Bridging the Digital Divide in South Africa and the Possible Role of Municipalities

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ABSTRACT

The digital divide presents all under-developed communities with a challenge. Not to participate in the Internet revolution will leave whole communities behind. To be able to deal with this divide, it is necessary to understand it fully, and to understand the roles of the current players in the telecommunications market who are expected to deliver the tools to the whole population to enable them to keep pace with this new global revolution. This study examines a South African perspective of the problem, and particularly why incumbent operators do not successfully bridge the digital divide, and whether the municipalities which are entering the telecommunications arena might contribute positively to a solution.

The study explores the connectivity, skills, confidence and beneficial usage aspects of the digital divide in depth, and then compares these parameters of the digital divide against the strategies and goals of the major telecommunications operators in South Africa for a match. It appears from such comparison, that the major operators are strongly focused on conventional business, and beyond the connectivity component, do not appear to address the digital divide in its totality.

Many municipalities are investing in telecommunications networks, based on their existing electricity and water management backbones, and are entering the public telecommunications operator space. Municipalities have a mandate to deliver to provide services to residents and businesses, on perhaps different bases from conventional telecommunications operators. In this respect, their goals and strategies in this field appear to suggest that municipalities might go further in bridging the digital divide than the conventional operators.

DECLARATION

I, Donald Graham Andrews declare that this research report is my own, unaided work. It is submitted in partial fulfilment of the requirements for the degree of Masters of Business Administration in the University of the Witwatersrand, Johannesburg. It has not been submitted before for any degree or examination in this year or at any other University.

DG Andrews February 2009

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LIST OF ABBREVIATIONS

BPL	Broadband over Powerline
EBITDA	Earnings Before Interest, Taxes, Depreciation and Amortization
Gbps	Gigabits per second
ICASA	Independent Communications Authority of South Africa
ICT	Information and Communications Technology
ISP	Internet Service Provider
ITU	International Telecommunications Union
OECD	Organisation for Economic Co-operation and Development
SNO	Second National Operator (Neotel)
UNICTTF	United Nations Information and Communication Technologies Task Force
USAASA	Universal Service and Access Agency of South Africa
USAL	Under-Serviced Area License
VANS	Value-Added Network Service
VoIP	Voice over Internet Protocol
Wi-Fi	Wireless local area network (WLAN) based on IEEE802.11 standards
WiMAX	Worldwide Interoperability for Microwave Access based on IEEE802.16
WSIS	World Summit on the Information Society

1 INTRODUCTION

1.1 Purpose of study

The purpose of the research is to analyse why the digital divide in South Africa is not being bridged by the incumbent players in the telecommunications market, and to consider the potential for municipal telecommunications operators to bridge the gap.

1.2 Context of study

An attempt has been made by the regulatory authorities in the form of the Independent Communications Authority of South Africa (ICASA), together with the South African government, to encourage higher levels of penetration of telecommunications services especially to the underserved population of South Africa. To this end, Telkom SA was required as part of its licence in 1996 to roll out several million new fixed lines (Department of Communications 1997). In addition, Cell C started as the third cellular operator in November 2001. More recently, seven operators established specifically to target so-called under-serviced areas, were granted Under-Serviced Area Licenses (USALs) by ICASA and in August 2006, Neotel, the Second National Operator and long-awaited competitor to Telkom, opened its doors.

With a monopolist, government-owned fixed-line operator, three cellular operators and multiple operators specifically established to provide telecommunications services to the under-serviced (the USALs), it appears as if, except for the cellular operators, these providers are failing to achieve the government's objectives.

For instance, Telkom's Annual Report for 2005 (Telkom SA 2005) makes it clear that fixed lines are in decline, contrary to what was intended by the licence, and worse, that this has been the trend for the last 8 years. Telkom did in fact install a substantial number of lines but many lapsed due to non-payment and more flexible competition from the cellular operators with their pre-paid offerings. The demand for a sustainable service did not exist in the new customer base to create a value for the subscriber. The theme of

this research touches on how subscribers might perceive value in a telecommunications service.

The USALs have not yet started operating, as their business models are tenuous, being based on areas of low income and little demand. They will only be considered briefly in this study for this reason. Neotel has started marketing and providing services and they are included in the study.

It appears then, that there is a danger that the existing economic divides between the people of South Africa will extend to their ability to access and use Information and Communications Technology (ICT).

It is in this context that the municipalities, for all their problems, appear to offer some potential to assist in bridging this divide. South Africa is urbanising rapidly, and this might terminally impact the USALs whose catchment is rural. Municipalities own extensive rights of way for roads, water and electricity, and operate telecommunications networks with which to support their core services. All these offer potential for municipalities to widen their scope and enter the telecommunications business in some way. This study is intended to analyse whether this may help in bridging the digital divide in all its forms.

1.3 Problem statement

1.3.1 *Main problem*

The purpose of the research is to analyse why the digital divide in South Africa is not being bridged by the incumbent players in the telecommunications market, and to consider the potential for municipal telecommunications operators to bridge the gap.

1.3.2 *Sub-problems*

The first sub-problem is to analyse why the digital divide in South Africa is not being bridged by the incumbent players in the telecommunications market.

The second sub-problem is to analyse the potential for municipalities to help bridge the digital divide in South Africa.

1.4 Significance of study

The study fills a gap: The South African telecommunications market contains several, very large, very successful operators, generating large profits, which they invest in expanding their networks, and investing abroad. These are Telkom SA, with its subsidiary, Vodacom, and MTN. Telkom/Vodacom returned an EBITDA margin of 41% in 2005 (Telkom SA 2005), with MTN following in similar fashion also with 41% (MTN Group 2005).

Neotel, the Second National Operator, has commenced operations, and the market place is fleshed out with smaller players including Cell C, Virgin Mobile, and the often forgotten group of operators - the so-called USALs – Under-Serviced Area Licensees, set up specifically to address the lack of telecommunications penetration in especially rural areas, and to help bridge the digital divide. All the operators have some sort of social obligation in their license agreement.

So, with all these players, why can they not bridge this digital divide? Is it simply a lack of access to voice telephony, or does it include Internet access and broadband? There are some worrying indicators in the South African telecommunications space, given that we are a developing country. The ITU, or International Telecommunications Union, (ITU 2005) places South Africa 39th in a study of the Digital Opportunity Index, out of 40 countries studied. Telkom's Annual Report (Telkom SA 2005) states that the fixed line market is declining at 2.4% per annum. Given that traditionally the basic telecommunications service is a fixed line telephone, this is alarming. An attempt will be made to analyse the significance if any, of this situation in perpetuating the digital divide. Apart from Telkom, no other operator operates in this market. The cell operators may not, Neotel is brand new, and the USALs are battling to get off the ground.

This study will attempt to analyse why the incumbent operators cannot bridge the divide and whether additional operators, specifically municipalities, might fill the gap.

The study will provide guidance to government, the regulator ICASA, municipalities, equipment vendors, service providers and financial institutions as to the viability of this sector, be it as entrants to the market (the municipalities), users of municipal networks, suppliers of equipment, or funders of such ventures.

1.5 Delimitations and limitations

1.5.1 *Delimitations*

The study will focus on South Africa only in terms of the conclusions, although examples will be sought all over the world.

The digital divide that will be applicable is that within South Africa, and although it may appear similar to that found elsewhere, this is not part of the study, and will be purely incidental.

The study will not attempt to define the digital divide, and accepts that there are divisions within South Africa in terms of accessibility of modern telecommunications services. A definition of digital divide is found in Section 1.6 below.

1.5.2 *Limitations*

Given that regulations differ markedly between countries, this study may not be directly applicable to any other situation, but may offer some insights that may be extrapolated into new environments.

1.6 Definition of terms

The following definitions are relevant to this research:

- ICT-Information and Communication Technologies: all the means at our disposal, fixed and mobile, with which to communicate and exchange information electronically
- Digital Divide: unequal access to, and ability to beneficially use, Information and Communication Technologies, serving both our voice and information needs. This is further defined in the Literature Review.

1.7 Assumptions

There are currently no assumptions that, if they do not hold, will influence the outcome of the research.

2 LITERATURE REVIEW

2.1 Introduction

A selection of existing literature on the topic of the digital divide, and the role of municipalities in the telecommunications arena, will be evaluated in order to establish the broad extent and direction of previous research in these areas, and to attempt to structure the answering of the questions posed in this study. An attempt will be made to highlight specific arguments and ideas in the digital divide debate, and to focus the discussion for this paper.

2.2 Scope of Literature Review

The literature review attempts to provide sufficient depth on the subject at hand to understand the general length and breadth of the problem, and how the digital divide might be bridged in a South African context. It will be used to develop a first pass understanding as to why the existing players haven't bridged the gaps, and to explore whether municipal telecommunications operations might assist this process. This study is completely based on published literature and the scope of literature referenced in the main research body in Chapter 4 is considerably wider than presented in this literature review.

2.3 Failure to Bridge the Digital Divide

In developing an understanding of the reasons for failure to bridge the digital divide can be developed, it is first necessary to define and characterise the digital divide, within a South African context, then to consider operator-related factors impeding their bridging the divide.

2.3.1 *Definition of the Digital Divide*

Definitions of the digital divide are varied but tend to agree on the broad principles. The World Summit on the Information Society (WSIS 2003) defines it as follows: “The digital divide separates those who are connected to the digital revolution in ICTs and those who have no access to the benefits of the new technologies. This happens across international frontiers as well as within communities where people are separated by economic and knowledge barriers”.

Michael Gurstein (2003) offers a number of definitions from a range of sources:

- From the Internet: "The term ‘digital divide ’ describes the fact that the world can be divided into people who do and people who don’t have access to — and the capability to use — modern information technology, such as the telephone, television, or the Internet. The digital divide exists between those in cities and those in rural areas. For example, a 1999 study showed that 86 percent of Internet delivery was to the 20 largest cities. The digital divide also exists between the educated and the uneducated, between economic classes, and, globally, between the more and less industrially developed nations."

- The OECD: "As used here, the term "digital divide" refers to the gap between individuals, households, businesses and geographic areas at different socio-economic levels with regard to their opportunities to access Information and Communication Technologies (ICTs) and to their use of the internet for a wide variety of activities. The digital divide reflects various differences among and within countries."

Fuchs and Horak (2006: p.1) define the digital divide as “unequal access to and usage of new technologies”, and Beebe et al (2003) who define the digital divide as the gap that exists between those who can access and effectively use digital information and communication tools, and those who cannot.

2.3.2 *Characterising the Digital Divide*

Given the definitions of the digital divide, it is important to characterise it in order to analyse the extent to which the structures of the South African telecommunications market are conducive to bridging the divide.

A sociological dimension is added to the definitions by Bagchi (2005: p.50) “reflecting broader contextual factors such as existing social, economic, cultural, and learning inequalities.” Although non-technical, these may well be components of the digital divide in South Africa. Bagchi (2005) also lists purely technological factors as dividers, and these are also arguably present in South Africa, given the peculiar structure of our telecommunications industry.

Bagchi (2005) proposes a model which considers the impact of Economic Indicators, Social Indicators, Ethno-linguistic Indicators and Infrastructural Indicators, none considered previously, as components of the digital divide. Bagchi’s thinking is illustrated in Figure 1. Such thinking awakens us to a more sociological review of the reasons behind the digital divide.

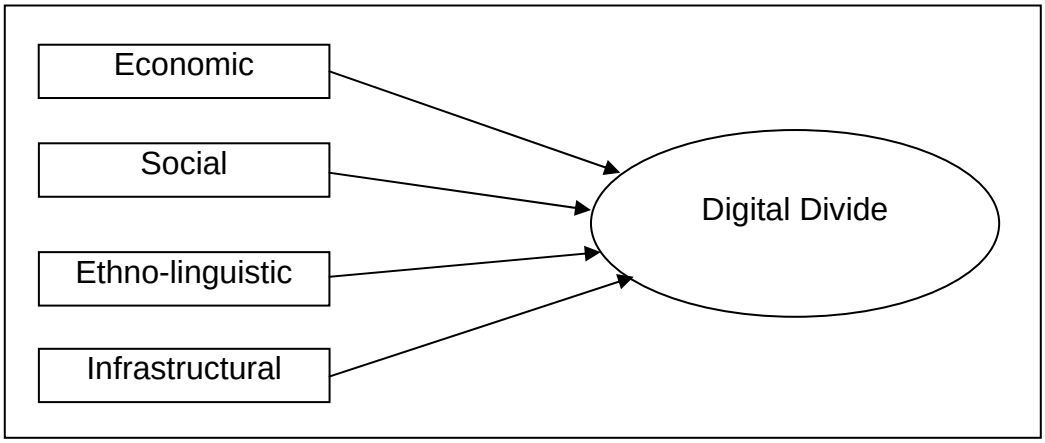


Figure 1 – A Digital Divide Model

(Bagchi 2005)

Supportive of Bagchi, are Fuchs and Horak (2006), who introduce concepts of absence of “mental access”, “material access”, “skill access” and “usage access”. A worrying dimension is introduced to the mix by van Dijk (2006) who believes that while the digital

divide is narrowing in developed countries, it may well be widening in developing countries due to a widening of the physical access divide.

