is concerned with using hermeneutics as a specific mode of analysis.

Hermeneutics is primarily concerned with the *meaning* of a text or text-analogue (an example of a text-analogue is an organization, an individual or even a country, which the researcher comes to understand through oral or written text). The basic question in hermeneutics is: what is the meaning of this text? (Radnitzky, 1970).

The idea of a hermeneutic circle refers to the dialectic between the understanding of the text as a whole and the interpretation of its parts, in which descriptions are guided by anticipated explanations (Gadamer,1976). It follows from this that we have an expectation of meaning from the context of what has gone before. The movement of understanding "is constantly from the whole to the part and back to the whole" (ibid, p. 117). As Gadamer explains, "It is a circular relationship. . . The anticipation of meaning in which the whole is envisaged becomes explicit understanding in that the parts, that are determined by the whole, themselves also determine this whole." Ricoeur suggests that "Interpretation . . . is the work of thought which consists in deciphering the hidden meaning in the apparent meaning, in unfolding the levels of meaning implied in the literal meaning" (Ricoeur,1974).

In hermeneutic analysis as used in an information systems study, the object of the interpretive effort becomes one of attempting to make sense of the country as a text-analogue. In a country, people (e.g. different stakeholders)

can have confused, incomplete, cloudy and contradictory views on many issues. The aim of the hermeneutic analysis in this study becomes one of trying to make sense of the whole Internet diffusion in the country using the research questions as a guide. Good examples of research articles in IS which explicitly use hermeneutics are those by Boland (1991), Lee (1994), and Myers (1994).

CHAPTER 4: DATA ANALYSIS AND RESEARCH FINDINGS

4.1.1 The Internet Diffusion in Kenya

The Dimensions of Internet Diffusion that were previously examined on section 2.2.1 above are discussed here in detail with reference to Kenya for the period of 1995 to 2005.

4.1.2 Pervasiveness

The pervasiveness of the Internet in a particular country is a measure of the number of users there are per capita. When researching pervasiveness in Kenya as with all developing countries, one has to take into consideration that users access the Internet in many ways. Kenya's population accesses the Internet at cyber cafes, at work, academic institutions and at home. The Table below provides a breakdown of the different levels of Pervasiveness for a country as provided by Wolcott et al (2001). The highlighted level is the current Pervasiveness for Kenya Ounda (2006) based on the analysis, which will follow.

Table 4: Pervasiveness of the Internet in 2005

Level 0	***Non-existent***. The Internet does not exist in a viable form in this country. No computers with international IP connections are located within the country. There may be some Internet users in the country; however, they obtain a connection via an international telephone call to a foreign ISP.
Level 1	***Embryonic***. The ratio of Internet users per capita is on the order of magnitude less than one in a thousand (less than 0.1%).
Level 2	***Nascent***. The ratio of Internet users per capita is on the order of magnitude of at least one in a thousand (0.1% or greater).
Level 3	***Established***. The ratio of Internet users per capita is on the order of magnitude of at least one in a hundred (1% or greater).
Level 4	***Common***. The ratio of Internet users per capita is on the order of magnitude of at least one in ten (10% or greater).

Ounda (2006), has conducted research into the Internet diffusion in Kenya and found out that there was an estimated 450,000-500,000 users of the

Internet in 2005. The table below summarizes key findings of the Report by Ounda (2006) as well as identifying the real growth rates based on Census data for Kenya (CIA World Factbook 2004 & 2005)

Table 5: Longitudinal Estimates of Internet Users (1995-2005)

Year	Approx Users	Approx Population	% of Population
1995	100	24,000,000	0.000004
1996	10,000	25,000,000	0.04
1997	25,000	26,000,000	0.1
1998	50,000	27,000,000	0.19
1999	70,000	28,000,000	0.25
2000	100,000	29,000,000	0.34
2001	200,000	30,000,000	0.67
2002	400,000	31,000,000	1.3
2003	420,000	32,000,000	1.31
2004	450,000	33,000,000	1.36
2005	500,000	33,829,590	1.5

(Source: CIDCM Report, August 1998; CIA World Factbook 2004 & 2005).

The results show that Kenya has seen a reasonable growth in Internet from the time of inception in 1995 to 2005, but steadily increased and according to Ounda (2006), there has been a steady increase since then. However Ounda (2006), found that the number of Internet users as at 2005 was a mere 1.5% of the total population. The benefits derived by this small group are insufficient to eliminate the economic disadvantages of the peripheral communities in the whole country. Most of the Internet users in Kenya visit it just for sending e-mails to friends or to join chat groups. Businesses have also embraced the Internet as a way of carrying out business transactions. Sectors like the car imports, agriculture and computer sales are good examples where the Internet is gaining ground as a means of transacting business.

Kenya has therefore not yet reached level 4 based on the GDI Pervasiveness index, which stipulates that that at least ten percent of the population must have access to the Internet before level 4 can be achieved.

From the above explanation, the pervasiveness in 2005 may be indicated as shown below.

Table 6: Pervasiveness in Kenya (1995-2005).

1995 - 1996	1997 - 2001	2002 – 2005
Level 1	Level 2	Level 3

4.1.3 Geographic Dispersion

Geographic dispersion measures the physical dispersion of the Internet within a country. A high level of dispersion is important to encourage diffusion throughout the country and not only in the major cities. In particular geographic dispersion looks at the number of points of presence in the first-tier political subdivisions (Kenya's 8 provinces) Kenya is currently at level 3.5 as indicated by the shaded area in the table below following the analysis to follow.

Table 7: Geographic Dispersion of the Internet in 2005

Level 0	***Non-existent***. The Internet does not exist in a viable form in such a country. No computers with international IP connections are located within the country. A country may be using unix-to-unix copy protocol (UUCP) connections for e-mail and USENET (this is a widely distributed online bulletin board which consists of thousands of online forums on any topic its users could dream up).
Level 1	***Single location***. The Internet points-of-presence (POPs) are confined to one major population centre.
Level 2	***Moderately dispersed***. Internet points-of-presence are located in multiple first-tier political subdivisions of the country.
Level 3	***Highly dispersed***. Internet points-of-presence are located in at least 50% of the first-tier political subdivisions of the country.
Level 3.5	***Highly dispersed.*** *Internet POPs in all the 8 provinces of the country but lacking a nationwide coverage.*
Level 4	***Nationwide***. Internet points-of-presence are located in essentially all first-tier political subdivisions of the country. Rural access is publicly and commonly available.

In 1995, ARCC was the first ISP located in Nairobi, which placed Kenya at level 1 with one POP. In 1996, the number of ISPs increased to nine but with their presence still concentrated in major urban centres. In 1997, the ISPs

were about 40 in number spreading across the major urban centers of Nairobi, Mombasa, Eldoret and Kisumu. This placed Kenya at level 2 since not all the eight provinces had Internet POPs.

Following the liberalization of the telecommunications sector in 1998, there was a dramatic increase in the number ISPs and Internet Backbone providers. This increased the number of Internet POPs in the country and by the year 2005, Kenya had 72 registered ISPs. However, out of this number, following a new requirement by the licensing authority to have Voice-over-the-Internet (VoIP) licenses bundled in ISPs and returns of connected customers, the number of operational ISPs as at December 2005 was only 42.

Currently, Kenya has Internet POPs in all the 8 provinces but lacks a nationwide coverage mainly in the rural areas. This puts Kenya in between levels 3 and 4 whose average is (3+4)/2 = 3.5. The POPs for the Internet have also substantially increased in number following spirited efforts by the CCK to set up multipurpose telecentres in urban as well as remote areas. There have also been cyber cafes set up in major urban places but lately due to competition, some have phased out.

Many ISPs, cyber cafés, POPs and multipurpose community call centers have been set up in all the first-tier political subdivisions of the country. These have increased the rate of access of the Internet by the population in remote parts of the country but since electricity is necessary for the operation of Internet facilities, the areas with no rural electrification programmes have been disadvantaged.

As of 2005 Kenya is therefore at level 3.5. Although POPs exist in all first tier political subdivisions, rural access is still not available in sufficient numbers as discussed above.

Table 8: Geographic Dispersion (1995-2005)

1995 – 1997	1998 - 2001	2002 – 2003	2004 - 2005
Level 1	Level 2	Level 3	Level 3.5

4.1.4 Sectoral Absorption

The Sectoral Absorption dimension measures the extent to which organisations in the academic, commercial, health and public sectors have committed to Internet use. The GDI framework uses IP connectivity as the base measure of the dimension as described by the table below. The table indicates the exact measures used by the dimension with the highlighted portion indicating Kenya's current level based upon the analysis to follow. The dimension uses leased line connectivity or the presence of hosted or co-hosted Internet servers as its metrics; because buy-in to these technologies indicates a high level of use, and serious commitment to, the Internet by an organisation.

Table 9: Sectoral Absorption of the Internet

Sector	Minimal (1 point)	Medium (2 points)	Great majority (3 points)
Academic	0%-10% have leased line Internet connectivity	10%-90% have leased line Internet connectivity	90% have leased line Internet connectivity
Commercial	0%-10% have Internet servers	10%-90% have Internet servers	90% have Internet servers
Health	0%-10% have leased line Internet connectivity	10%-90% have leased line Internet connectivity	90% have leased line Internet connectivity
Public	0%-10% have Internet servers	10%-90% have Internet servers	90% have Internet servers

The major impacts of the ICT industry are largely felt when the various sectors of the economy enjoy unlimited use of the telecommunications and computer-related networks.

From previous research done by Ounda, (2006), he found out that KENET provides Internet connectivity to most learning institutions although there are others which have their own leased lines. However, the list of KENET members does not comprehensively include all the learning institutions according to the classification advanced by Wolcott et al. (2001). This shows that Kenya affords only minimal points in terms of sectoral absorption as far as *academic institutions* are concerned i.e. 0-10% have leased line Internet connectivity.

Some *health and research institutions* obtain their leased line interconnectivity from the KENET pipe bandwidth. This number too remains a paltry less than 10%.

Ounda, (2006) also found out that among the *public institutions* the Ministry of Finance is the leading in terms of e-readiness. Other government ministries have since followed suit but this remains untapped to great potential. "Kenya Revenue Authority (KRA) has mooted an idea of interlinking all government operations in major ministries but this has proved futile because of the unwillingness by some highly-placed individuals who do not like techno-savvy environment". This was a response from a CCK Manager, Telecom Licensing. The public institutions in Kenya also can hardly afford a paltry 10% of Internet and/or web presence.

Data regarding the Global Diffusion of the Internet in the commercial sector remains fuzzy and disjointed. Thus, a comprehensive analysis along this line remains elusive as far as this study is concerned. However, "companies worth their salt all have a web presence" and the .ke domain names are quoted to be in the region of 3000 (Cyber statistics, March 2006). This is according to a respondent from Telkom Kenya Ltd. Approximately 10-90% of the commercial enterprises in the country have leased line Internet connectivity. (Ounda, 2006)

The sectoral absorption may be summarized to have largely remained uniform throughout the period under review in the health sector, the public sector and the educational institutions with significant improvements being witnessed in the commercial sector, and privately owned health and educational institutions (Ounda, 2006). According to one respondent from the CCK, "sectoral absorption remains an area in the country where statistics totally lack and this necessitated the regulatory body (CCK) to place a bid for a study to be done with particular focus on this. The bids for the study were opened on 8th March 2006, with the study expected to be finalized in the last quarter of this year". This lack of statistics makes it impossible to assess the advantages that the Global Diffusion of the Internet derives for our educational institutions and the health, the public and the commercial sectors. However, these changes are

too minimal as to effect meaningful shifts in the overall sectoral absorption over the period in review, and it appears like Kenya has leveled out at level 1, and would require the level of adoption of Internet connectivity to increase for the level of change.

Table 10: Sectoral Absorption (1995-2005)

1995 - 1997	1998 – 2001	2002 – 2003	2004 - 2005
Level 1	Level 1	Level 1	Level 1

4.1.5 Connectivity Infrastructure

Connectivity infrastructure assesses the extent and robustness of the physical structure of the network by looking at the aggregate bandwidth of the domestic and international backbones, the number and type of inter-connection exchanges, and the type and sophistication of local access methods being used. Kenya is currently at level 2 as indicated by the shaded portion of Table 11 based upon the analysis to follow.