All agree however, that there are differences between people and their ability, both as a function of their capabilities or wealth, and their location within a country, or in the world, to access the services offered by Information and Communications Technologies (ICTs), as diverse as voice telephony, to full broadband with all its offerings. The WiMAX Forum (Cayla et al. 2005: p.2) simply defines it as “unequal access to ICTs” which summarises it nicely.

Gebremichael and Jackson (2006: p.269) make the harsh statement that the digital divide is but “one component of the larger problem of Information Poverty”. They say “what was once a “discrepancy” quickly became a matter of global concern”. Western nations simply had to manage the equitable access to ICT networks, the developing world, especially Sub-Saharan Africa, had to create the basic underlying infrastructure first. This lack of infrastructure critically impeded underdeveloped nations from benefiting from the economic and social growth associated with ICT.

These factors resonate with aspects of South African society and can certainly be used to analyse this marketplace.

2.3.3 *Evidence of the Digital Divide in South Africa*

The ITU, as the United Nations agency for telecommunications, has compiled a Digital Opportunity Index (ITU 2005), which places South Africa 39th out of 40 countries studied. The index is based on three criteria:

- Opportunity – measures accessibility of service. If the user has it, will they use it, the first part being infrastructure dependent and the second, dependent on cost.
- Infrastructure – looks at fixed and mobile telephony, fixed and mobile Internet availability, and households with a computer.
- Utilization – analyses the number of users using the Internet, as well as those with access to broadband.

South Africa scores reasonably well on the Opportunity index, 0.59 (out of a maximum of 1) implying that if the capability exists, it is used. Infrastructure at 0.12 puts South Africa on a par with the Philippines, perhaps reflecting van Dijk's (2006) concern about the widening of the access divide in developing countries above. Utilization is a low 0.04 alongside Thailand and Turkey. The Utilization parameter is a key indicator of the presence of the digital divide in South Africa, as this is where simple access turns into value.

Overall South Africa scores 0.25, as does India.

Survey Medians are 0.92, 0.43, 0.23 and 0.51 overall. The survey leader (South Korea) scored 0.97, 0.70, 0.65 and 0.77.

These values suggest very strongly the presence of some major differences between South Africa and the developed world. We are also well aware of large differences of wealth within the country, illustrated clearly by the South African Gini coefficient of 57.8 (UNDP 2005), so we can reasonably conclude that there are "digital divides" both within South Africa and between South Africa and the developed world.

There is also evidence to suggest that far from declining, this divide is growing. This is supported by the decline in South African fixed telephone lines (Telkom SA 2005), traditionally used as the basis for internet access, and latterly for broadband, although many wireless operators have aggressively entered this space. Perhaps the new Neotel, and recent relaxations on international bandwidth provision, heralded by the imminent arrival of new undersea cables, may reverse this trend.

A final set of statistics is presented by Gillwald et al. (2004) showing the ICT Access differences between urban and rural dwellers. Figure 2 below illustrates the point well, showing marked differences between residents of metropoles, smaller towns and rural areas. This suggests considerable opportunity remains for municipalities to enter the telecommunications business.

2.3.1 *Operator Considerations*

The present structure of the South Africa operator market has been driven mainly by the Telecommunications Act of 1996 (Republic of South Africa 1996), which provided for Telkom's exclusivity until May 2002, the eventual establishment of a Second National Operator (now Neotel), and the establishment of Under-Serviced Area Licensees (USALs). It also covered the mobile operators, MTN, Vodacom and the envisaged Cell C, in addition to providing for Sentech to be licensed as an international operator and multimedia provider. Finally, Value-Added Network Service providers (VANS) were licensed to operate essentially customer-outsourced networks, and act as Internet Service Providers (ISPs).

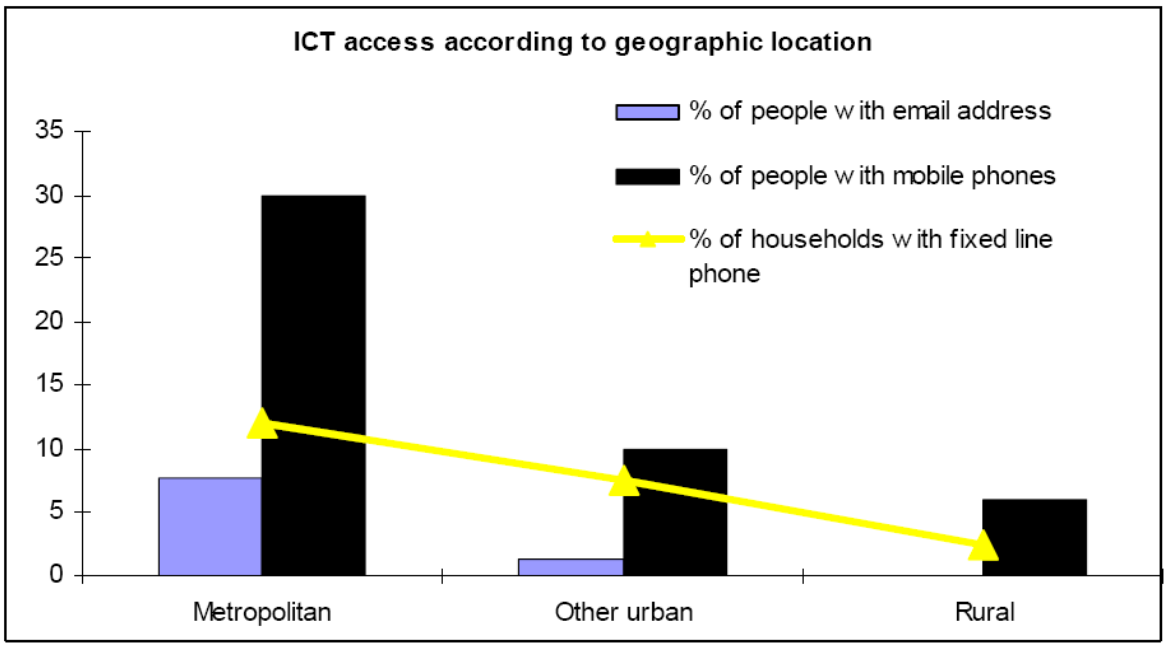


Figure 2 - ICT Access According to Geographic Location

(Gillwald et al. 2004)

An objective of the Act was to develop an ICT strategy to bridge the digital divide. The USALs were a cornerstone of this policy under which the Minister of Telecommunications could identify areas with less than 5% teledensity and set them aside for a USAL operator. As a further part of the strategy to bridge the digital divide, the Universal Service and Access Agency of South Africa was established.

That there is a digital divide in South Africa is not the issue in this paper. The question arises therefore, with the range of possible operators, why does it persist, and this will lead to the question of whether municipal operators may be more successful where others have, if not failed, then not succeeded. A number of issues present themselves. Telkom continues to report a decline in installed fixed lines, although the company generates handsome revenues at an EBITDA of almost 45% (Telkom SA 2006).

The USALs are little known, but cannot claim any successes it seems. Seven USALs were recommended to receive licences in 2004 (ICASA 2004), and a press release in 2004 (Dibakwane 2004) advises that R5million was given to an initial four license holders to prepare business plans. The funds derive from the Universal Service and Access Agency of South Africa (USAASA), which received a grant of R17.5million in 2005 (Universal Service and Access Agency of South Africa 2006). USAASA seems an underfunded agency, given its goals, compared to international practice which would have seen it receive between 1% and 2% of telecommunications revenues, closer to R540million in 2002, according to an ITWeb article (Mawson 2006). In another ITWeb article, (Senne 2006b), it is reported that as of April 2006, the USALs had no allocation of radio spectrum over which to operate their services.

Neotel, the Second National Operator (SNO), is late to market. Telkom's exclusivity as the fixed line operator expired in May 2002, and at the time of writing (February 2007), Neotel has yet to launch a service. Complicating matters in this area, the South African government has established a new broadband operator, Infraco, to provide high capacity bandwidth at cost. The fixed operator market is further distorted by Sentech and its international license.

From the above it is clear that there are multiple agencies involved in the attempt to bridge the digital divide. Tipton (2002) expresses concern based on South-East Asian experiences over the fragmentation of effort, competition for budgets and skills, and perhaps lack of a clear common goal. It is important to analyse these concerns in the South African context. Further complicating this space at the time of writing are the recent judgements in the South African High Court in the last quarter of 2008, permitting a huge variety of small and large VANS licence holders to be licensed to construct and

operate networks, which may now result in the market potentially being flooded with operators (Cull 2008). The licensing process is well under way (ICASA 2009).

This study will focus on Telkom, the mobile cellular operators Cell C, MTN and Vodacom, and Neotel. The other players are either insignificant in terms of practical impact (USALs) or do not operate in the digital divide space (Sentech), or are too recent to have had any impact (VANS).

2.3.2 *Legal Environment*

Two major acts have and are, framing the telecommunications sector in South Africa. These are the Telecommunications Act, 103 of 1996 (Republic of South Africa 1996), and its replacement, the Electronic Communications, 36 of 2005 (Republic of South Africa 2005).

The Telecommunications Act of 1996 has as its goal the “regulation of telecommunication activities other than broadcasting”, and to “establish … a Universal Service Agency”. The objectives of the act are to:

a) promote the universal and affordable provision of telecommunication services;

b) promote the provision of a wide range of telecommunication services in the interest of the economic growth and development of the Republic;

c) make progress towards the universal provision of telecommunication services;

d) encourage investment and innovation in the telecommunications industry;

e) encourage the development of a competitive and effective telecommunications manufacturing and supply sector;

f) promote the development of telecommunication services which are responsive to the needs of users and consumers;

g) ensure that, in relation to the provision of telecommunication services, the needs of the local communities and areas are duly taken into account;

h) ensure that the needs of disabled persons are taken into account in the provision of telecommunication services;

i) ensure compliance with accepted technical standards in the provision and development of telecommunication services;

j) ensure fair competition within the telecommunications industry;

k) promote the stability of the telecommunications industry;

l) encourage ownership and control of telecommunication services by persons from historically disadvantaged groups;

m) protect the interests of telecommunications users and consumers;

n) encourage the development of human resources in the telecommunications industry;

o) promote small, medium and micro-enterprises within the telecommunications industry;

p) ensure efficient use of the radio frequency spectrum;

q) promote the empowerment and advancement of women in the telecommunications industry.

Items a), b) and c) are of interest to this research. Notably, no explicit reference is made to the concept of a digital divide, perhaps because these were still the early days of the Internet and its potential and explosive growth which left behind underdeveloped communities, was not yet perceived. Reference to a digital divide had to await the Telecommunications Amendment Act, 64 of 2001 for the additional objective (amongst others) of "(s) develop the Information, Communication and Technology (ICT) strategy for the Republic, in order to bridge the digital divide" (Republic of South Africa 2001).

The new Electronic Communications, 36 of 2005 has as its goal "To promote convergence in the broadcasting, broadcasting signal distribution and telecommunications sectors…; to provide for the continued existence of the Universal

Service Agency and the Universal Service Fund; and to provide for matters incidental thereto":

a) promote and facilitate the convergence of telecommunications, broadcasting, information technologies and other services contemplated in this Act;

b) promote and facilitate the development of interoperable and interconnected electronic networks, the provision of the services contemplated in the Act and to create a technologically neutral licensing framework;

c) promote the universal provision of electronic communications networks and electronic communications services and connectivity for all;

d) encourage investment and innovation in the communications sector;

e) ensure efficient use of the radio frequency spectrum;

f) promote competition within the ICT sector;

g) promote an environment of open, fair and non-discriminatory access to broadcasting services, electronic communication networks and to electronic communications services;

h) promote the empowerment of historically disadvantaged persons, including Black people, with particular attention to the needs of women, opportunities for youth and challenges for people with disabilities;

i) encourage research and development within the ICT sector;

j) provide a clear allocation of roles and assignment of tasks between policy formulation and regulation within the ICT sector;

k) ensure that broadcasting services and electronic communications services, viewed collectively, are provided by persons or groups of persons from a diverse range of communities in the Republic;

l) provide assistance and support towards human resource development within the ICT sector;

m) ensure the provision of a variety of quality electronic communications services at reasonable prices;

n) promote the interests of consumers with regard to the price, quality and the variety of electronic communications services;

o) subject to the provisions of this Act, promote, facilitate and harmonise the achievement of the objects of the related legislation;

p) develop and promote SMMEs and cooperatives;

q) ensure information security and network reliability;

r) promote the development of public, commercial and community broadcasting services which are responsive to the needs of the public;

s) ensure that broadcasting services, viewed collectively—

i. promote the provision and development of a diverse range of sound and television broadcasting services on a national, regional and local level, that cater for all language and cultural groups and provide entertainment, education and information;

ii. provide for regular—

(aa) news services;

(bb) actuality programmes on matters of public interest;

(cc) programmes on political issues of public interest;

(dd) programmes on matters of international, national, regional and local significance;

iii. cater for a broad range of services and specifically for the programming needs of children, women, the youth and the disabled;

t) protect the integrity and viability of public broadcasting services;

u) ensure that, in the provision of public broadcasting services—

   i. the needs of language, cultural and religious groups;

   ii. the needs of the constituent regions of the Republic and local communities;

   iii. the need for educational programmes, are duly taken into account;

v) ensure that commercial and community broadcasting licences, viewed collectively, are controlled by persons or groups of persons from a diverse range of communities in the Republic;

w) ensure that broadcasting services are effectively controlled by South Africans;

x) provide access to broadcasting signal distribution for broadcasting and encourage the development of multi-channel distribution systems in the broadcasting framework;

y) refrain from undue interference in the commercial activities of licencees while taking into account the electronic communication needs of the public;

z) promote stability in the ICT sector.

The full set of objectives has been quoted to show that despite the wide coverage of issues in the sector, nothing is said about the digital divide, despite much being said about the historically disadvantaged. Even the Universal Service Agency and the Universal Service Fund appear somewhat incidental to the core of the act. It may therefore be argued that neither this act, nor its predecessor, actively promote the bridging of the digital divide, and as a result (as will be shown later), pressure of the right sort on operators is not effectively applied.

2.3.3 *Conclusion*

In summary, the literature suggests that there is indeed a phenomenon that may be described as the digital divide, and that it manifests itself clearly within South Africa and between South Africa and developed countries. At issue is why the plethora of operators

and agencies cannot reduce the divide, and whether an additional new player might help.

Research Question 1: Why is the digital divide in South Africa not being bridged by the incumbent players in the telecommunications market?

2.4 Potential for Municipalities to bridge the Digital Divide

In considering whether Municipalities might play a role, one has to consider what might be different from the rural areas. Government policy has been to establish the USALs in the rural areas to expand ICT accessibility there, but the rural population is slowly but surely migrating to the cities in South Africa (World Bank 2006). So consideration must be given to whether this is a meaningful trend, likely to make an urban solution to the digital divide more successful.

2.4.1 *Urbanisation in South Africa*

South Africa's black population is experiencing "massive" (Kinsella and Ferreira 1997: p.4) urbanisation, since the Group Areas Act was repealed in 1988. Many settle in informal settlements on urban fringes.

In their analysis of entrepreneurial activity in Khayelitsha, Morris et al. (1996: p.64) say "Sixty per cent live in cities, and this is accelerating; the country is moving towards huge cities surrounded by squalid townships and unorganized slums."

The pattern of migration is not only from rural to urban, but to specific urban metropoles viz Gauteng, the Western Cape, and to a lesser extent, Durban (van der Berg et al. 2002)

The World Bank (2006) collects statistical information which supports the above contentions as illustrated by Figure 3 below.

We can clearly see the pattern developing of a major move of people to the urban centres, and especially those which offer the hope of employment and a better life, although reality often seems to be different.

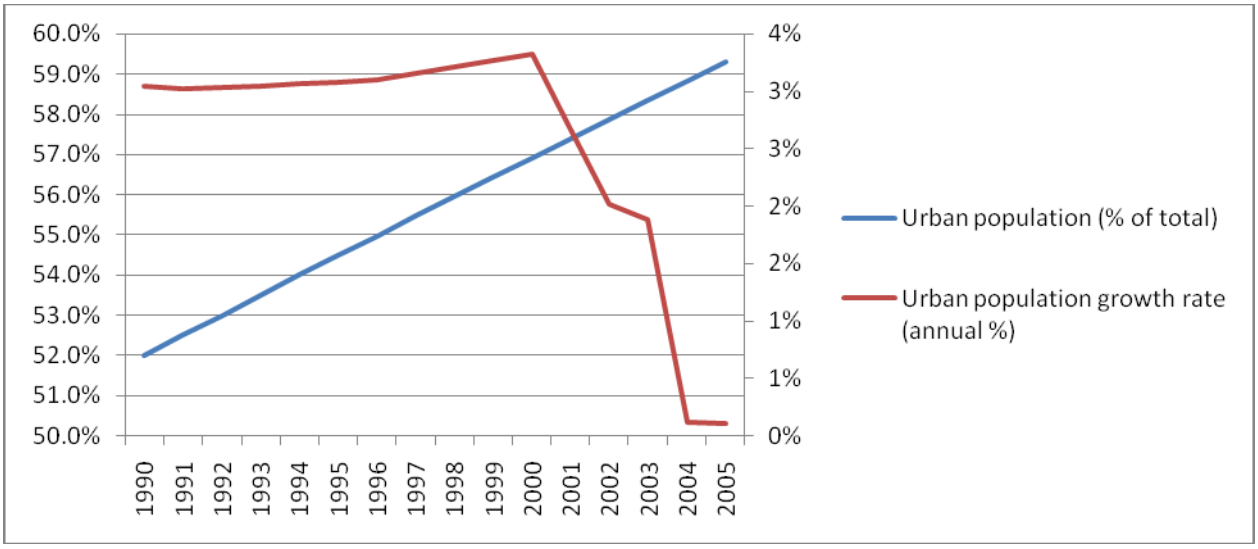


Figure 3 - Urbanisation Statistics

(World Bank 2006)

2.4.2 *Failure of USALs*

In the context of this rate of urbanisation, it is easy to perceive why the companies set up to serve the rural areas have not yet made their mark, although seven have now been licensed. Several reputable studies support this contention, including Finnie et al. (2003) who maintain that the USALs' business model has been damaged by delayed licensing, large, rural service areas, and the high costs associated with network provision. Business models are not viable because the subscriber density is low and rural areas are less affluent than their urban counterparts. Note that a USAL is by definition an operator in an area where teledensity is less than 5% (Republic of South Africa 1996).

It is important to note that the USAL license areas include the neighbouring metropole, but these do not include the major metros of Gauteng, the Western Cape and Durban. Rather they encompass the likes of East London, Welkom and Polokwane, all suffering net out-migrations (van der Berg et al. 2002).

Another study puts it more bluntly (Gillwald et al. 2004: p.31), referring to rural areas as being perceived to be uneconomic, and to offer a "diminishing" business case. What hope is there then that the USALs will rise and service the under-served and bridge the digital divide? For these reasons, USALs are not part of the operator community studied here.

2.4.3 *Municipalities as Potential Saviours*

Municipalities are well-positioned, it would seem, to play a role in the telecommunications space. Many large municipalities in South Africa and abroad operate private telecommunications networks with which to manage the services they deliver (Gillett et al. 2006), especially water and electricity. This appears to give them a springboard to greater things. Municipalities offer opportunities to break the "natural" monopoly of last mile access. From some points of view this might also have the benefit of returning the ownership of such access into public hands. Municipalities have servitudes, needs and skills that equip them to play in the telecommunications arena, not necessarily as a telecommunications operator, with its financial muscle, but perhaps as an enabler of services.

In the United States, in New York City, the digital divide still exists, (Lai and Brewer 2006) and the majority of businesses, especially small businesses, rely on dial-up access even today in this world which broadband technology has made "flat." In New York this is exacerbated by the lack of competition amongst service providers, limiting customer choice. Lai and Brewers' study (2006) recommends that New York City facilitates the provision of broadband services, to bridge their digital divide.

That most US users, as late as 2004, still use dial-up as their internet access is supported further by Gillett et al. (2004) in a study of local government broadband initiatives. These may start with the intention to improve local government service delivery and offer e-government services, but can easily extend to commercial provision of services to end customers.

Four possible municipal roles are offered (Gillett et al. 2004):

- Broadband user – purely for their service delivery and e-government roles.
- Rule-maker – as to how others may use and access their infrastructure.
- Financier – investing in others building the broadband networks.
- Infrastructure Developer – investing in the infrastructure and operating it themselves.

The range of technologies open to municipal operators is practically similar to that available to telecommunications operators (Bakowski 2006):

- DSL over copper phone lines – may not be accessible to the municipality in all cases, unless the local loop has been unbundled.
- Cable (as used in Cable TV) – not available in South Africa.
- Wireless (Wi-Fi and WiMAX) – new technologies with huge promise.
- Cellular networks – unlikely as these are natural competitors.
- Optical fibre – costly initially, but offers huge bandwidths, already in municipal plans.
- Satellite – flexible but costly for broadband.
- Broadband over Power Lines – a technology unique to electricity providers' networks, offering ubiquitous access to users. Some complexities though.

Bakowski (2006) proposes four main goals of such operations:

- Investing in Cutting Edge Technologies;
- Creating economic development;
- Reaching underserved areas;
- Increasing revenue for the City.

Bakowski (2006) further proposes a set of stakeholders, tabulated here in full as it is very relevant to our study:

Table 1- Stakeholders in Municipal Telecommunications

(Bakowski 2006)

Stakeholder	Interests	Importance/Impact
Municipality	Promoting economic growth; balancing its budget; improving internal efficiency; lessening administrative burden.	Major; Decision-maker and primary implementer
Phone companies	Providing voice, broadband, and video services to paying customers.	Major; new policies could directly impact profitability, service relationships.
Cable companies	Providing video, voice, and broadband Internet services to paying customers.	Major; must contract with City for service provision.
Internet Service Providers (ISPs)	Selling access to the Internet; increasing overall demand for Internet services.	Minor; effects are indirect.
Electric utilities	Providing a broadband alternative for underserved areas.	Minor; effects are indirect and in the future.
Telecommunications Network Providers	Attracting businesses with high demand for network services.	Minor; effects are indirect.

Stakeholder	Interests	Importance/Impact
Businesses	Increasing productivity; expanding competitive alternatives for telecommunications services.	Major; may enhance business climate, provide funding.
Consumers	Expanding competitive alternatives for broadband, telecommunications services.	Minor; effects are generally indirect.
Citizens	Better City service delivery; enhanced protection of welfare, public safety; proper fiscal management.	Major; may effect all directly; voters play important role.
Educational Institutions	Connecting to peer institutions and creating new collaborations; increasing opportunities for students.	Major; may serve as partners in development, effects for education could be direct.

2.4.4 *South African Activity*

South African municipalities are quick adopters of new ideas, as evidenced by reports from a recent conference (Mochiko 2006) which indicate a number of municipalities already active in the public telecommunications arena - Cape Town, Durban, Johannesburg, Knysna and Tshwane Metro, with others in the pipeline.

Their motivations are similar to those quoted above from the US, and with the new Electronic Communications Act of 2005 (Republic of South Africa 2005), the legal way is open for municipalities to operate commercially in the telecommunications market.

2.4.5 *Conclusion*

In summary, literature suggests that municipalities (or local government) have something of significance to offer in the area of telecommunications services, and may well be able to play a significant role in reducing the digital divide in a country such as South Africa.

Research Question 2: What is the potential for municipalities to help bridge the digital divide in South Africa?

2.5 Conclusion of Literature Review

A selection of existing literature on the topic of operators and the digital divide, and the role of municipalities in the telecommunications arena, has been reviewed and key issues identified from previous works. Some pointers to answers have been gleaned and would appear to support the proposed research questions.

The digital divide has been defined in a South African context, including the legal framework, and the possibilities that municipal telecommunications operations might be able to bridge this gap explored.

3 RESEARCH METHODOLOGY

This chapter describes the methodology that will be followed to answer the research questions posed above.

3.1 Research methodology

The method of research is by means of literature review, by studying established literature on the topics of the digital divide and municipal telecommunications, and drawing conclusions from previous studies, within the context of the South African environment. There is a considerable body of literature on the topic that although is not all based on the South African situation, may easily be related to South Africa, and their conclusions applied locally. The literature already reviewed above is the basis, but the topics raised are explored in considerably more detail in the research section, Chapter 4 below.

The literature review method has been selected as the most appropriate approach to this study because the intention is to re-use as much previously developed understanding of the digital divide and possible solutions as practical, and to place this existing body of knowledge into a South African context. This report is a survey of previous work, rather than a survey of opinions and trends. There is little point in re-learning the parameters of the digital divide. It is more productive to fully understand the digital divide in a world context, apply this to the South African environment, and from there answer the questions. This will permit the determination of action steps to bridge the digital divide, and allow ideas for further study and analysis to be developed more quickly. In the situation presented here, this approach seems to offer a chance to re-establish the basis on which the questions posed may be tackled.

The study therefore analyses the characteristics of the digital divide, based on a considerable body of published literature and broad research world-wide, so as to create a conceptual benchmark against which the South African situation may be compared. This portion is based around the work of amongst others Fuchs and Horak (2006), and van Dijk and Hacker (2000), who very similarly define some key parameters defining the

components of the digital divide. These key parameters appear in all the studies reviewed and illustrate the value of the literature review-based approach. It will be evident from the research developed in Chapter 4 that South Africa is not fundamentally different from other parts of the world and therefore findings from elsewhere point clearly to the relevant issues for bridging the South African digital divide.