Table 11: Connectivity Infrastructure of the Internet in 2005

		Domestic Backbone	International Links	Internet Exchanges	Access Methods
Level 0	Non-existent	None	None	None	None
Level 1	Thin	<=2 Mbps	<=128 Mbps	None	Modem
Level 2	Expanded	2 Mbps-200 Mbps	128 Kbps- 45 Mbps	1	Modem 64 Kbps leased line
Level 3	Broad	200 Mbps-100 Mbps	45 Mbps-10 Gbps	More than 1; bilateral or open	Modem 64 Kbps leased line
Level 4	Extensive	100 Gbps	10 Gbps	Many; both bilateral and open	<90% modem 64 Kbps leased line

The connectivity infrastructure as shown above is still relatively underdeveloped in terms of domestic backbone, international links, access methods and Internet exchange points existing in our country.

Kenya currently has two registered Internet exchange points as given in Kenya. From 1997 – 2002, there was only one Internet Exchange Point (KIXP). There is a second IXP that has been licensed though its presence has not been felt. This places Kenya at level 2.

The domestic backbone Internet infrastructure in Kenya is still being dominated by Telkom Kenya, the national landline operator and despite having a liberalized Telkom market, there has been no presence of an alternative provider so far. The current domestic backbone bandwidth capacity in Kenya is 2048 Kbps (or over 2 Mbps). This places the country at level 2 of this element of the dimension of connectivity infrastructure. (Ounda, 2006).

The current international bandwidth for the country also stands at 2048 Kbps (or over 2 Mbps) but with downlinks, which can be as much as 8 Mbps. This places Kenya at level 2.

Access methods examine the percentage of users (mostly homes or SME's) that use modems to access the Internet as well as the proportion of 64k Leased Lines in use. Ounda, (2006) found that Kenyans had the options of accessing the Internet using either modems with dial-up connections or the leased lines. Dial-up connections were only available in the presence of a fixed telephone line. The leased line option has a fixed telephone line dedicated to the modem for accessing the Internet. According to Telkom Kenya, Internet access is through either the 64/128/256 Kbps leased lines or through the 64 Kbps dial-up accounts. Due to their prohibitive costs, there is limited usage of the leased lines. This leaves the majority of subscribers as the medium to large corporate firms. Home users in Kenya mainly choose the option of the dial-up accounts because they are less expensive (Ounda, 2006).

Telkom Kenya introduced the Asymmetrical Digital Subscriber Line (ADSL) services in 2003. ADSL is a technology that enhances the performance of existing telephone line infrastructure through a permanent connection to the Internet. Telkom provides the ADSL modem on a rental basis to the client but

the restriction is that the customer has to be within 5 KM from the equipment supporting this service.

Table 12: Summary of Connectivity Infrastructure (1995-2005)

	1995- 1997	1998- 2001	2002 - 2003	2004 - 2005
Domestic Backbone	Level 0	Level 0	Level 1	Level 2
International Links	Level 0	Level 0	Level 1	Level 2
Internet Exchanges	Level 0	Level 0	Level 2	Level 2
Access Methods	Level 1	Level 1	Level 2	Level 2
Aggregate	**Level 0**	**Level 0**	**Level 1.5**	**Level 2**

4.1.6 Organizational Infrastructure

The strength of the Internet industry is evaluated by the Organisational Infrastructure dimension. It provides a measure of the competitiveness of the market for Internet and telecommunications services. The table below provides an overview of the Organisational Infrastructure dimension and the characteristics of the different levels. The shaded portion indicates Kenya's current level based on the analysis which will follow.

Table 13: Organizational Infrastructure of the Internet in 2005

Level 0	***None***. The Internet is not present in this country.
Level 1	***Single***. A single ISP has the monopoly in the Internet service provision market. The ISP is generally owned or significantly controlled by the government.
Level 2	***Controlled***. There are a few ISPs and the market is closely controlled through high barriers to entry. All ISPs connect to the international Internet through a monopoly telecommunications service provider. The provision of domestic infrastructure is also a monopoly.
Level 3	***Competitive***. The Internet market is competitive. There are many ISPs and low barriers to market entry. The provision of international links is a monopoly, but the provision of domestic infrastructure is open to competition or vice versa.
Level 4	***Robust***. There is a rich service provision infrastructure. There are many ISPs and low barriers to market entry. International links and domestic infrastructure are open to competition. There are collaborative organizations and arrangements such as public exchanges, industry associations, and emergency response teams.

In 1995, ARCC was the only ISP registered. At this time only a few ISP's dominated the market. This placed Kenya at level 1 (Ounda, 2006). However, in 1996, the number rose to 9 and at the beginning of 1997, 40 ISP's were

registered following the liberalization of the Telecommunications sector in July 1999 and the eventual split from the now defunct Kenya Posts and Telecommunications (KPT&C) into three arms of Postal Corporation of Kenya (PCK), Telkom Kenya and CCK. The number of ISPs has since decreased down from 72 in mid 2004 to 42 due to a stringent licensing clause by CCK, which required these ISPs to file returns of connected customers by 31st December 2005. Some ISPs chose to ignore this requirement hence were technically de-registered. Only about 14 out of these 42 made the returns to CCK representing 33% of the registered ISPs.

During this period Telkom Kenya had a monopoly ownership of JamboNet, the international Internet Gateway. This meant that Telkom provided both the domestic and international telecommunications and/or Internet infrastructure from July 1999 up to 2004. The cost of JamboNet was therefore prohibitive to most ISP's as there was no alternative competition. The monopoly placed Kenya at level 2.

The number of ISPs increased and the Internet market industry became more competitive having few barriers to market entry with restrictions being only in the provision of international Internet backbone service networks. This number stands at 42 (See Appendix 3). This arguably placed the country at level 3 between July 1999 (the year after liberalization) and 2003. After the monopoly clause for state-owned Telkom Kenya was lifted in the provision of both domestic and international telecommunications services networks, many players emerged between the years 2004 and 2005, and the Internet services industry became more competitive (Ounda, 2006). This is no longer the case as the number of Backbone providers has since increased to six. Kenya also has two mobile phone operators who have also applied for a Gateway license from CCK.

Another measure of competition in the industry is the existence of organizational bodies, which lobby for the interests of their members. In Kenya there has been collaboration between ISP's in the form of an association for the ISP's called Telecommunications Services Providers of Kenya (TESPOK). TESPOK regulates the ISP industry in terms of entry and

observance of rules. Another association is that of cyber café owners called the Cyber cafes Owners Association of Kenya.

Kenya arguably is at level 4 of the organizational infrastructure of the GDI framework when we consider all the elements like Internet exchange points (IXPs), ISPs, International Internet Gateway providers and the nature of competition of this market.

Table 14: Organizational Infrastructure (1995-2005)

1995	1996 - 1999	2000 – 2003	2004 - 2005
Level 1	Level 2	Level 3	Level 4

4.1.7 Sophistication of use

The Sophistication of Use dimension evaluates the level of innovation associated with the Internet. The table below provides an overview of the dimension with the highlighted portion indicating the current (2005) level based on the analysis to follow.

Table 15: Sophistication of Use of the Internet in 2005

Level 0	***None***. The Internet is not used, except by a very small fraction of the population that logs into foreign services.
Level 1	***Minimal.*** The user community struggles to employ the Internet in conventional, mainstream applications.
Level 2	***Conventional***. The user community changes established practices somewhat in response to or in order to accommodate the technology, but few established processes are changed dramatically. The Internet is used as a substitute or straightforward enhancement for an existing process (e.g. e-mail vs. post). This is the first level at which we can say that the Internet has taken hold in a country.
Level 3	***Transforming***. The use of the Internet by certain segments of users results in new applications, or significant changes in existing processes and practices, although these innovations may not necessarily stretch the boundaries of the technology's capabilities.
Level 4	***Innovating***. Segments of the user community are discriminating and highly demanding. These segments are regularly applying, or seeking to apply, the Internet in innovative ways that push the capabilities of the technology. They play a significant role in driving the state-of-the-art and have a mutually beneficial and synergistic relationship with developers.

This explores how those who are championing the use of the Internet within a country apply this technology. According to Ounda, (2006), Early adopters of the Internet in Kenya used it for sending e-mails. These users had to log onto foreign host accounts in the United States of America and later Europe. This was clearly at level 0.

The first ISP was setup in Kenya in 1995 host the local users through leased lines from foreign firms. Kenyans began to find alternative use for the Internet like browsing or for research by a few technical enthusiasts. Kenya leapt to level 1 in terms of sophistication of use (Ounda, 2006). With the Internet being embraced by almost all sectors of the society for everyday use, the country is currently at level 2 in terms of sophistication of use (Ounda, 2006).

Table 16: Sophistication of Use (1995-2005)

1995 - 1996	1997 - 2001	2002 – 2003	2004 - 2005
0	1	2	2

4.1.8 Longitudinal Analysis of Dimensions

The table below show a summary of the internet diffusion dimensions in Kenya which was obtained from the analysis of various dimensions using the GDI framework.

Table 17 Kenya's Dimensions for 2004

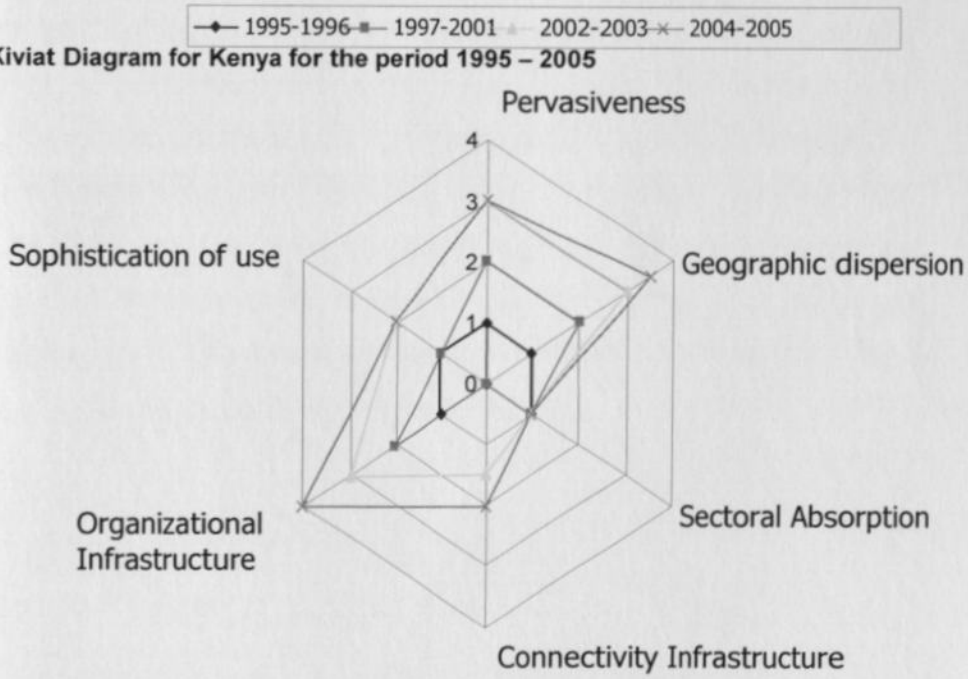
Dimension	Level	Comments
Pervasiveness	Level 3 Established	The ratio of internet users per capita is at least one in a hundred (1% or greater)
Geographic Dispersion	Level 3.5: highly dispersed	There are POPs in all the 8 provinces but lacking nationwide coverage
Sectoral Absorption	Level 1 Common	In the commercial sector, there is 10-90% of business using internet servers. In the health, academic and government, only a minimal leased line connectivity.
Connectivity Infrastructure	Level: 2 Expanding	The current domestic backbone bandwidth capacity in Kenya is 2048 Kbps (or over 2 Mbps). The current international bandwidth for the country also stands at 2048 Kbps (or over 2 Mbps) but with downlinks, which can be as much as 8 Mbps. The leased line has a fixed telephone line dedicated to the modem for accessing the Internet. Internet access in Kenya is through either the 64/128/256 Kbps leased lines or through the 64 Kbps dial-up accounts.
Organisational Infrastructure	Level 4 *Robust*	There is a rich service provision infrastructure. There are many ISPs and low barriers to market entry. International links and domestic infrastructure are open to competition. There are collaborative organizations and arrangements such as public exchanges, industry associations, and emergency response teams.
Sophistication of Use	Level 2 *Conventional*	The user community changes established practices somewhat in response to or in order to accommodate the technology, but few established processes are changed dramatically. The Internet is used as a substitute or straightforward enhancement for an existing process (e.g. e-mail vs. post). This is the first level at which we can say that the Internet has taken hold in a country.

Table 18: Summary of Internet Dimensions for Kenya 2005

Dimension	1995-1996	1997-2001	2002-2003	2004-2005	TOTAL
Pervasiveness	1	2	3	3	9
Geographic dispersion	1	2	3	3.5	9.5
Sectoral Absorption	1	1	1	1	4
Connectivity Infrastructure	0	0	1.5	2	3.5
Organizational Infrastructure	1	2	3	4	10
Sophistication of use	0	1	2	2	5

The Kiviat Diagram for Kenya obtained from the data above is as follows.