A broad spectrum of digital divide literature is researched in Chapter 4 with special reference to South Africa, attempting to match the issues raised against the South African environment, and the operators in South Africa. This highlights the key reasons why operators in South Africa fail to bridge the digital divide. The sociological factors introduced by Bagchi (2005) appear throughout the analysis.

The second question will be answered firstly by researching the municipal telecommunications environment, to gain an understanding of the drivers behind the setting up of municipal telecommunications businesses, their purpose and their form. The digital divide factors identified above will then be matched to the goals of municipal operators, and it is anticipated that two or possibly three factors will come to the fore. If these are addressed by the municipalities as part of a telecom offering, there is a possibility of closing digital gaps. By taking the factors in turn, and analysing them against potential municipal telecommunications offerings, it will be possible to reach a conclusion as to whether or not municipalities have a significant role to play.

3.2 Research Design

The research is handled in two parts:

- Firstly, an extensive evaluation of the parameters understood to represent the digital divide, followed by an in-depth review of the origins, goals and approaches of municipalities entering the telecommunications market. Chapter 4 deals with the theoretical base for this study, and establishes the theoretical framework for answering the questions posed.

- The second stage in the first part of Chapter 5 is to take the results of the theory exposed in Chapter 4, and apply it to the operators in turn, to understand why they are not bridging the digital divide. This will answer Research Question 1.

- The final stage in the second part of Chapter 5 is to apply the theory against the goals of the municipal telecommunications operators and to determine whether these goals will lead to the reduction or elimination of the digital divide. This provides the answer to Research Question 2.

3.3 Data analysis and interpretation

Data analysis will be an extensive literature survey, understanding the world-wide trends and findings regarding the digital divide, and matching the South African situation with these studies.

Publicly available literature and data will be used. A large body of published works, annual reports and other articles, will be used to develop a local interpretation of possibility, based on international experience, and local trends. As this is a topical subject, reputable newspaper articles will also be referenced for the latest movements, especially on the municipal front. Detailed data in support of the literature, and in some cases to present the current situation, is available from Statistics South Africa, the ITU, United Nations, and the World Bank, amongst others.

The study is anchored on the four parameters identified above (Fuchs and Horak 2006), namely “mental access”, “material access”, “skill access” and “usage access”. These appear in slightly differing forms in much of the literature as will be seen. It will be shown that these are the keys to understanding the digital divide, and interpreting them in context will lead to clear answers to the research questions.

3.4 Validity and reliability

3.4.1 *External validity*

The External Validity of the study is high, due to the fact that the digital divide is well characterised by an eminent body of researchers.

Likewise, any data will be derived from reputable sources, such as Statistics South Africa, the ITU, United Nations and the World Bank, or will be sources such as those bodies might have used.

This will impart, it is believed, acceptable external validity to this study. The conclusions will be focused on South Africa, but the methodology will be re-usable.

3.4.2 *Internal validity*

It is important for Internal Validity that we cover as wide a range of ICT and digital divide-related parameters as possible, and to an acceptable level of detail, and for which there is quality data, especially for South Africa.

The ability to predict future trends or relationships from the models built here will be high, it is believed, because the underlying conclusion is valid at this point in time, but may be remeasured at a future time and the same process followed. As many of the parameters change relatively slowly (over periods of years, not months), the interpretations should remain valid for reasonable periods, at least long enough to be applied to the problem.

3.4.3 *Reliability*

The study has Reliability – it is based on quality analyses and statistics and may therefore be expected to be accurate. By analysing the subject matter deeply, it will be possible also to ensure precision.

4 RESEARCH

4.1 The Digital Divide

The definitions of the digital divide above should briefly be revisited to calibrate the discussion that follows. The digital divide concerns the “unequal access to and usage of new technologies” according to Fuchs and Horak (2006: p.1). Beebe et al (2003) define the digital divide as the gap that exists between those who can access and effectively use digital information and communication tools, and those who cannot, or who do not have access. The key here is both having access and the ability to exploit that access and get useful value from it. According to the OECD (2001: p.5) “the term digital divide refers to the gap between individuals, households, businesses and geographic areas at different socioeconomic levels with regard both to their opportunities to access information and communication technologies and to their use of the Internet for a wide variety of activities”. Cuervo and Menendez (2006: p.757) also quote UN Secretary General Kofi Annan as saying “ there are really several digital divides”, which is apparent when the definitions above are decomposed.

The discussion below explores and expands upon these factors to better understand what exactly is meant by “digital divide”.

4.1.1 *Factors of the Digital Divide*

The parameters one considers when analysing the digital divide cover both supply side and demand side parameters. A considerable body of literature covers the supply side, with comparatively little attention being paid to demand side issues (Mariscal 2005). This may turn out to be a grave error, as we see in this research.

Many authors refer to sets of parameters for quantifying and measuring the digital divide, with slight differences, but generally following a consistent theme, and all in line with the introduction above. A sample of these papers is reviewed and the key parameters for measuring the digital divide are extracted. A detailed review then follows of each of these

parameters or issues, from which will develop the argument for answering the questions posed in this research.

Cullen (2001), examining the digital divide in the USA, UK, Canada and New Zealand, identifies specific groups as being disadvantaged: those with low incomes, few educational qualifications, poor literacy level, who are unemployed, the elderly or disabled, those in isolated communities, sole parents, women and girls. The factors Cullen identifies are:

- Physical Access: the telecommunications infrastructure with the ability to support reliable Internet connections, at affordable cost – to support sustainable routine access;

- Lack of ICT Skills and Support: many disadvantaged people as described above have weak computing and/or technology skills, often linked to poor literacy. This places manual workers or the unemployed at a disadvantage relative to business or professional people;

- Attitudinal Barriers: attitudes are closely linked to skills and support with the idea that computers are for technically clever people, or perhaps to a middle-class “white” culture. In developed countries, Cullen asserts, gender plays a relatively small role, compared to developing countries where gender disparities may be marked;

- Content: if Internet content is not relevant or interesting, usage declines. This is notable in the elderly or women, and to those outside the Western Internet culture. Much of the content is created in the USA or the UK, and may have little local relevance.

Fuchs and Horak (2006: p.1) defined the “topic of the digital divide” as being about the “unequal access and usage of new technologies”. They proceed to discuss a number of strategies for dealing with the digital divide, and describe a “digital apartheid” (Fuchs and Horak 2006: p.6) suggesting that certain groups and regions are systematically excluded from cyberspace and its associated benefits. Whether this is true or not, is not at issue, but they develop links to the UN Human Development Index. They define concepts of global digital divide, a social divide and a democratic divide:

Table 2 – Types of Digital Divide

(Fuchs and Horak 2006)

Types of Digital Divide	Signified by
Global divide	Divergence of Internet access between industrialized and developed societies
Social Divide	Gap between information rich and poor in each nation
Democratic Divide	Difference between those who do, and do not, use the opportunities of digital resources to engage, mobilize and participate in public life

Fuchs and Horak (2006) suggest that technologies are enablers and constraints on human endeavour, with dimensions of material access, the capability of using the technology, and the potential to benefit from the technology:

- Material access implies access to the necessary hardware, software and networks with which to access the ICT infrastructure and content;
- Usage capabilities refer to the skills to operate the hardware, software and networks successfully, to reach and extract useful online content;
- Beneficial access is about being able to actually use the information extracted in a useful manner to benefit oneself and surrounding society.

An additional component added by Fuchs and Horak is that of “mental access”, referring to “digital experience” or simply the self-confidence to use the technology.

The range of solutions to the digital divide generally refer to one or other form of “access” as being the key (Gurstein 2003), based on the digital divide being defined as an “access” problem. Gurstein (2003) develops the theme of “access” further:

- Access to the network and associated infrastructure is fundamental without which little else is possible. But this access is very bound up with the commercial interests involved in providing such access, including clearly, all the telecommunications operators and associated service providers;

- Accessibility is however, also about considering how to make ICT access “usable and useful”, especially perhaps by marginal and/or excluded populations and communities (an allusion to the concept, even if unintentional, of digital apartheid). Gurstein (2003) clearly makes the point that “access” here is about “being able to consume and receive rather than produce and distribute” ie removing the commercial push from “access” and looking more at user or consumer pull. The challenge is for the end users can do something “locally significant” with the technology and information to which they have access.

Gurstein (2003) summarises his view by saying that once physical “access” has been satisfied, the user has the “knowledge, skills, and supportive organizational and social structures to make effective use of that access” and to achieve his or her goals.

Van Dijk and Hacker (2000) analysed the digital divide as a “complex, dynamic phenomenon”, and analysed what they termed the “multifaceted concept of access”. In 2000, at the time of their study, there was a question as to whether there even was a digital divide, and whether it was closing or widening. The question also had clear political overtones. Four kinds of “access” were distinguished, contributing to the divide:

- Psychological Access – based on the lack of digital experience, driven by lack of interest, fear of computers, and simply not attracted to the new technologies;

- Material Access – simple lack of a computer with a network connection;

- Skills Access – a lack of relevant skills due to user-unfriendliness of the technology, inadequate education, and/or social support;

- Usage Access – insufficient use opportunities (perhaps also including usefulness of content)

According to the study (van Dijk and Hacker 2000), Material Access gets the most focus, and the digital divide is bridged once one has a computer! The mental or psychological barrier is deemed limited to the old people, housewives, illiterates and the unemployed. The study further contends that once the first 2 access limitations have been overcome, the latter 2 come strongly into play. In developing their argument, van Dijk and Hacker attempt to demonstrate the dynamic of the digital divide.

Van Dijk and Hacker (2000) conclude that there is “an absolute, yawning and unbridgeable gap” between classes of people. They reject concepts of “technological segregation” and “classical apartheid” advanced by the likes of the NAACP President Kweisi Mfume, and Jesse Jackson respectively, however, as solving the “segregation” caused by lack of equipment and network access does not remove the differences and divides. Skill and Usage are coming to the fore as limiters, and the contention is that the task of future societies is to prevent these differences from intensifying. They further point out that the digital divide is dynamic: one cannot simply analyse it at one point in time, due to the ongoing proliferation of new and different devices and applications, whether business or entertainment oriented, which continues to move the goal posts.

Gebremichael and Jackson (2006) begin to look at Sub-Saharan Africa. Again the same parameters appear, although the technological access is split between Technology and Telecommunications. Their view of the problem, heavily based on Bertot (2003) is as follows:

- Technology: those with and those without access to technology – here one must assume that the technology is relevant to the problem of a digital divide;
- Telecommunications: this makes the distinction between high and low-speed data services such as the comparison between broadband internet and dial-up over a telephone line;
- Economic Dimensions: relates to the ability to afford the requisite technology and telecommunications services required for ICT access and usage;
- Information Access: this explores the divisions between those with access rights to retrieve and exchange information and those without;

- Information Literacy: the ability to seek information of value, and ability to put the information obtained to some worthwhile use.

Gebremichael and Jackson (2006) further comment that any argument about ICT being a luxury in Sub-Saharan Africa, where there are many other pressing problems, is weak, as other developing regions, notably Bangladesh and Brazil, have used ICT successfully in tackling traditional Third World plights. A final telling point made is that “all ICT is developed within a cultural context”.

Mutula (2004), also studying the Sub-Saharan digital divide, reveals some interesting insights into the problem, again along similar lines to the other studies, but with important nuances. He explores nine separate dividing factors, starting with the linguistic complexity of region, and the fact that none of the indigenous regional languages is a language of the Internet and computing:

- Local content issues: this is a question of the relevancy of the Internet, and considers the absence of content on issues such as traditional medicine, community theatre and cultural artefacts. The tacit nature of the local traditions threatens them with extinction. The absence of local content is underlined by the proportion of global internet hosts in the region;

- Communication and community building issues: the use of English as the lingua franca in science and scholarship has translated into English being the language of the Internet. Evidence is advanced to show that an important digital dividing issue is the lack of empowerment in the language of the Internet;

- Financial constraints in education: educational institutions in Sub-Saharan Africa have difficulty in funding ICT technology and services. This is exacerbated by the high costs associated with bandwidth especially;

- ICT Awareness, literacy and skills: Sub-Saharan Africa is in the lowest third of the world literacy rates (supported by the UNDP (2005)) and this poses a serious challenge to developing and sustaining a publishing and library infrastructure from which to develop an indigenous ICT industry;

- Paucity of research and scientific capacity: budgetary constraints in the region contribute to declining research output, resulting in limited research and development capacity, impacting the building of a critical mass of self-sustaining ICT skills. Imported technical know-how and information is employed instead. Even university libraries cannot maintain adequate collections of material, nor fund sufficient internet access to alleviate the problem;

- Policy, politics and restrictive factors: “elitist” institutions, such as universities, government offices and corporates have the best access to ICT facilities, although in many cases the utilisation of these facilities is low. Taxation, political barriers, political expediency and simple lack of awareness amongst government officials contributes to this divide. The authoritarian nature of many Sub-Saharan governments (at least in the past) did not contribute to an environment conducive to the development of Internet related services;

- HIV/AIDS factor: although the Internet could contribute to the reduction of the HIV/AIDS pandemic, funds are absorbed in dealing with the pandemic directly and therefore are not available to find digital divide reducing activities;

- Attitude change, awareness and skills development: understanding the benefits of ICT in the region is not universal, and this needs to change. This extends into the actual use of the technologies which <u>are</u> actually available eg mobile telephone networks are widely developed, yet fixed lines are the preferred delivery mechanism for ICT services;

- Civil wars, gender issues and prioritisation: the ravages of civil wars distract from the development of ICT infrastructures and damage what exists. Gender discrimination continues to limit opportunities for especially rural women, where technology penetration is inadequate. The information available on the available services, too, is not what is needed in these remote communities.