Figure 2: Kiviat Diagram for Kenya for the period 1995 – 2005



The Kiviat diagram above shows that Kenya has a low performance in terms of connectivity infrastructure, Sectoral absorption and sophistication of use of the Internet. Pervasiveness and geographic dispersion are developing at a reasonably good rate while organizational infrastructure appears to match that of other developing countries like South Africa and Egypt (Ounda, 2006). However, better results would be derived from the Global Diffusion of the Internet if all the dimensions of the GDI framework were fully developed.

4.2 Determinants of Internet Diffusion in Kenya

The GDI framework includes determinants which according to Wolcott et al (2001) may be thought of as proximate causes resulting in current conditions. By examining the relationship between determinants and dimensions one can understand how and why the Internet has evolved in Kenya.

4.2.1 Perceived Value of the Internet

The perceived value of the Internet refers to the advantages the Internet provides as opposed to other existing communication tools. This factor considers the advantages that people who use the Internet as a means of communication enjoy other than from some of the available means of communication at their disposal. Kenyans mostly use the Internet for sending e-mails to friends and relatives in far away places, for research by academicians, for inter-organizational communication and e-commerce for corporate users and web searches for topics of interest for technical enthusiasts. A study on the uses of the Internet in Kenyan universities identifies that e-mail communication is very popular even among the educated (Banji and Adeya, 2001). The research was carried out in 2001 over a three-month period with 56 respondents from 6 universities.

Table 19: Specific Uses of the Internet

Usage Category	Percentage (%)
E-mail	85.7
Academic research	79.6
Teaching materials	57.1
Current affairs	51.0
Networking with peers	34.7
Publishing work in progress	12.2
Entertainment (sport)	8.2
E-commerce	4.1
Others	10.2

(Banji and Adeya, 2001)

Clearly, the trend signifies what obtains in the society outside the academia since all innovations begin spreading from educational institutions into the larger society. This implies that e-mail use in Kenya is still high while the use of the Internet for e-commerce stands fairly underdeveloped which explains the weak financial sector since market and information access is limited (Ounda, 2006).

4.2.2 Ease of Use

The ease of use of the Internet depends on the literacy levels, education and local language content (Wolcott et al., 2001). The literacy level in Kenya was estimated at 85.1% (CIA World Factbook, 2005). Literacy in this case refers to when people aged 15 and above can read and write (CIA World Factbook, 2005). Therefore, it is expected that there are few problems faced by those who ordinarily want to surf the web or access their Yahoo or Hotmail accounts. However, with an unemployment rate of over 50%, spending money on Internet access charges would be a luxury. The level of literacy is adequate when it is assumed that these people all know the local language of accessing their e-mail accounts or for web search. English is the official language for transactions in Kenya while Kiswahili is the national language. The people who understand only the Kiswahili language are disadvantaged when it comes to the use of the Internet because the websites are mostly in the English language. This explains why, although many may be literate the pervasiveness of the Internet is still low when a majority of the people only understands the language of disadvantage (Ounda, 2006).

4.2.3 Cost of Internet Access

Internet in Kenya is accessed through the ADSL service, broadband service, dial-up accounts, leased lines or currently, the wireless service. Internet charges vary from one service to the next and these involve subscription to the ISP and the telephony costs which are paid to Telkom Kenya. According to Ounda, 2006, these costs are can only be afforded by a few Kenyans given that the Gross Domestic Product (GDP) was a paltry 2.2% according to the 2004 estimates (CIA World Factbook, 2005). Ultimately, the internet users

end up meeting the costs passed on to them by service providers as a result of which, in the long run, poor people cannot access the Internet services because of these prohibitive costs. Ounda, (2006), also found out that the dial-up services, which would be popular with majority of the people because of their friendlier costs, are out of reach owing to the unreliable telephone services from the only National Landline Operator, Telkom Kenya.

4.2.4 Access to Constituent Technologies

According to Keen (1995) ICT may essentially be grouped into four basic technological elements of information processing:

- Tools to access information,
- Telecommunications linkages (including networks),
- Information processing hardware and software, and
- Storage media.

These elements considered under GDI include telephones, modems, personal computers and private & public networks. The teledensity for fixed telephone services in Kenya was 0.88 (that is 0.88 lines for a population of 100) while the same for cellular mobile phone service was 14.4 in 2005 (CCK, 2005). The total fixed telephone lines in use in 2005 were 281,764 representing only 0.83% of the entire population with such services (CCK, 2005; CIA World Factbook, 2005).

The total mobile telephone subscribers in 2005 were approximated at 4,611,970 (CCK, 2005). This represented only 13.6% of the entire population safely assuming that these lines were each held by individuals. It is noteworthy that most of those who own mobile handsets are the same ones who may afford to have fixed telephone services. Ounda, (2006), found out that since this section of the population is small as to produce any meaningful economic results, the pervasiveness, connectivity infrastructure, geographic dispersion and Sectoral absorption of the GDI are affected by this low teledensity. South Africa with a teledensity of 11.35 in the fixed telephone services, one of the highest in the continent, does not even compare to those of developed countries in the West (Brown et al., 2005).

Another component of technology needed for Internet access is the number of personal computers (PCs). This may only be estimated at 1.5 in a population of 100. This follows the analysis generated from pervasiveness of the Internet in Kenya where at least 1 in 100 have access (1.5% that is 500,000 people out of a population of 33,829,590). The low number of PCs is obtained because of their prohibitive costs to the majority of citizens and this affects Internet Diffusion in the country. However, in a spirited effort by the Government to take Internet access services closer to the people, the PCK is establishing community telecentres throughout the entire country in its areas of presence (Ounda, 2006).

4.2.5 Demand for Capacity, Multiplicity of ISPs, Services Provided

The demand for Internet services only accrue from a population which is enthusiastic to use this technology for a multiplicity of purposes and Service Providers that are ready and willing to meet the growing demand constraints imposed by such a population. Because only around 20% of the entire population lives in urban areas with the rest being rural population, the demand for capacity for Internet access is mostly around these urban centers.

This is explained by the fact that requisite amenities for setting up Internet provision services are mainly concentrated around urban centers and the interactions with people from all walks of life increases 'urban awareness space' thus use of the Internet is easily learnt there than elsewhere. The number of ISPs has also increased tremendously from the initial years of Internet presence in the country where it was 9 in 1999 to a figure of 72 in 2005 before coming down to 42 in early January 2006 and only 14 of these remaining active in the market. This has been occasioned by competition in this field and ISPs have been introducing a number of Value-Added Services (VAS) to their connected customers in order to retain them.

The Voice-Over-Internet (VoIP) service, introduced in Kenya in September 2005, has removed the need for additional circuits to be used separately for accessing the Internet and making cheap international telephone calls through

a desktop. This service has proved popular with Kenyans especially those who have relatives outside the country with charges for such calls to Europe and America costing Ksh 15.00 per minute. With this popularity we see Internet Diffusion increasing in the country especially among the young population who always try out new technology ideas.

4.2.6 Geography

Rugged terrain with population spread across the entire countryside provides some challenge in building communication infrastructure (Wolcott et al., 2001). Communication systems in Kenya are concentrated around urban centers although the North Eastern part of the country is still disadvantaged in terms of adequate physical facilities, Kenya does not have serious rough terrain that may be a hindrance to the building of a communications system infrastructure. Therefore, geography does not play an important part in the influence of the Global Diffusion of the Internet in Kenya (Ounda, 2006).

4.2.7 Adequacy and Fluidity of Resources

Kenya, being a developing country with serious economic challenges to overcome in all its sectors of the economy, has little financial resources allocated to the Ministry of Information and Communication in the budget every year for the development of the communication infrastructure. The attempt to bridge the digital divide in the country has mostly been championed by privately owned enterprises. The two mobile telephone service providers, Safaricom and Celtel have been in the forefront in the sphere of Corporate Social Responsibility (CSR) through supporting government schools, health centres and institutes in disadvantaged areas through the provision of computers or erecting buildings. However, annual bank interest rates at 20% are prohibitive to many investors (Ounda, 2006).

4.2.8 Ability to Execute

This refers to the ability to plan, execute and complete projects expeditiously (Wolcott et al., 2001). Ounda, (2006), found out that the Kenya government has been slow in executing projects on time and that the private sector has been instrumental in rolling out telecommunications infrastructure in the country. Telkom Kenya enjoyed the monopoly in the provision of National Internet Backbone Services up to 2004 when five more operators were licensed. The services were poor and the downtimes were many resulting in serious financial losses to corporate clients and ISPs. The provision of fixed telephone services has also been poor because of the inability of TKL to meet the demands of its clients. The continued delay by the state to license the Second National Operator (SNO) has seen Internet Diffusion in the country dwindle because of capacity inadequacy to meet demand of clients by the only available PSNO - TelKom Kenya.

The Government, through the Permanent Secretary in the Ministry of Information and Communications, recently threatened to go it alone in the ambitious East African Submarine Cable System (EASSy) project which intends to roll out a 9,900 km undersea optic fiber cable linking countries in the East African Sea coast to a similar system in India. The system is expected to completely encircle Africa by high capacity optic fiber cable providing cheaper and more reliable communications network. The threat by the Government came as a result of its accusations of some partnering institutions for developing cold feet as far as costs are concerned. However, Kenya's ability to go it alone is in doubt given its lack of resources. The whole project whose starting date has delayed by three years is expected to be complete in August 2008 and will cost US$ 170 million. Kenya Data Networks, a local ICT firm and a subsidiary of the Sameer Group is rolling out optic fiber cable in Nairobi and Mombasa through a contract to Siemens before it embarks on a similar venture in Kisumu and later Eldoret. This will also help lower the costs of telecommunications services in the country (Kenya Engineer, 2006).

4.2.9 Culture of Entrepreneurship

The Internet is replete with technology that assists in its diffusion in national economy. According to Ounda, (2006), the majority of the citizens will only adopt the technologies if they are championed by individuals who are entrepreneurial and accept to take risks in investments. Many innovative Kenyans have contributed to the development of the Internet since its inception in the country. Ayisi Makatiani and two former Harvard colleagues were the founding members of the pioneer ISP Africa Online. Because of the success story of Africa Online, other entrepreneurs also came up and set up more ISPs like Wananchi Online, Nairobinet, Kenyaweb and many more. The entrepreneurial spirit was seen in the numerous cyber cafés, which were set up after the first ones proved successful before they became too many to remain competitive. Others had to shut down because they could not afford the operational costs and the charges levied by ISPs, which hosted them.

4.2.10 Forces of Change

The drivers for change can come from many different areas in a country such as a competitive environment, individuals who encourage change or a cultural predisposition to change. Change mangers are usually unpopular in their initial attempts to introduce new concepts not for any reason but only because these ideas are new. The actions of a few people such as Ayisi Makatiani and his two colleagues have contributed to the development of the Internet industry in our country by setting up Africa Online, a pioneer ISP after Karisi Communications, the precursor to Africa Online.

The current President of the republic of Kenya, Mwai Kibaki, may also be lauded for creating the Ministry of Information and Communications in this information age from the age-old Ministry of Transport and Communications when he assumed power in the year 2003 with the NARC victory over KANU. The Internet industry was less developed during the KANU regime due to unreliability of telephone services. However, the then Minister in Charge of Information and Communications, Hon. Raphael Tuju, initiated plans seeking the licensing of a Second National Operator.

Tuju also set the stage for the drafting of the ICT Policy, which was completed in November 2005. The current Minister for Information and Communications Hon. Mutahi Kagwe and his Permanent Secretary Dr. Bitange Ndemo have directed the CCK to re-advertise for bids for the Second National Operator which was riddled with controversy when Econet Wireless Consortium won the tender by providing false information in the Tender Documents. Tuju, the immediate former Minister, nullified the tender in 2004. Mutahi and Bitange have also informed the public of a plan to float 34% shareholding of Telkom Kenya through an Initial Public Offer (IPO) at the Nairobi Stock Exchange by April 2007. President Mwai Kibaki while opening an ICT Workshop in Nairobi on 28th February 2006 said "the Government will sell 34% of Telkom Kenya to the public through the Nairobi Stock Exchange. Another 26% of the Government's shares in Telkom will be sold to a strategic investor. I have directed that the sale of the 34% be expedited" (Kenya Engineer, 2006).

4.2.11 Enablers of Change

These are conditions that allow a community to accept and incorporate change including institutional, historical, cultural and educational factors (Wolcott et al., 2001). A national educational campaign for enabling the adoption of computers and the associated technologies including the Internet in Kenya is the 'Computer for Schools Project' which looks for donors to assist both primary and secondary schools acquire computers. An institutional enabling environment has been the setting up of the ICT Policy Center, which advises the Ministry of Information and Communications together with other stakeholders. Clearly, these enablers of change both have negative and/or positive influence on Internet diffusion (Ounda, 2006).

4.3 The State of Internet Diffusion in Africa

Wolcott et al. (2001) provide a framework by which Internet diffusion in a country can be described. The Global Diffusion of the Internet (GDI) framework consists of six dimensions, as discussed on Page 14 above.
Such a framework allows for a broad overview of diffusion in a country to be determined, and addresses the need for a consistent framework to allow for comparison between countries (Brown et al., 2004).

Table 20 below provides summary details of how the level of maturity of countries in Africa along the six dimensions as obtained from the various studies done for these countries: South Africa, Mauritius, Ethiopia, Uganda, Ghana, Togo, Egypt, Cape Verde and Kenya. This will enable the reader to know what path Internet diffusion took on the continent.

I. South Africa

Table 20: Summarizes South African Dimensions

Dimension	Level	Comments
Pervasiveness	Level 3 Established	South Africa has approximately 3 684 280 users
Geographic Dispersion	3.5	There are POP's in over 100 cities and in all nine provinces
Sectoral Absorption	Level 3 Common	Government Institutions have leased line connectivity but this is still at low penetration but Internet enabled computers are present in government institutions Tertiary Academics are fully connected to the Internet but at Secondary level connectivity still needs to be increased. Commercial institutions are connected through dedicated connections
Connectivity Infrastructure	2.5	Low penetration of broadband and the recent closing of South Africa's second Internet exchange are troubling
Organisational Infrastructure	Level 3 Competitive	ISP's must rely on Telkom for all domestic and international connectivity.
Sophistication of Use	Level 3 Transforming	South Africa has successfully embraced the Internet within SME's however there is still significant room for innovation

II. Ghana

Table 21: summarizes Ghana's Internet diffusion ratings

Dimension	Level	Comments
Pervasiveness	Level 3: Established	Approximately 300,000 users
Geographic Dispersion	Level 3: Highly Dispersed	POPs in 5 of 10 regions
Sectoral Absorption	Level 2: *Moderate*	Governmental and Academic organizations use some leased line connectivity. However, the entire campus is not connected. Business Use of servers is sparse.
Connectivity Infrastructure	Level 1.5: *Expanded*	Given level of infrastructure, lack of an exchange is noteworthy.
Organizational Infrastructure	Level 3: Competitive	ISPs can access international connectivity through their own satellites, but must rely primarily on Ghana Telecom for landlines.
Sophistication of Use	Level 2: Conventional	Little re-engineering of business and social process to leverage the Internet

III. *Togo*

Table 22: summarizes Togo's Internet diffusion ratings

Dimension	Level	Comments
Pervasiveness	Level 3: Common	The ratio of Internet users per capita is on the order of magnitude of at least one in a hundred (1% or greater).
Geographic Dispersion	Level 1: single Location	Internet points-of-presence are confined to one major population center. The ratio of Internet users per capita is on the order of magnitude of at least one in a hundred (1% or greater).
Sectoral Absorption	Level 2: *Moderate*	Governmental and Academic Organizations use some leased line connectivity. However, the Business use of servers is minimal.
Connectivity Infrastructure	Level 2: *Expanded*	Given level of infrastructure, there is one exchange hence the level of expansion
Organizational Infrastructure	Level 2: Controlled	There are only a few ISPs and the market is closely controlled through high barriers to entry. All ISPs connect to the international Internet through a monopoly telecommunications service provider. The provision of domestic infrastructure is also a monopoly.
Sophistication of Use	Level 2: *conventional*	The user community changes established practices somewhat in response to or in order to accommodate the technology, but few established processes are changed dramatically. The Internet is used as a substitute or straightforward enhancement for an existing process (e.g. e-mail vs. post). This is the first level at which we can say that the Internet has taken hold in a country.

IV. *Egypt*

Table 23: summarizes Egypt's Internet diffusion ratings

Dimension	Level	Comments
Pervasiveness	Level 2.5: Common	Egypt has approximately 220,000 users which is 0.37 of the population
Geographic Dispersion	2.5 Highly dispersed	Egypt has over 60 ISP's operating in June 2000. There are POP's in over 100 cities and in all nine provinces
Sectoral Absorption	Level 1.5 Moderate	The Government provides Internet content. Internet connectivity in Universities is good with access provided by Egypt University Network. Although around one-fifth of all primary schools have internet access, none of these have a website. Less than ten percent of hospitals use internet connectivity that they have and only five out of four thousand hospitals and clinics use their internet connections. Business use is growing but still limited.
Connectivity Infrastructure	Level 1.5 between Thin and Expanded	National Bandwidth is 14Mbit/s with a national exchange connecting major Gateway operators. Total International Bandwidth is 26Mbps. Most access is via dial-up with some leased line and ISDN. No cable modem or ADSL available.
Organisational Infrastructure	Level 2.5 Competitive	There are theoretically no barriers to becoming an ISP, but ISP's are restricted in the ability to provide local and international infrastructure Telecom in Egypt controls most of the provision and regulations are not transparent or clear.
Sophistication of Use	Level 2 Conventional	Most websites are static and majority of businesses have not yet been transformed by the internet.

V. *Uganda*

Table 24: summarizes Uganda's Internet diffusion ratings

Dimension	Level	Comments
Pervasiveness	Level 1: Embryonic	Uganda has approximately 25,000 users out of a population of 22 million, which is 0.12 %. This level is just above 1, but considering that many users only use email, and are concentrated in one place, pervasiveness is embryonic.
Geographic Dispersion	Level 1: Single Location	All ISPs are situated in the capital Kampala. Any connection outside the capital would entail long distance calling, as there is no internet dial prefix.
Sectoral Absorption	Level 1: Rare	The ranking is a function of the level connectivity server ownership in business, Government, Health care, and education, each of which are rated as rare. There is moderate connectivity in Makerere University

		and a small amount of businesses and NGO's use leased lines. In government and health connectivity is limited to dialup access as few organisations operate their own servers.
Connectivity Infrastructure	Level 1.5 Expanded	There is a microwave national backbone for the telephone network that could be adapted to internet use. Two mobile operators are also building microwave networks. Bandwidth is limited to 64kbps. International connectivity via VSAT and satellite links is 1.2Mbps. There is no Internet Exchange. Most access is vial dial-up but demand for leased lines is growing from heave users keen to avoid heavy telephone usage charges. There is some ISDN.
Organisational Infrastructure	Level 3: Competitive	There is free entry to the ISP market. ISP's must be licensed and a fee is levied. They contribute up to 2% of revenue to a telecom development fund. Of the 8 licensed, only 4 are in operation with two showing any significant market presence.
Sophistication of Use	Level 1: Minimal	The most popular application is email, otherwise it is also used to search the web, to download music and software. There are a few sophisticated websites and e-commerce is practically non-existent.

VI. ***Mauritius***

Table 25: summarizes Mauritius's Internet diffusion ratings

Dimension	Level	Comments
Pervasiveness	Level 4: Pervasive	Mauritius is rated 4, as the estimated penetration rate is 15% of the total population, (above the 1 in 10 to reach the pervasive level).
Geographic Dispersion	Level4: Nationwide	Mauritius is rated 4, as internet is available countrywide.
Sectoral Absorption	Level 3: common	Mauritius has over between 50 –90 percent of organisations in the academic, government, health and business having internet access.
Connectivity Infrastructure	Level 2.5: Expanded and Broad	Mauritius has a well-developed telephone network and recently connected to the SAFE fibre-optic cable for international connectivity. However the predominant mode of access is still the low speed dial-up method.
Organisational Infrastructure	Level 2: Controlled	There are a few ISP's, which still rely on Mauritius Telecom for connectivity. However the government has recently liberalised the industry.
Sophistication of Use	Level 2 Conventional	The most popular applications are surfing or browsing and email. Other uses are still developing.

VII. Cape Verde

Table 26: summarizes Cape Verde's Internet diffusion ratings

Dimension	Level	Comments
Pervasiveness	Level 3: Common	At December 2001, there were an estimated 12'000 Internet users in the country or 2.8 per cent of the population
Geographic Dispersion	Level 3: Highly Dispersed	Internet access is available from any location with a telephone line and modem charged at local call rates. However there are no telephone lines in the rural areas.
Sectoral Absorption	Level 2:Moderate common	This ranking is a function of the type of connectivity in education, government, health care and business. All institutes of higher learning have Internet access. One third of secondary schools are connected to the Internet (9 out of 27). A few primary schools are connected. By the end of 2000, all ministries were connected through the government Intranet. Connectivity at the local administrative level is less. Few businesses are connected to the Internet let alone have web sites. There is limited connectivity in the health sector.
Connectivity Infrastructure	Level 2: Expanded	International connectivity is 3mbps via fibre optic submarine cable. There is a nationwide fibre/microwave/satellite backbone— built for the telephone network—that operates at various speeds and over which data traffic can flow. However there is no dedicated national Internet backbone. There is no Internet exchange since there is only one ISP. High-speed local access options are limited to ISDN and leased lines since broadband access via DSL or cable modem is not available.
Organisational Infrastructure	Level 1: Single	One ISP has a legal monopoly for international communications. The monopoly was granted for a 25-year period, until 2025.
Sophistication of Use	Level 2 Conventional	The most popular applications are email and information retrieval There are a number of government databases and plans to develop online government applications.

VIII. *Ethiopia*

Table 27: summarizes Ethiopia's Internet diffusion ratings

Dimension	Level	Comments
Pervasiveness	Level 1: Experimental	Pervasiveness in Ethiopia is rated at 1, experimental. Even assuming an optimistic estimate of 60'000 Internet users out of a population of almost 55 million, the user rate is of only 0.092 per cent.
Geographic Dispersion	Level 1.5: moderately dispersed	There are 8 towns outside the capital city with POPs and internet access is available nationwide at the cost of a local call. Small number of computers is a hindrance to internet diffusion.
Sectoral Absorption	Level 0.5: Rare	The ranking is a function of the level connectivity server ownership in business, Government, Health care, and education, each of which are rated as rare themselves. There are no lease lines and schools are not connected to the internet. A few government institutions have simple usage and usage in the business sector is minimal.
Connectivity Infrastructure	Level 1: Thin	Internet connectivity is at 4mbps outgoing and 10mbps incoming. There is no internet backbone or an internet exchange point as there is only one ISP. Only 10 leased lines exist and broadband is not available.
Organisational Infrastructure	Level 1: Single	The Ethiopian Telecommunications corporation is the sole internet service provider. It is owned by the government and has the complete monopoly on the Internet service provision market.
Sophistication of Use	Level 1: Minimal	The most popular application is email and web search. A few local language web sites exist and there are no immediate plans for application development.

4.3.1 A Summary of the Dimensions of Internet Diffusion in Africa

Such a framework allows for a broad overview of diffusion in a country to be determined, and addresses the need for a consistent framework to allow for comparison between countries (Brown *et al.*, 2004). However, despite the numerous African countries, this study only, that is; Kenya, Uganda, Ethiopia, Ghana, Togo, Mauritius, Egypt, Cape Verde and South Africa. The Table 1 below provides details of a cross-country Internet diffusion along the six dimensions.