Many of the above items overlap with each other and may be grouped for simplicity, but without losing the message contained therein.

Fink and Kenny (2003) examine the question of “What is the digital divide?” and identify the four major interpretations of “gaps” prevalent in the literature:

- A Gap in access to the use of ICTs – measured simply by the distribution of telephones and computers;
- A Gap in ability to use ICTs – measured by considering the skills base;
- A Gap in actual use – the amount of actual telecommunications usage, the number of online users, the number of Internet hosts and the amount of electronic commerce;
- A Gap in the impact of use – measured by financial and economic returns from the use of the ICT infrastructure and information.

A different question when discussing the digital divide is “equality of what”, which gives rise to a set of three questions on inequality (van Dijk 2006):

- To what inequality does the digital divide concept refer?- van Dijk explores the literature and categorises inequalities as technological, material, immaterial, social and educational, much in line with the discussion above;
- What is new about the inequality of ICT access and usage? – to analyse this, van Dijk (2006) suggests taking a historical perspective;
- Do new types of inequality rise or exist in the information and network society? If so, what?

Building from these initial questions van Dijk (2006) develops his set of divides:

- Types of access – defined as a technological opportunity (or lack thereof), as focused on by much of the research;
- Material access – the financial ability to acquire the physical access to the necessary technology and networks to use the ICT infrastructure;
- Motivational access – this should rank higher in the order as without the motivation, the material ability to acquire the technology means little;

- Skills access – van Dijk (2006) highlights three digital skills: operational skills-the ability to drive the technology; informational skills-the skills to search for and select information; strategic skills-the skills to use ICTs to achieve a particular goal or set of goals;

- Usage access – van Dijk suggests exploring four parameters here: usage time, usage diversity, broadband or narrowband use, and active or creative use.

Van Dijk summarises these in a hierarchy (Figure 4), suggesting a closed loop process, loop closure being the need or opportunity to seek the next innovation.

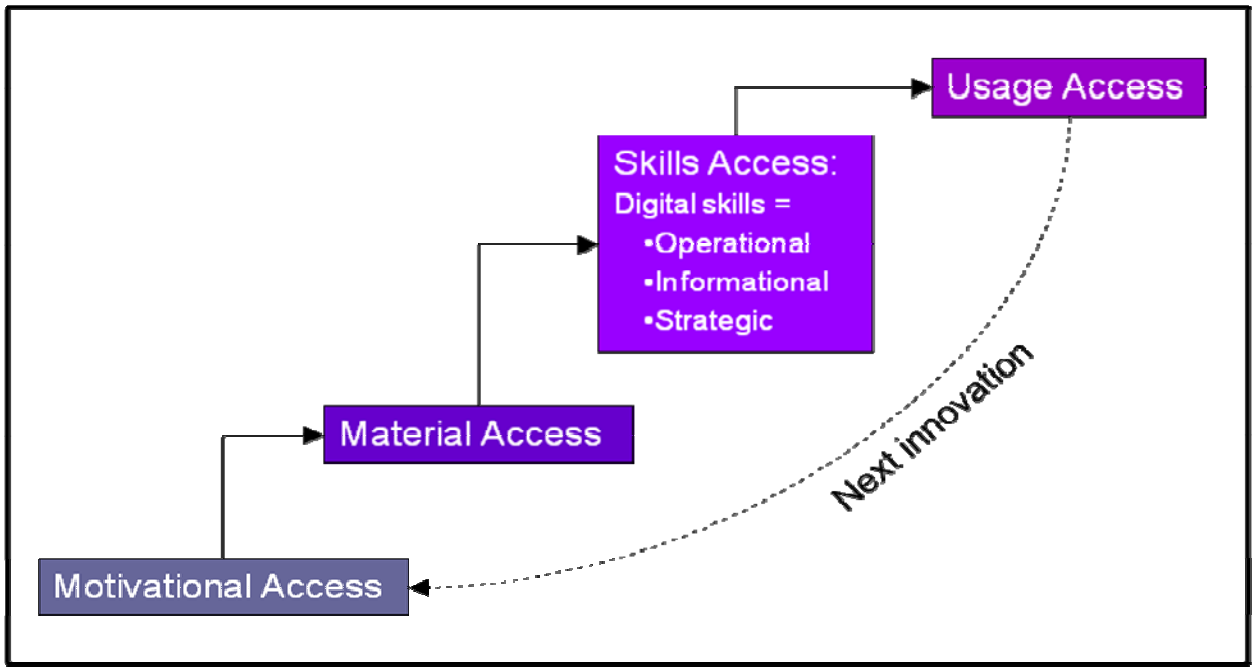


Figure 4 – Cumulative and Recursive Model of Access

(van Dijk 2006)

The combination of the above reviews is summarised in Table 3 below. Four grouping factors are identified and suggested definitions are as follows:

- ICT Connectivity: the physical and financial ability, and freedom, to connect to ICT services;

- ICT Skills: the actual ability to utilise the technology and systems required to use ICT services

- ICT Confidence: the attitude and motivation required to exploit the ICT skills and resources

- Beneficial Usage: the ability to exploit useful and relevant content

It will be noted that the various papers do not always map exactly into the spaces defined, because the authors, naturally, take slightly differing views and place different emphases on the points made. However this does not, it is believed, detract from the validity of the groupings.

Table 3 – Digital Divide Parameters Summary

Factor	Characteristics	Reference
ICT Connectivity	Physical Access	Cullen
	Material Access	van Dijk and Hacker; Fuchs and Horak; van Dijk
	Access to the network and associated infrastructure	Gurstein
	A Gap in access to the use of ICTs	Fink and Kenny
	Technology and/or Telecommunications and Economic Dimensions	Gebremichael and Jackson
	Financial constraints in education; policy, politics and restrictive factors	Mutula
	Types of access	van Dijk

Factor	Characteristics	Reference
ICT Skills	Lack of ICT Skills and Support	Cullen
	Skills Access	van Dijk and Hacker
	Usage capabilities	Fuchs and Horak
	A Gap in ability to use ICTs	Fink and Kenny
	Information Literacy	Gebremichael and Jackson
	ICT Awareness, literacy and skills; HIV/AIDS factor; paucity of research and scientific capacity	Mutula
	Skills access	van Dijk
ICT Confidence	Attitudinal Barriers	Cullen
	Psychological Access	van Dijk and Hacker
	A Gap in actual use	Fink and Kenny
	Attitude change, awareness and skills development; civil wars, gender issues and prioritisation	Mutula
	Motivational access	van Dijk
Beneficial Usage	Content	Cullen
	Usage Access	van Dijk and Hacker; van Dijk
	Beneficial access	Fuchs and Horak
	Make ICT access “usable and useful”	Gurstein
	A Gap in the impact of use	Fink and Kenny
	Information Access	Gebremichael and Jackson
	Local content issues; Communication and community building issues	Mutula

Each of these factors will be explored in more detail, to fully understand them and their meaning.

4.1.2 *Factor 1 ICT Connectivity*

Considering Table 3 above, one might be forgiven for believing that the ICT Connectivity problem is the most important to solve. It might also be argued though, that this is a problem simply solved by financial means – the means to provide the telecommunications networks, and the means to provide the hardware and software. While of course this may simply be provided by subsidy or outright donation, and thereby "solved", it is clearly better to create a demand for services to the point where users themselves make available the financial resources to acquire the services and tools themselves. The discussion below attempts to develop the issues, concepts and problem surrounding the provision of ICT Connectivity in a manner that is useful to the users.

Cullen (2001) opens the discussion on the digital divide with a view from a Gartner report on the digital divide in American society highlighting the USA Internet penetration per socio-economic class based on statistics from February 2000 – see Table 4.

Table 4 - USA Internet Penetration by Socio-Economic Group

(Cullen 2001)

Socio-Economic Group	Internet Access
Lower income	35%
Lower middle income	59%
Upper middle income	73%
Top income	83%

Therefore, being "poor" will directly impact a family's ability to purchase the tools and services to enable them to connection to the ICT universe. Cullen considers the Physical

Access divide as being the “lack of a robust *telecommunication infrastructure* with sufficient reliable bandwidth for Internet connections, and *cost*, the ability to purchase, rent or travel, to utilise without financial hardship, the necessary equipment. Affordable routine access is essential for participation in the new information age”. This view clearly places cost and more importantly, affordability, at the centre of the physical access problem. Cullen points out though, that socio-economics is not the whole problem, illustrated by the comment “lack of a robust *telecommunication infrastructure* with sufficient reliable bandwidth for Internet connections”. The point she raises is that irrespective of social standing, rural communities will suffer reduced connectivity options due to geographic isolation. These reduce typically to low bandwidth and unreliable connections. A further point in Cullen’s discussion is that “routine access” is a pre-requisite for successful use of ICT.

Cullen makes a final interesting point regarding the ICT accessibility for disabled people, regardless of physical disability, although the point is also made that the Internet may be a great enabler for disabled people.

A second description of the ICT Connectivity problem explored by Fuchs and Horak (2006) is one of Material Access, which aligns well with the financial discussion above. Fuchs and Horak go on to explore the concept of the Global Divide, defined as the “Divergence of Internet access between industrialized and developed societies”, and its impact on Africa, illustrated in Table 5 below.

This is supported by data from the Human Development Report of 2005 (UNDP 2005) placing Sub-Saharan African countries in the lower half of the Human Development Index, and South Africa itself on 120 (the lowest ranking is Niger on 177). South African Internet penetration is 7.4%, the highest in Sub-Saharan Africa with the exception of the Indian Ocean islands. The conclusion is that the digital divide is a critical problem in Sub-Saharan Africa, most countries being practically excluded from the information society. Fuchs and Horak believe that Internet access, and usage, has to be assured for developing countries to support inclusive and participatory democracies.

Statistics demonstrate that the African countries with very low Internet access are among the least-developed countries in the world in terms of health, education, and income, suggesting a correlation between “social gaps” and the “global digital divide”. Fuchs and

Horak point out that the UN argues ‘‘the network society is creating parallel communications systems: one for those with income, education and literary connections, giving plentiful information at low cost and high speed; the other for those without connections, blocked by high barriers of time, cost and uncertainty and dependent upon outdated information’’. This is the issue surrounding the Material Access concept as it affects ICT Connectivity.

Table 5 - Internet Usage: Africa and the World 2006

Region	Share of World Population	Internet Penetration (% of Population)
Africa	14.1% (14.3)	2.6 (3.5)
Rest of the World	85.9% (85.7)	17.9 (24.7)
World Total	100.0%	15.7 (21.7)

Note: Main figures from Fuchs and Horak (2006). Figures in brackets updated from Internet World Stats (Miniwatts Marketing Group 2009)

Gurstein adds a commercial view by considering the business interests behind the provision of access capability and services. These are the infrastructure providers such as the telecommunications operators (both fixed and mobile), supported by other operators such as the satellite operators and Internet service providers. These groups clearly benefit from the attention given to ICT connectivity or “access”. A focus on access attracts public attention and subsidies, and developments such as the Universal Service Access Fund in South Africa, supported by the Universal Service and Access Agency of South Africa (USAASA), and the USALs or Under-Serviced Area Licence Operators which are intended to extend the access services in areas with less than 5% teledensity (Claasen 2006). Early in 2008, the Universal Service Access Fund contained about R850million in unused funds (Vecchiatto 2008b).

An extension of the commercial perspective is the market for e-commerce retailers, and the suppliers of information to the public. Governments especially are able to benefit by reducing dramatically their publication and distribution costs by making these “accessible” electronically. Recent announcements in South Africa regarding set-top digital television decoders support this (Digital Broadcasting Migration Working Group 2006).

These agencies and initiatives result in considerable expenditure on ICT infrastructure and the creation of access points such as telecentres at post offices, libraries and schools, but comparatively little is spent on the supporting capacity to use ICT services. Gurstein (2003) in fact questions whether the “access lobby” is concerned with the “usage” side of the digital divide question, and he poses the “access for what” question.