Table 28: Longitudinal Analysis of Dimensions of the GDI Framework (Wolcott et al., 2001)

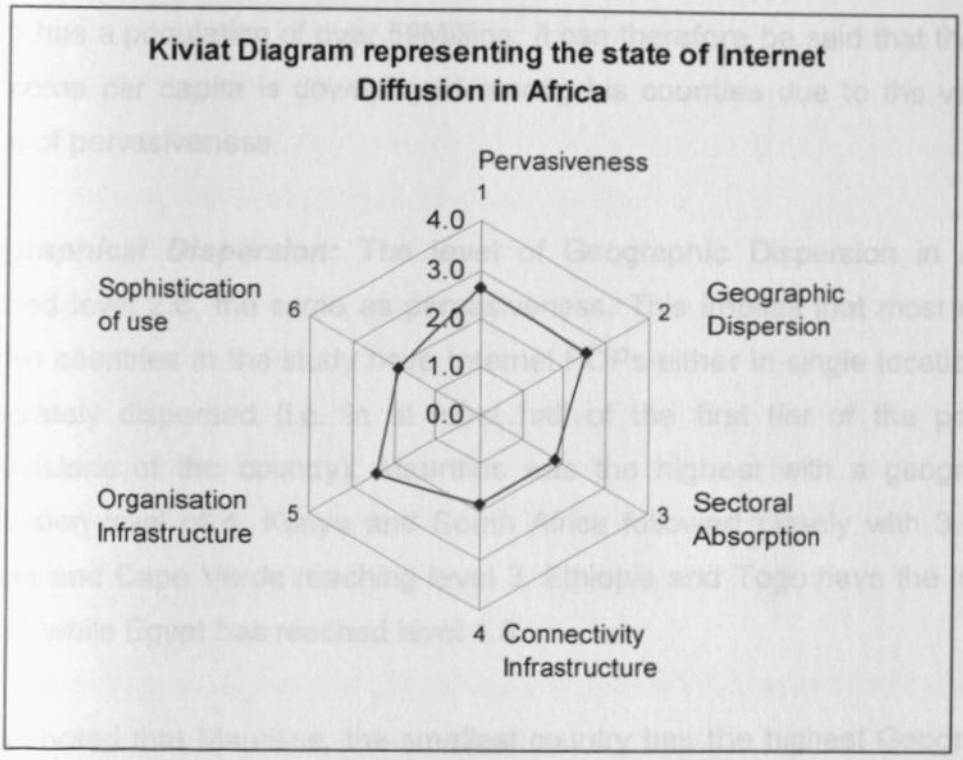
Country/Dimensions	P	GD	SA	CI	OI	SU	Totals
Kenya	3	3.5	1	2	4	2	15.5
Uganda	1	1	1	1.5	3	1	8.5
South Africa	3	3.5	3	2.5	3	3	18
Ghana	3	3	2	1.5	3	2	14.5
Mauritius	4	4	3	2.5	2	2	17.5
Togo	3	1	2	2	2	2	12
Egypt	2.5	2.5	1.5	1.5	2.5	2	12.5
Ethiopia	1	1.5	0.5	1	1	1	5
Cape Verde	3	3	2	2	1	2	13
Totals	23.5	23	16	16.5	21.5	17	116.5
Africa Average	2.6	2.6	1.8	1.8	2.4	1.9	12.9

P=Pervasiveness; GD=Geographic Dispersion; SA=Sectoral Absorption; CI=Connectivity Infrastructure; OI=Organizational Infrastructure; SU=Sophistication of Use

4.3.2 Kiviat Diagram representing the state of Internet Diffusion in Africa

Using the data from the table above, a Kiviat diagram as obtained below to show the state of the Internet diffusion in Africa.

Figure 3 Kiviat Diagram representing the state of Internet diffusion in Africa



Pervasiveness: From the table above, the level of pervasiveness in Africa reached 2.6. This level is in between Established and Common. According to the GDI framework, this means that the countries in this study mainly have a ratio of Internet users to the total population of in between 0.1% and 1%.

One would expect that the countries with a higher population would have a higher level of pervasiveness. This was not the case in the countries that were considered for this study. It was noted that some countries have a higher level of pervasiveness than others, despite having a higher per capita income than others. For instance South Africa has a higher income per capita than Kenya, and both countries have a pervasiveness level 3, which implies that the Internet use in the two countries is established. The population of users in the

two countries also differs significantly with 500,000 Kenyans using the Internet as opposed to 3,684,280 South Africans.

On the other hand Mauritius with the lowest population (1.25M) among the countries examined has the fourth highest income per capita and has pervasiveness level 4. This is the highest level among the countries considered in this study. On the other hand Egypt with a pervasiveness level of 2.5 has a population of over 59Million. It can therefore be said that the role of income per capita is downplayed among his counties due to the varying levels of pervasiveness.

Geographical Dispersion: The level of Geographic Dispersion in Africa reached level 2.6, the same as pervasiveness. This implies that most of the African countries in the study have Internet POPs either in single locations or moderately dispersed (i.e. in at least half of the first tier of the political subdivisions of the country). Mauritius was the highest with a geographic dispersion level of 4. Kenya and South Africa followed closely with 3.5, wit Ghana and Cape Verde reaching level 3. Ethiopia and Togo have the lowest level 1 while Egypt has reached level 1.5.

It was noted that Mauritius, the smallest country has the highest Geographic dispersion had POP in all the locations. A country like Kenya also had POPs in all the 8 provinces, despite there being no nationwide coverage. South Africa had POPs in over 100 cities in all the nine provinces.

From the above observation it can be said that the size of a country does not determine the level of geographic dispersion of a country. Other factors such as income per capita, the number of ISP's, the geography of a country, and constituent technology availability played a major role in the geographic dispersion. For instance, despite Kenya reaching level 3.5 with POPs present in all the 8 provinces, lack of electricity in the rural areas as well as lack of telephone access in those areas makes the country lack national coverage of internet. It can be said that there are other factors that should be considered while determining whether a country has nationwide coverage especially in the developing countries.

Sectoral Absorption:

The level of Sectoral Absorption in Africa reached level 1.8. Uganda and Kenya had a level of 1 while South Africa and Mauritius had a level of 3. Ethiopia had the lowest level of 0.5.

It was observed that South Africa and Mauritius despite the obvious difference in the geography of the two countries had the same level of Sectoral Absorption. Between 10-90% of all the sectors (Academic, Health, Government, and Commercial) sectors have leased line connectivity. In Kenya for instance this applies only to the commercial sector with the other sectors showing minimal usage of the technology.

For instance, whilst it was noted that the Governments of South Africa and Ghana play a very key role in the growth of the Internet in the country (Brown, et al, 2005; Forster et al, 2004), the situation in Togo is different where the commercial sector has taken a lead role (Bernstein & Goodman, 2005).
It can be said therefore that the level of Internet usage in the different sectors in the countries considered in this study was significantly different.

Connectivity Infrastructure: The level of Connectivity Infrastructure in Africa reached level 1.8, the same as Sectoral Absorption. South Africa and Mauritius had the highest level at 2.5 (between Expanded and Broad), while countries like Ethiopia, Egypt, Uganda, Kenya, Ghana, Togo and Cape Verde had a level of between 1 and 2.

South Africa has a level of 2.5, which implies low penetration of Broadband. In 2004, the second Internet exchange was closed, and the country still maintains the highest level in Africa. Mauritius has a very well developed Telephone network and recently connected to the SAFE fibre optic cable for international connectivity.

It was observed that in all these African countries considered in the study the main mode of access was still through via the slow dial-up access. This is because of the high cost of access in most parts of the countries as well as the income per capita with only a small population being able to access the

Internet. Other factors were the availability of constituent technologies in most parts of the rural areas, hindering access by the rural population in most countries. Uganda infrastructure development may have been hindered by the civil war in the 1970's and 1980's as no investment was done to promote any growth of the infrastructure.

Organisational Infrastructure: The level of Organizational infrastructure in Africa reached level 2.4. Kenya had a level 4 organizational infrastructure, while Uganda, South Africa and Ghana had a level 3. Togo, Egypt, Mauritius, Ethiopia and Cape Verde had a level of between 1 and 2.5.

It was observed that Kenya has many ISPs, low barriers to entry into the ISP market providing a rich service provision infrastructure in the country. International and domestic infrastructure are open to competition.

In South Africa, ISPs must rely solely on Telkom for domestic and international connectivity. In Mauritius the environment is controlled and all ISPs have to rely on Mauritius Telecom for connectivity, despite the government having liberalised the market. The Ethiopian telecommunication Corporation is the sole Internet service provider; it is owned by the government and has the monopoly on the Internet service provision. Ethiopia has a level of 1.

Sophistication of Use: The level of Sophistication of Use in Africa reached level 1.9. South Africa has the highest level 3 in the countries that were considered for this study. Uganda and Ethiopia have the lowest level of 1, with Egypt, Kenya, Cape Verde, Togo, Ghana, and Mauritius all reaching level 2.
It was observed that South Africa has embraced the Internet especially within the SME's. The user community in South Africa is regularly applying the Internet in innovative ways but according to the Internet diffusion study, there is till significant room for innovation.
On the other hand in Kenya, the user community changes established practice in response to or in order to accommodate the technology although few processes are changed dramatically. Here the Internet is also used ads as a straightforward or substitute for an existing process like email as

opposed to posting letters. This is the first level that Internet can be said to have taken hold in a country.

In a country like Ethiopia with a level 1, Internet is used for conventional applications such as email, there are few websites, and there is no planned development for new Internet applications.

Other factors that determine the sophistication of use of the Internet are the level of education of the population and the perceived value of the Internet. If a population perceives the Internet as having little value, then they will not be interested in making innovative use of it. On the other hand, if the high population of a particular country does not posses a high level of education then they cannot use the Internet in any innovative way. They may also not be able to see the value of using it at all.

It can therefore be said that the countries with a low sophistication of use of the Internet either have low levels of education, or cannot use the Internet in any innovative way except perhaps read email, or they do not see the value of enhancing the Internet. The perceived value of Internet is minimal to such a population.

5.0 CONCLUSIONS AND RECOMMENDATIONS

The objectives of this study were to answer the questions stated in section 1.2 above in order to compile a report highlighting the following primary objectives:

1. Determine the level of Internet diffusion in Kenya and Africa
2. Provide a longitudinal analysis of Internet growth in Kenya and in Africa
3. Critically analyse the determinants of Internet diffusion in Africa

From the research findings as presented in chapter four above Objectives 1 and 2 are analysed and presented as per the GDI framework. The level of Internet in Kenya and Africa and a longitudinal analysis of Internet dimensions and determinants presented and discussed.

5.1 Critical Analysis of the determinants of Internet diffusion in Africa

The GDI framework developed by Wolcott et al., 2001 is not only a model that is used to determine the state of internet diffusion within a country, but is also very useful in performing cross-country analysis of internet diffusion. The dimensions and determinants of Internet diffusion are discussed above based on the longitudinal analysis of the individual country dimensions. The state of the Internet in Kenya is also discussed above after analysis of the various dimensions of Kenya in section 4.1.1 above.

Technological Determinism assumes that "technological development is autonomous and that societal development is determined by the technology" (Howcroft and Trauth, 2005). From the research, it can be said that the countries with a higher level of internet diffusion may not necessarily be the most developed

These studies argue that if Internet use has a substantial positive impact on the rate of productivity growth, then cross-country differences in Internet use

can exacerbate existing income inequalities between countries. However, some authors have argued that adoption of ICTs such as the Internet can offer the opportunity for late-industrializing countries to catch up with richer countries (Kagami and Tsuji, 2001, Steinmuller, 2001).

One of the most persistent findings in all of these studies is that the rate of Internet diffusion is correlated with per-capita income: Internet technology diffuses fastest in rich countries (Comin and Hobjin, 2003; Beilock and Dimitrova, 2003; Chinn and Fairlee, 2004; Kiiski and Pohjola, 2002; Hargittai, 1999; Wong, 2002; Dewan et al., 2004). This is considered to be true even when one compares differences in adoption rates within groups of industrialized countries such as the OECD (Kiiski and Pohjola, 2002) and geographic regions such as Asia (Wong, 2002). However, a review of literature does not provide a basis for these conclusions given the little research that has been carried out with regard to Internet diffusion in the late-industrializing countries.

Antonelli (2003) provides one explanation for this finding, arguing that new technological change may be "biased" in that it may increase the productivity of inputs with relatively low factor prices in the country of origin; largely the case with most ICTs since they emanate from industrialized countries. Antonelli argues that ICT fits this profile, as it is a skilled-labor and capital-intensive technology that is unskilled-labor saving. Thus, he argues it is much better suited for developed countries such as the U.S. than for developing countries.

Antonelli argues that ICT is complementary with many of the managerial and organizational changes that have been undertaken in the developed world. As a result, he argues that new innovations in ICT such as the Internet work to increase the competitive advantages of developed nations such as the U.S. However, these statements in a way may appear far fetched, since they are not based on facts from developing countries, but rather rely on theories or researches that have been undertaken in the west.

For instance, several studies have also sought to understand how a country's governmental institutions can encourage or discourage the diffusion of new

ICT such as the Internet. Comin and Hobjin (2003) and Beilock and Dimitrova (2003) argue that ICT diffuses more quickly to democratic countries and those with political freedom, while Oxley and Yeung (2001) argue that rule-of-law plays a major role. Chinn and Fairlee (2004), Hargittai (1999), Kenney (2001), and Wallsten (2003) show that telecommunications and regulatory policy are also important in explaining cross-country diffusion rates. Some studies have argued that Internet use will diffuse more quickly to countries with higher education (Chinn and Fairlee, 2004, Kiiski and Pohjola, 2002; Dewan et al., 2004).