Gurstein (2003) concludes his discussion on “access” by saying that “all can support” it, by providing markets for equipment, extending these to the services markets, once usage picks up.

Van Dijk and Hacker (2000), exploring the digital divide phenomenon in America and Europe (mainly referring to the Netherlands), conclude that digital divide discussions are dominated by the “access” issue. Considerable data on this aspect of the digital divide exists as governments and other agencies collect statistics, categorising them in terms of income, education, occupation, gender, age, race and location. They illustrate graphically the differences between the social categories between low and high income, elementary and university education, and so on.

For America, the Gap of Income vs Use of Computers is illustrated in Figure 5, below, and the Gap of Education vs Use of Computers in Figure 6 below. These illustrate quite clearly the digital divide as a dependency on income and education. These follow an intuitive pattern indicating that with higher income and better education, the use of information technology increases.

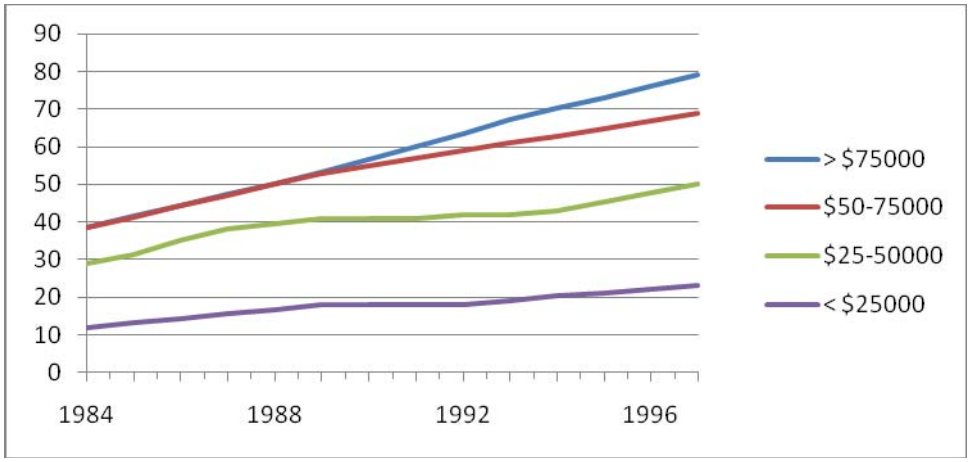


Figure 5 - Gap of Income vs Use of Computers – USA

(van Dijk and Hacker 2000)

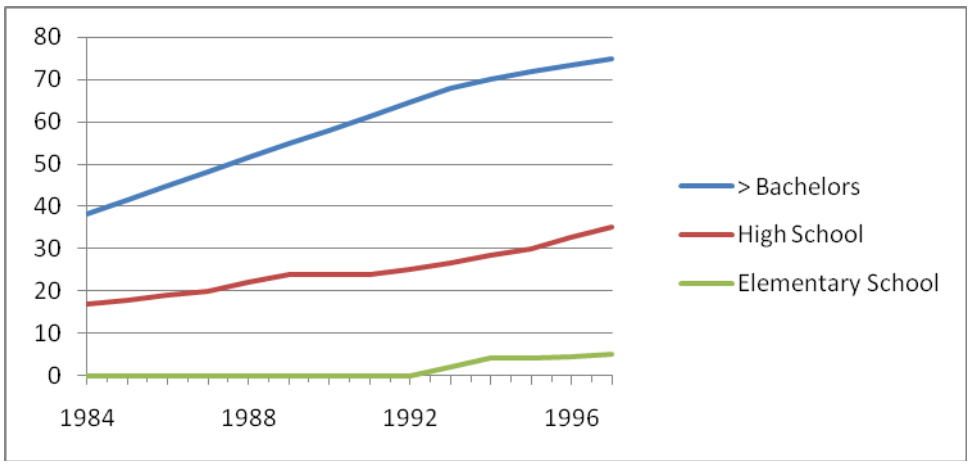


Figure 6 - Gap of Education vs Use of Computers – USA

(van Dijk and Hacker 2000)

Quite interesting in terms of the stark differences is the Gap of Age vs Use of Computers shown in Figure 7 below. Unlike the Age and Education graphs, this highlights the huge divide between the under 65s and over 65s. This may be due to the fact that many over 65s are retirees and no longer have access at work, or to the psychological confidence factors that are explored later.

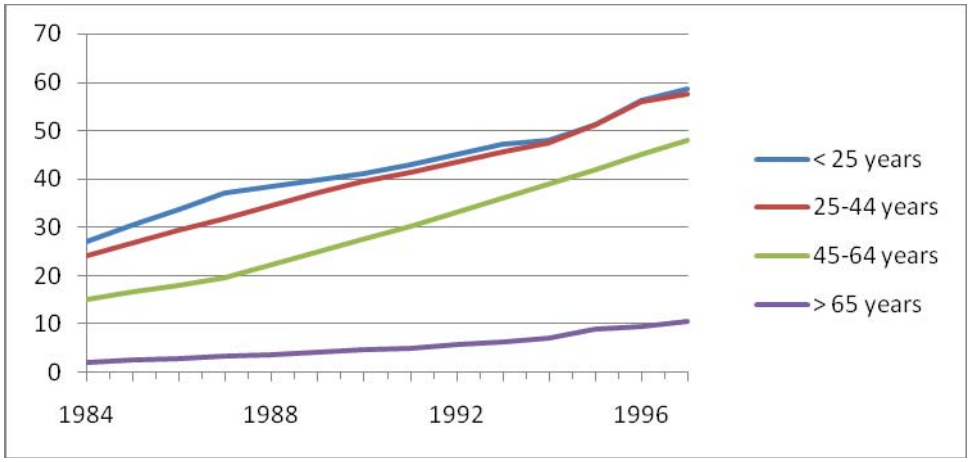


Figure 7 - Gap of Age vs Use of Computers – USA

(van Dijk and Hacker 2000)

In their analysis, van Dijk and Hacker (2000) compare America and the Netherlands. The graphs are essentially similar, but the Netherlands does not exhibit the stark differences of America, perhaps because of differences in the social support structures in Europe against the more market-driven USA.

In Figure 8 above, van Dijk and Hacker (2000) reflect the results of a Dutch Social and Cultural Planning Agency study in 2000, which made an in-depth regression analysis of the weights of the most important variables regarding the possession (or connectivity), skills and usage of ICT tools. Perhaps not surprisingly, Income and Age drive the possession of computers and the associated access mechanisms, with Education and Gender much less important.

Gebremichael and Jackson (2006) explore three dimensions affecting ICT Connectivity, Technology, Telecommunications and Economics. Their analysis focuses on Sub-Saharan Africa, where they point out that only 1 in 13 households have access to television, while only 5.9 million Africans have personal computers. This compares to some 200 million radios that are the most “prominent” mass media device in Sub-Saharan Africa.

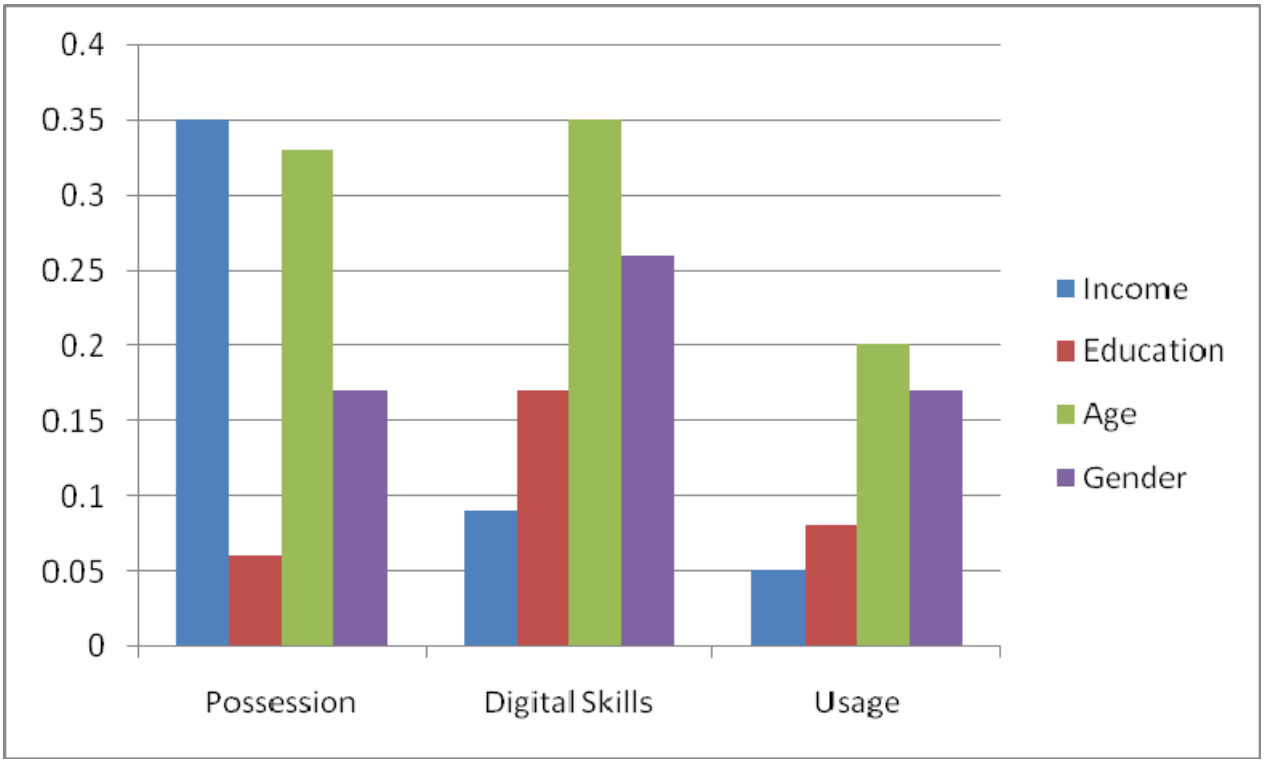


Figure 8 - Multiple Regression of Demographic Variables-Holland

(van Dijk and Hacker 2000)

Statistics of telephone usage reveal a trend that UNICTTF believes might be hamper the bridging of the digital divide. Mobile telephones are rapidly outstripping their fixed line counterparts. Gebremichael and Jackson (2006) quote a UNICTTF report released in 2004 estimating 24 million mobile and 20 million fixed users. A BMI-Techknowledge study (Hurst and Neilson 2006) has very different numbers showing the vast real and anticipated growth, illustrated in Table 6 below.

The UNICTTF position as described by Gebremichael and Jackson expresses concern about the trend to increasing mobile usage to the detriment of fixed line infrastructure, as this might hamper Internet usage growth as this is traditionally built around fixed-line infrastructure, continuing to marginalise this segment of the world's Internet population.

Of particular interest in these numbers is the fact that Sub-Saharan Africa contains South Africa, the regional powerhouse, with an equally poor fixed line penetration. Telkom SA, the incumbent operator, reports a 9.5% fixed line penetration rate for its financial year ending in March 2008 (Telkom SA 2008a), against 10.1% for 2004 ie a decline.

Table 6 – Mobile vs Fixed Telephone Users

Paper (Year of statistics)	Mobile Users	Fixed Users	Ratio Mobile:Fixed
Gebremichael and Jackson (2004)	24milion	20million	1.2:1
BMI-T (2005) (Hurst and Neilson 2006)	90million	11.7million	7.7:1
BMI-T (2010) (Hurst and Neilson 2006)	169million	12.9million	13:1

By way of comparison, Figure 9 illustrates fixed and mobile penetrations in selected African countries for the year 2006 (ITU 2007). This simply re-emphasises the dominance of mobile connections, while graphically illustrating the under-development of the fixed line sector.