While these 'blanket' statements may be assumed to apply across the board, whether in developed or developing countries, the caution could be that location, history and environmental influences may provide alternative views. A case in point is where Kenya can be regarded as a democratic country within the developing world with a very dynamic telecommunications sector, but evidence may prove otherwise that other countries such as Togo may have higher diffusion rates of the various technological innovations.

Other studies have investigated how existing telecommunications infrastructure influences the rate of Internet diffusion (Beilock and Dimitrova, 2003, Chinn and Fairle, et al, 2004). Kiiski and Pohjola (2002) argue that Internet access prices are an important determinant of the rate of Internet diffusion, while Hargittai (1999) finds less of a role for them. Dewan et al. (2004) show that telephone costs influences the rate of Internet diffusion; and this is particularly true at low levels of Internet penetration. While these have largely focused on what determines the diffusion of the Internet, it may again be important to note that, these studies have not had a focus on Africa, let alone a country such as Kenya.

Some researchers have even fronted the influence of language, especially with regard to the influence of the English language. That since most web sites are in English, English language countries may have an advantage in Internet use. Several cross-country studies of the Internet have explored the role of English language use in diffusion (Hargittai, 1999, Kiiski and Pohjola, 2002); however these studies have generally been unable to uncover a systematic role for language on a global basis. The role of English in Internet

adoption remains therefore an open question, since while English may originally be a language from Britain; the USA has consistently been regarded as one of the top countries in terms of the rate of Internet diffusion and other related technologies.
Thus, whilst the researches quoted seem to indicate that the rate of diffusion as well as its determinants to a large extent depends on the level of industrialization, there appears to be some gap in terms of reliance on factual information emanating from developing countries.

Thus while the overall empirical evidence supports the view that, in the short run at least, Internet technology has diffused fastest to industrialized nations with greater income, more open political institutions, and with more-developed telecommunications infrastructures, the basis of this inquiry is that the purported evidence is to say, the least partial.

While it may be correct to state at an aggregate level of analysis that an international digital divide exists between rich and poor countries, very little in terms of empirical evidence from developing countries have been used to support this position. In fact, some authors such as (Dewan, 2004) have even argued that if a digital divide exists, it is diminishing over time. This is the more reason why there is need for knowledge accumulation, especially with regard to the diffusion of technologies such as the Internet, which are considered critical for narrowing the digital divide.

So while researchers are being coaxed subtly of the need to focus on Internet diffusion in developing countries, one challenge faced by researchers in studying this is the difficulty in controlling for unobserved cross-country differences. Countries differ in complex *political*, *cultural*, and *economic* ways that are impossible to control. Recognizing these differences may aid in avoiding a 'blanket banding' of countries and therefore tag them in a certain way.

Researchers have attempted to address the problem of unobserved country-level differences in other ways. For one, as noted above, several recent studies have compared countries within similar global regions or

demographics. Kiiski and Pohjola (2002) examine OECD countries, while Wong (2002) and Kraemer and Dedrick (2002) show there exists significant variation in Internet use among Asian countries. Kauffman and Techatassanasoontorn (2005) have found evidence of multinational regional contagion in the diffusion of wireless technology. Other studies have sought to understand how income and other factors affect the use of Internet technology along different points in the distribution of diffusion (Dewan et al., 2004).

However, even though the effort to study different regions is apparent, little is reported on Africa. From preliminary literature search, only about five countries in Africa (South Africa, Ghana, Uganda, Ivory Coast and Togo) have carried out Internet diffusion studies. For instance, whilst it was noted that the Governments of South Africa and Ghana play a very key role in the growth of the Internet in the country (Brown, et al, 2005; Forster et al, 2004), the situation in Togo is different where the commercial sector has taken a lead role (Bernstein & Goodman, 2005).

Thus even amongst these few studies on the diffusion of the Internet in Africa and other parts of the world, there seems to be *evidence of variance in Internet use across countries*, suggesting the presence of what some authors have titled an international digital divide.
Though *differences in income* explain most of this variance, a variety of other factors have been found to explain the residual not explained by income differences.

Researchers have begun to use a number of approaches to sort through this conflicting evidence and to extend the early important work on cross-country Internet use. This has included focused empirical approaches that look at similar countries or that look at Internet use within a particular country, or case studies that are able to explain in detail how the Internet is used within a country.

The vast digital divide between Kenya's citizens can be attributed to a number of cultural and economic causes, the majority of which originate from Kenya's

existing policies of the telecommunications sector. As a result a large analogue leased line.

5.2 Recent Policy Statements and Reactions

Given that the previous sections relied on data prior to 2006, there is need to attempt to capture the implications of policy pronouncements by the Government of Kenya and the Government of South Africa. The two governments have been selected, not because they are representative, but based on availability of the information regarding some of the aspects of this study.

Thus the analysis in this section, while not invalidating the prior analysis is an attempt to predict implications of policy statements that will take effect in early 2007. The documents that were selected for analysis included a policy statement by the Minister for Communications, Dr. Ivy Matsepe-Casaburri on the 2nd of September, 2004 (Table 28). Subsequently, other statements as reported in various newspapers and magazines and by various stakeholders were also analysed (e.g., e-Business Handbook, 2004).

Table 29: Recent Policy Announcements

Government Pronouncements
P1. Self-provision and Greater Choice for Mobile Operators: "*As of 1 February 2005 Mobile operators may utilise any fixed lines that may be required for the provision of the service including fixed lines made available by Telkom or any other person providing a public switched telecommunication service*".
P2. Provision of Public Pay Phones: "*As of 1 February 2005 persons may apply for a licence to provide public pay phone services in any area of the Republic*".
P3. Provision of Voice by Value Added Service Providers: "*As of 1 February 2005 value added network services may carry voice using any protocol*".
P4. Choice in the Provision of Value Added Network Services: "*As of 1 February 2005 value added network services may also be provided by means of telecommunications facilities other than those provided by Telkom and the Second National Operator*".
P5. Cession of Telecommunications Services by VANS/Optimising the Use of Private

Telecommunications Network Facilities:
" 1 February 2005 shall be the date from when a person who provides a value added network service shall be entitled to cede or assign the right to use, or to sublet or part with control or otherwise dispose of the telecommunications facilities used for the provision of the value added network service".
P6. Preparing our Youth for the Knowledge Economy:
"As of 18 January 2005 public schools and public further education training institutions will be entitled to a 50% discount on: all telecommunications calls to an Internet service provider and on any connection or similar fees or charges levied by an Internet service provider for accessing the internet or transmitting and receiving any signals via the internet or for such access and transmission and reception"

The first policy directive would be an attempt to reduce the monopoly of Telkom (and potential duopoly once the SNO is active) in the provision of fixed line services. The beneficiaries are mobile operators who will be allowed to source for this service from any provider. Thus, there is an implicit directive that it need not be Telkom or the SNO providing this service. If this directive is interpreted 'as is', the expectation is that there will be positive impacts in at least two of the GDI dimensions. The first positive impact is on the organizational infrastructure dimension, since before implementation of this policy directive, only Telkom provided the local fixed line infrastructure for the Internet. This directive serves to improve the organizational infrastructure in implicitly allowing other public and private organizations to offer this service. This may therefore improve the rating of African countries with such policy directives along the organizational infrastructure dimension in the year 2005 and beyond. The other positive impact is that introducing competition, which is true for a majority of the policy announcements, would of necessity prompt the firms in the environment to be more innovative. The expectation is that innovativeness will help therefore improve the rating along the sophistication of use dimension, as organizations compete for survival.

Concerning the provision of public payphones, the expectation is that this will impact positively on access to telephone services, and possibly Internet services by encouraging entrepreneurship and innovation. This may impact indirectly the dimensions of sectoral absorption and geographic dispersion, as fixed line services become more widely available.

Other policy pronouncements focused on (1) allowing VANS to provide voice services (e.g. VoIP) which were previously the domain of Telkom and the SNO once operational and (2) allowing them to source for telecommunication services from any provider. As interpreted earlier, the impact of this policy would to further enhance competition with its attendant benefits. It is expected that there will be noticeable technological innovation amongst the VANs and other providers in their technology deployments. Improvements are hence expected in the dimension of connectivity infrastructure since this policy will 'break' the dependence of VANS on Telkom. The rating along this dimension may therefore be positively influenced.

The VANS have also now been allowed to cede their telecommunications services as well as to allow VANS and other private individuals to optimize the use of private telecommunications network facilities. The government is attempting to send positive signals to investors to continue investing in this industry by allowing them control of their assets. This may have the impact of making the telecommunications industry more attractive and therefore spur more capital flows into the industry.

The last policy considered was aimed at preparing the youth for the knowledge economy by focusing on improving the diffusion of the Internet in schools. This is expected to impact positively on the number of Internet users adopting the Internet by addressing the cost of Internet access as a determinant. Sectoral absorption, as a GDI framework dimension is therefore expected to improve in the future as a result of this policy.

To surmise, the new communications policy changes are geared at infusing change in the telecommunications sector and are intended to create a more competitive and liberal environment, improved access to ICT infrastructures and services, affordable telecommunications services and choice in services provided by the sector.

5.3 Conclusion

Overall, it is evident that recent policy announcements have addressed some of the key recommendations. The perceived value of the Internet is set to rise, and it is anticipated that in 2006 and beyond, there will be wide-scale adoption of VoIP (Goldstuck, 2005). Significantly, costs of telecommunications and subsequently Internet access will drop, and access for disadvantaged communities and schools will become more affordable. The 50% discount to be provided for educational institutions will make that effect almost immediate. The opening of the market will also result in the introduction of new and innovative services and spur demand and entrepreneurship, as well as ensuring utilisation of untapped network capacity. The ability to execute new projects will, however, still be hampered by the ICT skills shortage and lack of capacity. The policy directives also do not address the wider socio-economic conditions that inhibit, nor more specific recommendations such as those suggested for influencing the ease of use determinant and the lack of skilled ICT resources.

It can therefore concluded that while these policies should have a major impact, it will not be the use of these polices alone, but rather their incorporation into a greater socio-economic and political framework accompanied by rapid implementation, that will encourage even greater Internet diffusion. The correct use of incorporated policies have previously been demonstrated in Estonia and Slovenia where Internet diffusion is amongst the highest in Central and Eastern Europe (Kitsing, 2004).

5.4 Limitations of the study

The limitations of the study included the following:

a) Awareness Limitations

This study required collecting data about the Internet Diffusion from all the sectors of the economy. This, however, was not possible since the people

who were in charge of the ICT sectors lacked adequate knowledge to respond effectively to the questionnaires of the interview.

b) 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. The interviews and questionnaires could not be administered to all the intended sample population.

c) Lack of Africa Studies

In addition, there are very few studies on the diffusion of the Internet in Africa. This study relied on 9 country studies which may not give a complete picture of the phenomenon.

5.5 Recommendations

Based on the above analyses of the GDI dimensions in Kenya and Africa, the following policy recommendations are made to address the influence of the determinants on Internet Diffusion:

Based on the above analyses of the GDI dimensions in Kenya, the following policy recommendations are made to address the influence of the determinants on Internet Diffusion:

Table 30: Policy Recommendations for Kenya

Determinant	How government can impact determinant
QUALITIES OF THE TECHNOLOGY ITSELF	
1. Perceived value	▪ Educate Internet users on the benefits of ICT. ▪ Provide Digital Electronic Signatures (DES) for e-Commerce applications. ▪ Provide legal framework to cushion Internet users from fraud.
2. Ease of use of the Internet	▪ Encourage local language content. ▪ Intensify education programs aimed at increasing adult literacy. ▪ Introduce computer education in primary schools and provide trained personnel to teach the subject.