Gebremichael and Jackson (2006) further illustrate practical difficulties in ICT Connectivity in Sub-Saharan Africa by contrasting the US$15 per month it might cost a USA Internet subscriber with the US$68 per month for 20 hours of Internet usage which is the African average. Contrast this with the average GDP per capita for Sub-Saharan Africa of US$1856 (UNDP 2005) or US$155 per month. Gebremichael and Jackson (2006) highlight the practical reasons for these high costs as being low teledensity, limited information infrastructure, and shortages of trained staff and even clientele. They

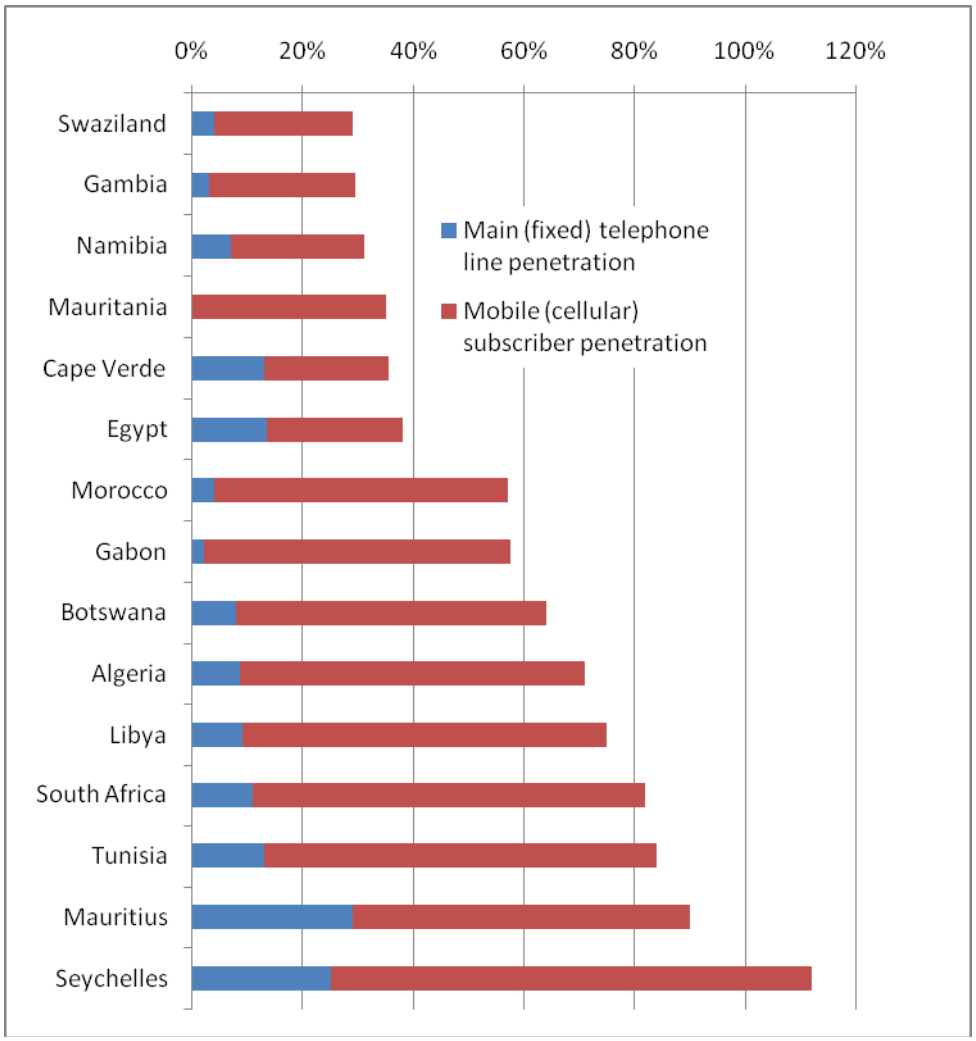


Figure 9 – Top 15 African Countries with Highest Penetrations – 2006

(ITU 2007)

note that Internet providers tend "to follow the paths of good telephone lines, middle-class markets, and money, hence exaggerating the rural–urban digital divide".

Mutula (2004) continues the exploration of the digital divide in Sub-Saharan Africa by looking at financial constraints plaguing educational institutions in the region. He highlights the reduction of student subsidies by 50% at the University of Zimbabwe in 1999, the lack of budget allocation for capital development at the Botswana University in 2004, and the merger process between universities in South Africa as indicators of the financial constraints on places of higher learning. This leads to underfunding of the

institutional libraries and equally their ability to acquire ICT connectivity equipment and services.

Mutula points to what he terms “elitist” institutions, ie universities, government offices and corporates, as typically having the best ICT facilities in the region, although largely under-utilised. He notes that in some cases this is due to restrictions on who may use such facilities in these institutions.

High taxation on ICT equipment and the provision of subsidised services may also contribute to lower affordability and penetration, by reducing the competitive space as a result of subsidies. Subsidies though, do have their place in non-profitable or less profitable areas.

Interestingly, Mutula points out that authoritarian regimes in Sub-Saharan Africa have tended to limit the provision and uptake of ICT services by not stimulating an environment of independent thinking and free media, and in some cases deliberately stifling it by restrictive measures such as the Access to Information and Protection of Privacy Amendment Bill in Zimbabwe, and the Prohibition of Hate Speech Bill in South Africa.

Fink and Kenny (2003) have analysed the digital divide looking at the distribution of telephones and computers and how the divides in these areas reflect the prevalence of what has been defined as the digital divide. Their analysis considers whether developing countries are really falling behind, and whether “per capita stock” (or access) or use rates are meaningful measures. They suggest that a different perspective arises when using “per income” measures.

To answer the question of whether poor countries are really falling behind, they consider the average annual growths of telephones (Figure 10) and Internet users (Figure 11) per capita (based on World Bank 2002 data), pointing out that developing countries (defined as Middle Income and Low Income in the figures) appear to be growing faster than developed countries. Their contention is if this trend continues, the developing countries must catch the developed countries and therefore the digital divide gap is closing.

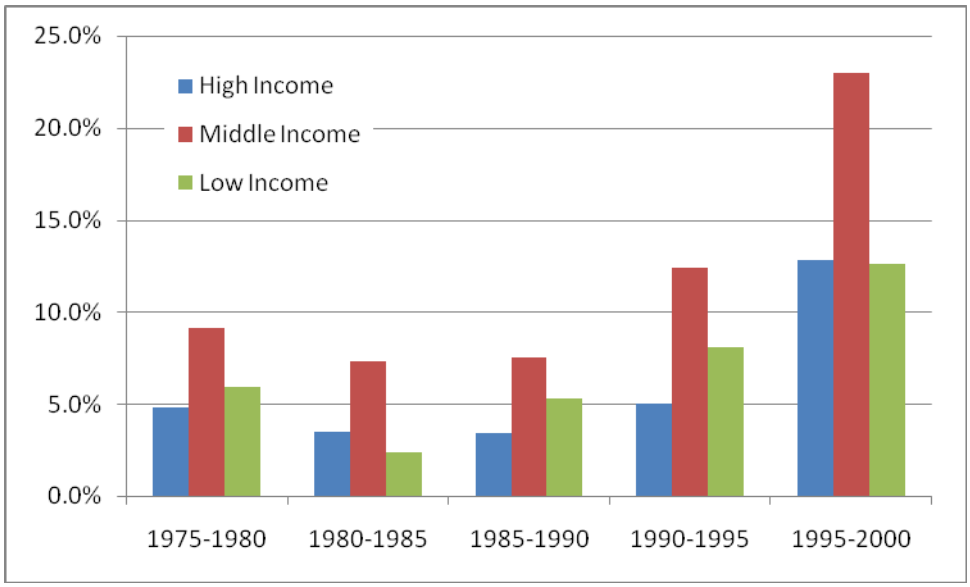


Figure 10 – Average Annual Growth of Telephones/Capita

(Fink and Kenny 2003)

Of particular interest are the early Internet users' growth rates in developing countries, which clearly reflect the very low base off which they started.

Fink and Kenny (2003) then develop a new measure which they define as a per income measure. This is illustrated in Figure 12 below. Of particular note, is the crossover of the middle income countries over the high income countries in 1998/9, and the trend towards a similar crossover by low income countries possibly by 2002. They call this the "digital leapfrog".

Although not concluding which measure is most accurate, nor most objective, they simply point out that conclusions may be vastly different depending on the denominator used, and whether one is comparing absolute values, such as Internet users/capita, or the growth rate of Internet users/capita.

Fink and Kenny's (2003) work does not contradict other analyses presented above, but simply applies different perspectives to it. In particular, it presents an international comparative view of the digital divide from an ICT Connectivity perspective based on real numbers.

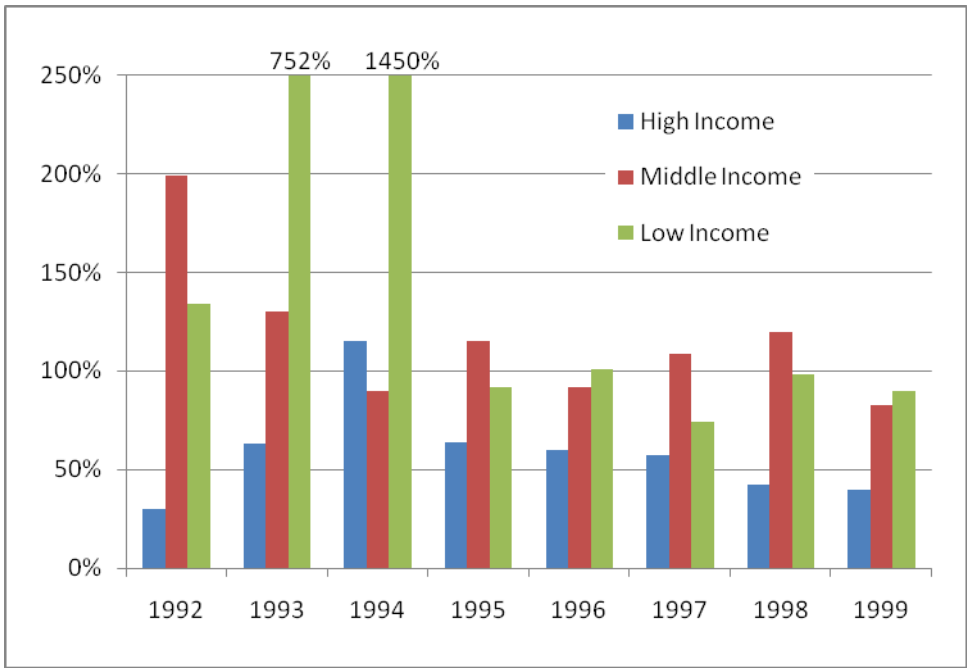


Figure 11 - Average Annual Growth of Internet users/Capita

(Fink and Kenny 2003)

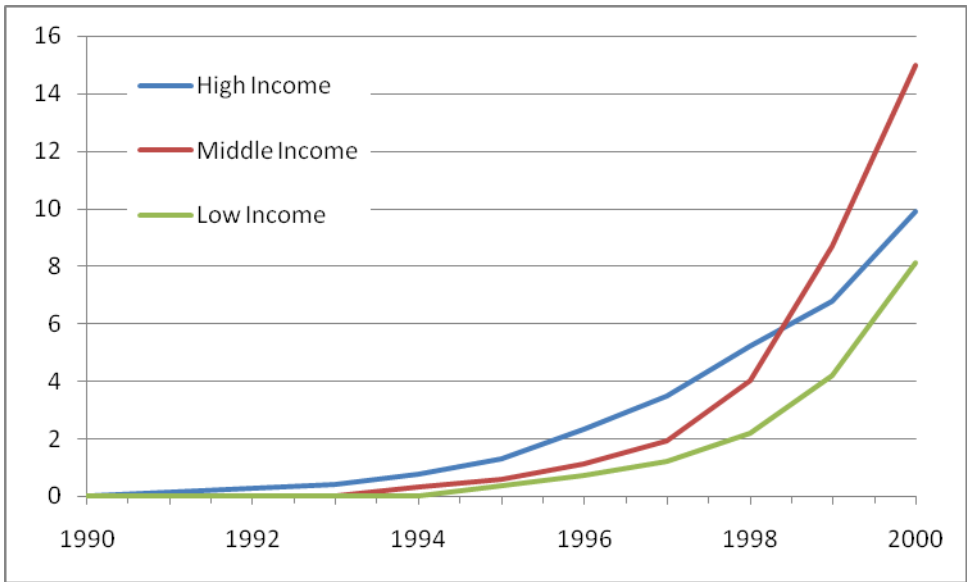


Figure 12 – Internet Users/GDP

(Fink and Kenny 2003)

One might better conclude that the real differences lie in the ability of different countries to take advantage of the ICT revolution. This line of discussion is further pursued in Section 4.1.5.

Van Dijk (2006) observes that digital divide research began with considering the persons possessing of computers with network connections as having “technological opportunity”. His belief is that early digital divide studies led to increased penetration of equipment and connectivity ie the physical access component. But since 2002, the analysis has begun to extend “beyond access” and to consider the social, psychological and cultural issues.

Van Dijk (2006) revisits his earlier work (van Dijk and Hacker 2000) which suggested that possession of the necessary ICT tools was heavily income and age dependent (see Figure 8), and suggests that although the cost of computer equipment has declined, it is still the most important factor for material access, and that “in poor countries lack of income remains the decisive barrier”.

A significant point made by van Dijk (2006) regarding material access is that it is preceded by motivational access as illustrated by Figure 4 above.

In summary, there is broad agreement between the papers reviewed above on a number of factors that cause a digital divide in ICT Connectivity. Clearly the availability of public infrastructure is a sine qua non for bridging the digital divide. This is followed by the means to possess the tools ie computers, software and network connection, to be able to access and begin to utilise the Internet with all that it offers. Affordability is the other side of the possession coin, lowering the barriers posed by low income levels. Once these material access constraints have been bridged, we can start to measure the Internet penetration into communities. This is where the digital divide becomes starkly visible: the difference between industrialised and developing countries is huge, exemplified especially in Africa with its extremely low degree of penetration. However, a per capita income measurement of penetration suggests poorer countries do measurably better than their rich counterparts.