3. Cost of Internet access	▪ Expedite the licensing of a SNO to improve telephone service reliability and lower costs. ▪ Improve circuit duplications/ system redundancies to have high service reliability. ▪ Mobile phone providers to encourage Internet access through cheaper means.
INTER-RELATIONSHIPS WITHIN THE TECHNOLOGY CLUSTER	
4. Access to constituent technologies	▪ Establish community telecentres in remote parts of the country. ▪ Lower tariffs on PCs or zero-rate them for affordability to majority citizens. ▪ License a SNO for high teledensity. ▪ Expedite the operations of a third mobile phone provider.
5. Demand for capacity, multiplicity of ISPs, services provided	▪ Set up Internet kiosks in rural areas. ▪ Encourage wireless access to the internet. ▪ License more ISPs to meet the demand capacity of users.
EXTERNAL/SURROUNDING FORCES	
6. Geography	▪ Build enabling amenities in North Eastern Province and other similarly disadvantaged rural areas.
7. Adequacy and fluidity of resources	▪ Introduce control of bank interest rates to spur investment in the ICT industry. ▪ Allocate more resources for ICT projects in the national budget through the Information & Communications Ministry. ▪ Train adequate personnel to work in the ICT sector.
8. Ability to execute	▪ Train more Government project managers. ▪ License the SNO to meet capacity demands. ▪ Roll out more optic fiber cable networks.
9. Culture of entrepreneurship	▪ Encourage innovation in society. ▪ Encourage skills in risk taking and entrepreneurship.
10. Regulatory/legal framework	▪ Encourage liberalization in the telecommunications market. ▪ License the SNO to improve the competitive environment.
11. Forces for change	▪ Train change managers with the Government taking a leading role in this. ▪ Allocate more resources to the ICT Policy Centre.
12. Enablers of change	▪ Encourage the mobile phone market by licensing more service providers. ▪ Allocate more resources for the ICT Policy Centre operations. ▪ Introduce gradual change to intransigent computer users. ▪ Encourage donor support for Computer for Schools Project in the Ministry of Education.

5.6 Suggestions for further research

There is need for the Government through the CCK to carry out a comprehensive study of the Internet industry to ascertain the real net economic contribution it has on the national income. Research on the sectoral absorption would be very important in ascertaining this level of economic contribution.

Further research on the exact determinants in Kenya needs to be carried out instead using the determinants from the GDI framework.

Despite the limitations, the increasing acceptance of the Internet makes this study important in understanding and interpreting the influence of the Global Diffusion of the Internet on economic security in Kenya. This work therefore sets up future contributions that will enable people in the academia, business managers, policy makers, ICT experts and investors to better understand different issues surrounding the Internet which is increasingly becoming indispensable to organizations the world over.

References

Antonelli, C., 2003, The digital divide: understanding the economics of new information and communication technology in the global economy, Information Economics and Policy 15, 173-199.

A. Bernstein and S. Goodman, 2005, Global Diffusion of the Internet VI: The Internet in Togo, Communications of the Association for Information Systems (Volume 15, 2005)371-392

APEC (2000) *"APEC's E-Commerce Readiness Assessment* Guide" [Available Online] www.e-Commerce.gov/apec/docs/readiness_guide_files/readiness_guide_5.pdf [2004, 17 April]

Beilock, R., and D. V. Dimitrova, 2003, An exploratory model of inter-country Internet diffusion, Telecommunications Policy 27, 237-252.

Boland, R.J. and Day, W.F. "The Experience of System Design: A Hermeneutic of Organizational Action," Scandinavian Journal of Management (5: 2), 1989, pp. 87-104.

Boland, R. "Phenomenology: A Preferred Approach to Research in Information Systems," in Research Methods in Information Systems, E. Mumford, R.A. Hirschheim, G. Fitzgerald, and T. WoodHarper (eds.), NorthHolland, Amsterdam, 1985, pp. 193201.

Boland, R.J. Jr. "Information System Use as a Hermeneutic Process," in Information Systems Research: Contemporary Approaches and Emergent Traditions, H-E. Nissen, H.K. Klein, R.A. Hirschheim (eds.), NorthHolland, Amsterdam, 1991, pp. 439-464..

Bridges.org (2001) *"Comparison of e-readiness assessment models",* Bridges.org [Available Online] http://www.bridges.org/ereadiness/comparison.html [2004, 17 April]

Central Intelligence Agency (2004) "World Fact book 2004" http://www.cia.gov/cia/publications/factbook/] [2004, 05 September]

Checchi, R; Sevcik, G; Loch, K; Straub D.(2002*) "An instrumentation process for measuring ICT policies and culture"*, Proceedings of International Conference on Information Technology, Communications and Development, Katmandu, Nepal December 1-3, 2002, Computer

Association of Nepal [Available Online] http://www.cis.gsu.edu/~dstraub/Research/ACIT-APIT/Endnote/Publications/Presentations/ITCD2002-present.pdf [2004,15 April]

Cheung K, Ahn, J, Kim B, (2003) "Adoption of broadband Internet in Korea: the role of experience in building attitudes" Journal of Information Technology, December 2003, vol. 18, no. 4, pp. 267-280(14),Palgrave Macmillan

Chinn, M. D. , and R. Fairlie, 2004, The Determinants of the Global Digital Divide: A Cross-Country Analysis of Computer and Internet Penetration, NBER working paper #10686.

Choucri, N., Maugis, V., Madnick, S., Siegal, M.(2003)."Global e-Readiness – for What", Paper 1777 [Available Online] http://ebusiness.mit.edu [2004, 15 April]

Comin, D. and B. Hobijn, 2003, Cross-Country Technology Adoption: Making the Theories Face Facts, Federal Reserve Bank of New York Staff Reports No. 169, June.

Communication Commission of Kenya, List of ISPs[2005, December] [Available Online]

Davis, G.B., Lee, A.S., Nickles, K.R., Chatterjee, S., Hartung, R. and Wu, Y., "Diagnosis of an Information System Failure: A Framework and Interpretive Process," *Information & Management*, (23:5), 1992, pp. 293-318.

Dewan, S., D. Ganley, K. L. Kraemer, 2004, Across the Digital Divide: A Cross-Country Analysis of the Determinants of IT Penetration, Working Paper, Graduate School of Management, University of California, Irvine.

Dewan, S., S. C. Michael, and C. Min, 1998, Firm Characteristics and Investments in Information Technology: Scale and Scope Effects, Information Systems Research 9, 219-232.

Doolin, B. (1998). "Information technology as disciplinary technology: being critical in interpretive research on information systems." *Journal of Information Technology*(13): 301 - 311

Dutta, S & Jain, A. (2004) *"The Networked Readiness Index 2003–2004"*, Global Information Technology Report 2003-2004, Oxford University Press, ISBN: 0-19-517361-9 [Available Online]

http://www.weforum.org/pdf/Gcr/GITR_2003_2004/Framework_Chapter.pdf [2004,17 April]

Fan, J & Myers R,(2001), *Nielsen/NetRatings is Launched in South Africa* [Available Online] http://www.nielsen-netratings.com/pr/pr_010730.pdf, [2004, 20 August]

Foster, W; Goodman, S; Osiakwan, E; Bernstein, (2004) "*Global Diffusion of the Internet IV: The Internet in Ghana*", Communications of the Association for Information Systems Vol.13 Article 38

Gadamer, H-G. Truth and Method, The Continuing Publishing Corporation, New York, 1975.

Gadamer, H-G. Philosophical Hermeneutics, California, University of California Press, 1976a.

Gadamer, H-G. "The Historicity of Understanding," in Critical Sociology, Selected Readings, P. Connerton (ed.), Penguin Books Ltd, Harmondsworth, 1976b, pp. 117-133.

Goldstuck, A, (2004) "*The GoldStuck Report: Internet Access in South Africa 2004*", World Wide Worx

Goodman, W, (2003) *"Introducing the global diffusion of the Internet series"*, Communications of the Association for Information Systems (Volume 11, 2003) 555-559 [Available Online] http://www.mosaic.unomaha.edu/GDIIntro_2003.pdf [2004,15 April]

Hargittai, E., 1999, Weaving the Western Web: explaining differences in Internet connectivity among OECD countries, Telecommunications Policy 23, 701-718.

Howcroft, D., and Trauth, E., 2005 "The Choice of Critical Information Systems Research", *Information Systems Journal*

Information Technology and Broadcasting Bureau .(2000) *"APEC E-commerce Readiness Assessment Guide - A Self-assessment on Hong Kong's Readiness for E-commerce"*, Information Technology and Broadcasting Bureau [Available Online] http://www.kit.nl/frameset.asp?/specials/html/it_e-bibliography.asp&frnr=1& [2004,17 April]

Intelecon Research & Consultancy (2002). "*South Africa Rural ICT market opportunity report*", African Connection Centre for Strategic Planning [Available Online]

http://www.infodev.org/projects/telecommunications/351africa/SOUTH%20AFRICA%20Rural%20Market%20Assessment-%20FINAL.pdf] [2004, 2 September 2004]

ITU.(2001) *"African telecommunications indicators"*, International Telecommunication Union, Geneva [Available Online] http://www.itu.int/itudoc/gs/subscirc/itu-d/(188-01).rtf [2004,13 April]

ITU.(2002) *"Internet From the Horn of Africa: Ethiopia Case Study, July 2002* http://web.itu.int/osg/spu/casestudies.

ITU.(2002) *"Internet From the Horn of Africa: Ethiopia Case Study, July 2002"* http://web.itu.int/osg/spu/casestudies.

ITU.(2001) *"The Internet in an African LDC: Uganda case study"*, January 2001". http://www.itu.int/ti/casestudies.

Kagami, M. and M. Tsuji, 2001, The 'IT' Revolution and Developing Countries: Late-Comer Advantage. Institute of Developing Economies, Japan External Trade Organization, Tokyo.

Kardaras, D & Karakostas, B. (2001) *"An empirical investigation of the management practices and the development of electronic commerce in Mauritius",* International Journal of Information Management (21:6), pp. 441-455

Kauffman, R. J. and A. A. Techatassanasoontorn, 2005, Is There a Global Digital Divide for Digital Wireless Phone Technologies? Working Paper, MIS Research Center, Carlson School of Management, University of Minnesota.

Kauffman, R. J., J. McAndrews, and Y. Wang, 2000, Opening the "Black Box" of Network Externalities in Network Adoption, Information Systems Research 11, 61-82.

Kenney, M., 2001, The Growth and Development of the Internet in the United States, BRIE Working Paper 145 (Berkeley Roundtable on the International Economy).

Ketoto Ounda, D. 2006. A Multi-Level Analysis Of The Influence Of Global Diffusion Of The Internet On Economic Security In Kenya

A Critical Analysis of Internet Diffusion in Africa. MBA Research Proposal. University of Nairobi: Department of Management Science.

Kirkman, G; Osorio, C; Sachs, J (2002) *"The Networked Readiness Index: Measuring the Preparedness of Nations for the Networked World",*

Chapter 2, Global Information Technology Report 2001-2002 - Readiness for the Networked World, Oxford University Press, ISBN: 0-19-515258-1 [Available Online] http://cyber.law.harvard.edu/itg/libpubs/gitrr2002_ch02.pdf [2004, 17 April]

Kiiski, S. and M. Pohjola, 2002, Cross-country diffusion of the Internet. Information Economics and Policy 14, 297-310.

Kitsing, M. (2004) *"The Impact of Economic Openness on Internet Diffusion in Estonia and Slovenia"* The Fletcher School, Tufts University [Available Online] http://www.fletcher.tufts.edu/research/2004/Kitsing-Meelis.pdf [2004, 5 September]

Kolence, K & Kiviat, P.1973. *"Software Unit Profiles and Kiviat Figures"*, ACM SIG-METRICS: Performance Evaluation Review, September 1973, pp. 2-12. [Available Online] http://www.portal.acm.org/ citation.cfm?id=807267&dl=ACM&coll=GUIDE&CFID=11111111&CFTOKEN=2222222 [2004,17 April]

Kraemer, K. L. and J. Dedrick, 2002, Information Technology in Southeast Asia: engine of growth or digital divide? In Information Technology in Asia: New Development Paradigms, eds. C.S. Yue and J.J. Lim, Institute of Southeast Asian Studies, Singapore.

Kraemer, K. L., J. Dedrick, and D. Dunkle, 2002, E-commerce in the United States: Leader or One of the Pack? Working Paper, CRITO, University of California, Irvine.

Kraemer, K. L., J. Gibbs, and J. Dedrick, 2002, Impacts of Globalization on E-Commerce Adoption and Firm Performance: A Cross-Country Investigation, Working Paper, CRITO, University of California, Irvine.

Lee, M. and C. Cheung, 2004, Internet Retailing Adoption by Small-to-Medium Sized Enterprises (SMEs): A Multiple-Case Study, Information Systems Frontiers 6, 385-397.

Lewis, C. (2002). "*South Africa - Internet Timeline 1990 – 2002*", Center for International Development and Conflict Management, University of Maryland [Available Online] http://www.cidcm.umd.edu/ntn/south_africa/time_lines.htm Last [2004 , 05 September]

Lewis, C (2004) *"Negotiating the net: The Case of South Africa"* Center for International Development and Conflict Management, University of Maryland [Available Online] http://www.cidcm.umd.edu/ntn/south_africa/ south_africa_8-17-04.doc [2004, 05 September]

Loch, K; Straub, D and Kamel, S (2000) *"Use of the Internet: A study of individuals and organisations in the Arab World"*, Proceedings of Global

Loch, K; Nelson, G; Straub, D (2000) "*NSF project summary: IT transfer to Egypt: A process model for developing countries"*, Grant proposal, Georgia State University, Atlanta [Available Online] http://www.cis.gsu.edu/~dstraub/Research/ ACIT-APIT/interviewees.doc [2004, 16 April]

MarkShuttleworth Foundation, [Available Online] http://www.shuttleworthfoundation.org/ [2004, 25 August]

Mbarika, V (1999) *"Factors that affect growth of teledensity in least developed countries"*, Proceedings of 22nd Conference on Information Systems Research in the Scandinavia (IRIS 22), Jyvaskyla, Finland, 1999 [Available Online] http://www.ifla.org/VII/s7/projects/country.htm [2004, 9 April 2004]

Mbarika, V; Kah, M; Musa, P; Warren, J; Meso, P (2003) *"Predictors of Growth of Teledensity in Developing Countries: A Focus on Middle and Low-Income Countries"* [Available Online] http://www.is.cityu.edu.hk/research/ejisdc/vol12/v12r1.pdf [2004 ,16 April]

Menou, M (1999) *"Impact of the Internet: Some Conceptual and Methodological Issues, Or How to Hit A Moving Target Behind the Smoke Screen"*, The Internet: Its Impact and Evaluation, Proceedings Of An International Forum, Held At Cumberland Lodge, Windsor Park, 16-18 July 1999 [Available Online] http://www.idrc.ca/telecentre/evaluation/AR/24_Imp.pdf [2004,17 April]

Millennium Development Indicators (2003) "*Millennium Development Indicators: 03 December 2003*", United Nations Development Program [Available Online] http://www.sarpn.org.za/documents/d0000875/docs/UNDP%20MDG%20Indicators%20-%202004.pdf [2004, 03 July]

Muganda, N. (2005). A Critical Investigation of the e-Government Technology Artifact: Conceptualizations, Interactions and Impacts, a *Working Paper* Presented at the University if Cape Town, September, 2005.

Myers, M.D. "A disaster for everyone to see: an interpretive analysis of a failed IS project," Accounting, Management and Information Technologies (4:4), 1994a, pp. 185-201.

Myers, M. D. "Quality in Qualitative Research in Information Systems", Proceedings of the 5th Australasian Conference on Information Systems, 1994b, pp. 763-766.

Myers, M.D. "Dialectical hermeneutics: a theoretical framework for the implementation of information systems," Information Systems Journal (5:1), 1995, pp. 51-70.

National Telecommunications and Information Administration, 1995, Falling Through the Net: A Survey of the 'Have Nots' in Rural and Urban America, http://www.ntia.doc.gov/reports.html.

National Telecommunications and Information Administration, 1998, Falling Through the Net II: New Data on the Digital Divide, http://www.ntia.doc.gov/reports.html.

National Telecommunications and Information Administration, 1999, Falling Through the Net: Defining the Digital Divide, http://www.ntia.doc.gov/reports.html.

National Telecommunications Information Administration, US Department of Commerce, 2000, Falling Through the Net: Toward Digital Inclusion, October.

Nielson B. (2002,) "*Overview of eReadiness in the SADC Region*" [Available Online] http://www.unpan1.un.org/intradoc/groups/public/documents/CAFRAD/UNPAN006872.pdf [2004,8 April]

Nielson Net Ratings Inc. [2004, July]

Okoli, H & Chituanya, J (2003) *"Expert Assessments of E-Commerce in Sub-Saharan Africa: A Theoretical Model of Infrastructure and Culture for Doing Business Using the Internet"* [Available at http://etd02.lnx390.lsu.edu/docs/available/etd-1021103-111509 [2004, 17 April 2004]

Oyelaran-Oyeyinka, Banji & Adeya, Nyaki, Catherine. 2002. Internet Access in Africa: An Empirical Exploration. Research Article. The United Nations University: Institute for New Technologies, UNU/INTECH.

Oxley, J. and B. Yeung, 2001, E-commerce Readiness: Institutional Environment and International Competitiveness, Journal of International Business Studies, 32, 705-724

Paltridge, S (1994) *"A survey of tariff structures in Africa: Comparison to the rest of the world"*, Proceedings of Africa Telecom '94, Cairo [Available Online] http://www.sas.upenn.edu/African_Studies/ASA/lish.html [2004, 8 April]

Public Sector Highlights (2004), "*Publications and References: ABSA Bank*" [Available Online] http://www.absa.co.za/ibsa/publications_and_references/article_page10,1474,1204,00.html [2004, 13 June]

Radnitzky, G. *Contemporary Schools of Metascience*, Goteborg: Scandinavian University Books, 1970.

Ricoeur, P. The Conflict of Interpretations: Essays in Hermeneutics, Northwestern University Press, Evanston, 1974.

Ricoeur, P. "Hermeneutics: Restoration of Meaning or Reduction of Illusion?" in Critical Sociology, Selected Readings, P. Connerton (ed.), Penguin Books Ltd, Harmondsworth, 1976, pp. 194-203.

Ricoeur, P. Hermeneutics and the Human Sciences, Cambridge University Press, Cambridge, 1981.

Raman, S & Yap, C (1996) "*From a resource rich country to an information rich society: An evaluation on information technology policies in Malaysia*", IOS Press

Rogers, M (1995) *"Diffusion of Innovations"*, (4th ed.), New York: The Free Press [Available Online] http://www.nnlm.gov/pnr/eval/rogers.html [2004, 12 April]

Sarkar, M., 2003, Estimating Diffusion Models Using Repeated Cross-sections: Quantifying the Digital Divide, Working Paper, Yale University.

Sentech Speaks Out (2004) "Sentech Speaks Out" ICT World News Letter: Issue 98 (19/07/01 – 23/07/04) [Available Online]

http://www.ictworld.co.za/EditorialEdit.asp?EditorialID=19190&Archive=1 [2004, 29 August]

Steinmuller, W. E., 2001, ICTs and the possibilities of leapfrogging by developing countries. International Labour Review 140, 193-210.

Tachiki, D., S. Hamaya, and K. Yukawa, 2004, Diffusion and Impacts of the Internet and E-Commerce in Japan, Working Paper, Center for Research in Information Technology and Organization (CRITO), University of California Irvine.

Tan, Z. and W. Ouyang, 2004, Diffusion and Impacts of the Internet and E-Commerce in China. Working Paper, CRITO, University of California, Irvine.

Universal Service Agency (2004). *"Universal Service Agency 2004/2005 Business Plan"* (Presenation To Labour And Public Enterprises Select Committee, 23 June 2004) Universal Service Agency [Available Online] http://www.pmg.org.za/docs/2004/appendices/040623usapres.ppt] [2004, 1 September 2004

Whitford, S.(2004) "*Telecoms report slams Telkom",* [Available Online] http://www.itweb.co.za/sections/telecoms/2004/0404021159.asp?S=Internet&A=INT&O=FRGN [2004, 3 September]

Wilson, E; Daly, J & Griffiths, J (1998) *"Internet Counts: Measuring the Impacts of the Internet*", Washington, DC: National Academy Press [Available Online] http://www.bsos.umd.edu/cidcm/wilson/xnasrep2.htm [2004, 16 April].

Wolcott, P., Press, L., McHenry, W., Goodman, S., Foster, W. (2001) *"A Framework for Assessing the Global Diffusion of the Internet",* Journal of the Association for Information Systems, Vol 2, Article 6 [Available Online] http://mosaic.unomaha.edu/GDIIntro_2003.pdf [2004, 19 March]

Wolcott, P & Goodman, S. (2003) *"Global diffusion of the Internet I: India: is the elephant learning to dance?*", Communications of the Association for Information Systems Vol. 11 [Available Online] http://mosaic.unomaha.edu/India_2003.pdf [2004, 20 March]

Wong, P., 2002, ICT production and diffusion in Asia: Digital dividends or digital divide? Information Economics and Policy 14, 167-187.

Wong, P. and Y.-P. Ho, 2004, E-commerce in Singapore: Impetus and Impact of Globalization. Working Paper, CRITO, University of California, Irvine.

World Bank (2001) "World development indicators", World Bank, Washington, D.C [Available Online] http://www.worldbank.org/data/countrydata/countrydata.html [2004, 10 April]

Abbreviations and Acronyms

APEC	Asian Pacific Economic Cooperation
ARCC	African Regional Centre for computing
CAIS	Communications of The Association of Information Systems
CCK	Communication Commission of Kenya
CID	Harvard Centre of International Development
GDI	Global diffusion of the Internet Framework
GPPS	Global Packet-Switched Service
GDP	Gross Domestic Product
ICT	Information and Communication Technology
ISP	Internet Service Provider
IT	Information Technology
ITU	International Telecommunications Union
JAIS	Journal of The Association of Information Systems
KPTC	Kenya Posts & Telecommunication Corporation
LCD's	Least Developed Countries
MBps	Mega Bits per second
NRI	Network Readiness Index
OECD	Organization for Economically Developed Countries
POPs	Points of Presence
SME's	Small and Medium Enterprises
TCP/IP	Transmission Control Protocol / Internet Protocol
VOIP	Voice Over Internet Protocol
VSAT	Very Small Aperture Terminal

Definition of terms

Internet:	Refers to a connection of multiple computers that communicate with each other
Internet Diffusion:	Refers to the spread of the Internet
Determinants	According to Wolcott et al (2001) may be thought of as proximate causes resulting in the current nature of the Internet environment
Dimensions	Are six variables that capture the state of the Internet within a country at a given point in time

Appendix I: Interview Schedule

1. PERVASIVENESS

Pervasiveness measures the per capita number of Internet users in a country.

a. How has the number of Internet users in Kenya changed over time since the introduction of the Internet in the country?

.....

b. What is the approximate number of Internet shops or cyber cafes in Kenya?

c. How has the number of Internet users in Kenya contributed towards economic security?

.....

2. GEOGRAPHIC DISPERSION

This refers to the physical dispersion of the Internet in a country.

a. How many ISPs are registered in Kenya?

b. How many of these ISPs are operational?

c. What is the distribution of these ISPs in the major towns in the country?

.....

d. How have these ISPs contributed towards economic security in Kenya?

.....

3. SECTORAL ABSORPTION

This refers to the application of the Internet by such sectors as the academia, health, commerce and industry and the public service.

a. Which Universities in Kenya have leased line Internet connectivity?

b. Do major commercial enterprises in Kenya have their own Internet servers?

c. Which major health institutions in Kenya that you know have own leased line Internet connectivity?

d. Which major government or public institutions have Internet servers?

e. Which ISPs/IAPs host these major government institutions?

e. How has the adoption of the Internet in Kenya by the academia contributed towards economic security?

.....

f. How has the adoption of the Internet in Kenya by the public institutions contributed towards economic security?

.....

4. CONNECTIVITY INFRASTRUCTURE

This examines the robustness of the physical telecommunications and computer networks in a country based on the domestic backbone capacity, international connectivity, Internet exchanges, and local access methods.

a. What is the Kenyan domestic Internet backbone capacity?
b. How many Internet exchange points (IXPs) exist in Kenya?
c. What local Internet access methods exist in Kenya?
d. What is the capacity for the international Internet link existing in the country?
d. How has the connectivity infrastructure affected economic security in Kenya?

.....

5. ORGANIZATIONAL INFRASTRUCTURE

This assesses the robustness of the Internet services market within a country as well as the basic telecommunications services.

a. What is the level of market liberalization in the Internet service provision sector?

.....

b. What is the name of the association for Internet connection providers in Kenya?

.....

c. What is the nature of competition for the provision of the international and local Internet service?

.....

d. How does the Internet services market in Kenya contribute towards economic security?

.....

6. SOPHISTICATION OF USE

This explores how those who are championing the use of the Internet within a country apply this technology.

a. What is the level of usage of the Internet in Kenya?

High ☐ Medium ☐ Low ☐

b. How has the Internet in Kenya been applied by users? (specify)

E-mail ☐ E-trade ☐ Browsing ☐ Research ☐ Other ☐

c. What are some of the perceived economic benefits of Internet use in Kenya? List them.

.....

.....

d. What are your comments on the role of the level of Internet uptake in Kenya on:

- Minimization of economic uncertainties.

.....

- Enabling easy access to international markets.

.....

- Minimizing economic imbalances in peripheral communities in Kenya.

.....

- Spurring the development of high levels of technology innovations in the Kenyan economy.

.....

- Increasing the economic costs of other competitor countries.

.....