Building on the above theory, studies have confirmed strong correlation between income and education in the US and material access, whereas in the Netherlands the strongest access correlation is between income and age. Ironically in Sub-Saharan Africa, many educational institutions suffer from extremely unsatisfactory Internet access, where one might have though such institutions should be clearly targeted, perhaps preferentially.

Interesting in this context is that in Sub-Saharan Africa, it is believed that on the one hand, Internet access and usage are important support pillars for democracy, while on the other hand, authoritarian regimes have limited ICT penetration due to their restrictive approach to free thinking and speech.

Finally, and perhaps counter-intuitively, it is believed that the development of mobile telephony at the expense of fixed line telephones has a detrimental effect on achieving improved Internet penetration, and again in Sub-Saharan Africa, mobile telephone numbers as opposed to fixed, would bear out this belief, although this has not been offered as a rigorous hypothesis, it may be worth further study.

Once ICT Connectivity has been achieved, and it is clearly pursued as an end in itself, the other aspects of the digital divide become relevant in achieving our fuller understanding of the problem.

4.1.3 *Factor 2 ICT Skills*

Once the mainly ICT Connectivity problem is solved, the problem of the digital divide in some respects is just beginning. Connectivity is a mainly technical and financial problem, whereas the balance of criteria is more social in nature, being skills, confidence and usage. These cannot simply be fixed technically. Financial input will certainly help with the education needed to boost skills levels and so on, but cannot be a solution in itself.

Cullen (2001) points out that disadvantaged people possess low levels of computing and related technology skills, often coupled to, or as a result of, low literacy levels. The average illiteracy rates in Sub-Saharan Africa as example are 42% (UNDP 2005), measured over 45 countries. South Africa comes in at 18%. Business and professional people, by virtue of their occupations or where they work, get access to ICT services and develop the necessary skills to use them. This leaves manual workers and young people without tertiary education, or without home exposure, in similar disadvantaged positions. If ICT skills are not valued, they will not be acquired.

Certain skills are valued in certain communities and people develop these first, often through necessity, such as learning to drive and repair cars, sporting skills, or even electronic banking skills, albeit that these are at the higher end of the spectrum.

There is, of course, an inter-dependence of cost, access to equipment, educational achievement levels, cultural, age and gender factors which all work against the distribution of skills in disadvantaged communities. These are the obstacles to be overcome when attempting to establish the necessary ICT skills to exploit ICT services.

The objective of using ICT systems is to reach and extract useful online content, but this is not possible without the abilities to operate the hardware, software and networks (Fuchs and Horak 2006). The concept is also captured in the term “cognitive access”, to which Fuchs and Horak refer, the cultural skills needed to participate comfortably in the information world.

Fuchs and Horak (2006) review a selection of benchmarking studies which attempt to provide an objective understanding of the levels of skills and usage. The European Union uses a set of indicators, one of which measures the percentage of individuals using the Internet for specific purposes such as sending or receiving emails, finding information about goods and services, reading online newspapers, playing games and downloading music, Internet banking and so on. Other indicators reflect usage for health information, or training and education. These types of statistics are unfortunately not globally available. The United Nations use the UNDP Education Index that is largely based on adult literacy.

More recent studies by the ITU (ITU 2007) looking at Telecommunication/ICT trends in Africa, produce some interesting results. Figure 13 illustrates the levels of Internet penetration in the Top 15 African countries.

However, Africa suffers terribly from limited connectivity to the world, which is either reflective of the lack of demand, or a damping factor on demand. The ITU (2007) analysed the bandwidths available per country in Africa with the conclusion that 16 countries in Africa still rely on a single 10 Mbps international Internet connection (or less). African countries altogether had a total of 28 Gbps bandwidth available in 2006, while, for comparison, Asia accounted for 810 Gbps of the world’s 5500 Gbps bandwidth. Norway with 43 Gbps, had 1.5 times the bandwidth of all Africa, for a population of 4.6 million (CIA 2008), compared to the African population of some 955 million (Miniwatts Marketing Group 2009).

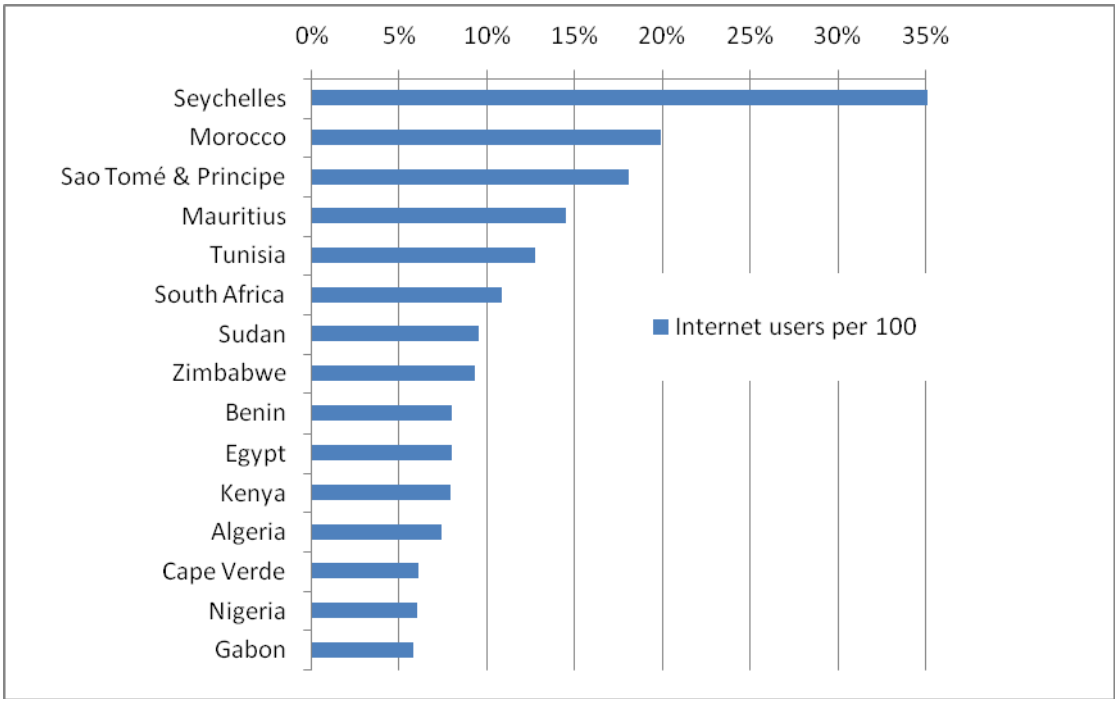


Figure 13 - Top 15 African countries - Internet users per 100 inhabitants, 2006

(ITU 2007)

That the lack of bandwidth may dampen demand is borne by recent press statements by Michael Malone, CEO and founder of Australian Internet service provider iiNet: “Demand and not supply is the driver for broadband. If there is supply, demand will rise to meet it, and possibly exceed it” (Vecchiatto 2008a).

A final modern statistic is the Economist Intelligence Unit’s e-Readiness Rankings, which place South Africa 35th and Nigeria 62nd out of 69 countries surveyed (Economist Intelligence Unit 2007). E-readiness is the “state of play” of a country’s information and communications technology (ICT) infrastructure and the ability of its consumers, businesses and governments to use ICT to their benefit. This underlines the huge digital divide between Africa and the world, and within Africa itself. The ITU (2007) states bluntly that “Affordability, lack of fixed line infrastructure and a low level of ICT literacy are the most striking reasons for the low levels of Internet use in Africa.”

In the study performed by van Dijk and Hacker (2000), illustrated in Table 7 below, it is highlighted that 36% of the population of the Netherlands had no or very few skills in 1998. The table also shows the age, gender and educational gaps. It was suggested that

subjective and emotional factors are responsible for this, as will be explored further in Section 4.1.4.

Table 7- Skills in the Use of PC programmes Netherlands

(van Dijk and Hacker 2000)

	No or very few skills Score 1,0-2,0	Reasonable Skills Score 2,1-3,5	Good Skills Score 3,6-5,0
All Ages	36	52	12
18-34 years	27	56	17
35-49 years	37	54	9
50-64 years	48	46	6
65+	67	31	2
Gender			
Male	28	55	17
Female	45	49	6
Education			
Low	69	25	6
Low-middle	49	46	5
High-middle	30	58	12
High-middle	27	55	18

Van Dijk and Hacker (2000) point out that “PCs and computer networks were renowned for their user-unfriendliness until well into the 1990s”, with improvements only coming with the appearance of graphical tools that simplify and make interaction with the computer more intuitive. They go on to suggest that “real practice and motivation are more important in acquiring digital skills than formal education”. This may be borne out by later studies after the full impact of graphical tools, and the absolute necessity to employ ICT technology in the workplace, has been analysed.

Van Dijk and Hacker (2000) argue that while there is some opinion suggesting there isn’t necessarily a digital divide, but more a spectrum of gradual differentiation between levels of digital users, the divide in terms of skills and usage may persist and even grow. They

believe this is a more critical divide in fact. Measurement of the digital divide is still problematic outside the Connectivity area. The skills or cognitive component may be measured by considering literacy, numeracy and *informacy*. The first two are self-explanatory but informacy is equated to digital skills and is reflected by the operation of ICT technology, and the searching for information in the ICT space. These three measures explain together more than simply educational level.

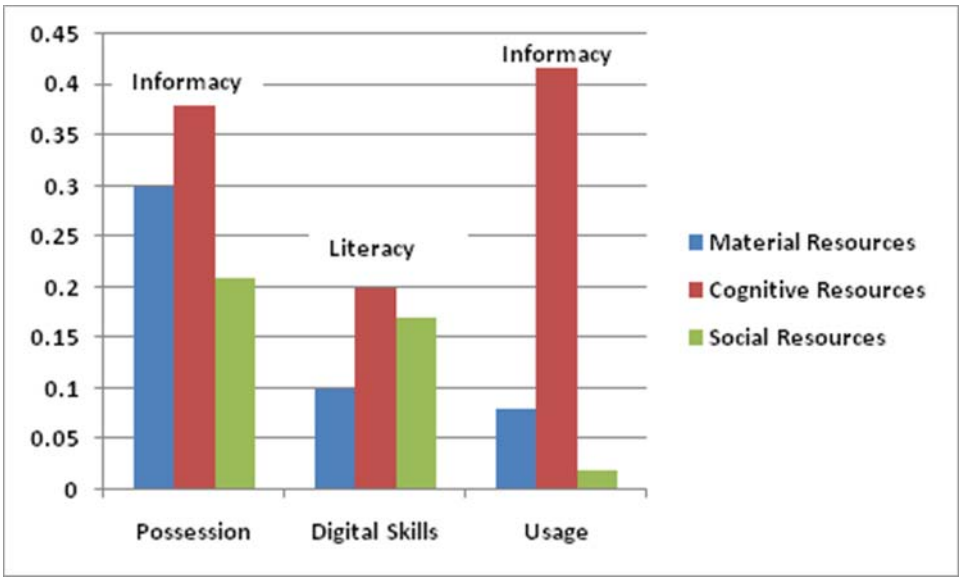


Figure 14 – Resource Comparisons – Holland

(van Dijk and Hacker 2000)

In Figure 14 above, it is suggested that informacy is the dominant Cognitive resource driving the possession of ICT technology and its usage, whereas Literacy appears to drive skills acquisition. The role played by the Social resources is not trivial in possession and skills development, and reflects Cullen's view (Cullen 2001) on the acquisition of skills if they are valued in the community. Notably from the graphic, numeracy is not the key cognitive skill, reflecting the fact that computers today are no longer solely number-crunching machines.

Van Dijk and Hacker (2000) state that "in an information society information is a so-called primary good", and everybody needs it to function in the society. However people also need "cultural capital" reflected by skills to select and process information. This cultural capital is very unequally distributed in society, which is why, although the possession or connectivity divide may be closing, or is "closable", the skills divide may persist.

The theme of digital literacy is taken up by Gebremichael and Jackson (2006), with the remark that literacy on its own is insufficient. Although Sub-Saharan Africa has made enormous strides in literacy (albeit still unacceptably low (UNDP 2005)), the lack of digital literacy will hamper ICT skills development. Explicit investment will be required to address this deficiency. A view is expressed that as much as three-quarters of the Sub-Saharan African population are behind in the adoption and usage of ICT tools, with the division being along all lines: age, gender, rural and urban, education and employment, simple illiteracy, ignorance and poverty. All these factors present huge hurdles which need to be overcome. The G-8 Digital Opportunity Task Force in 2001 recommended a plan of action leading to the creation of eStrategies promoting amongst other things, the improvement of traditional and digital literacy. The practical difficulty of boosting digital literacy in an environment where conventional illiteracy is as high as 42% (UNDP 2005) is very high, and in effect further divides Sub-Saharan African dwellers from the rest of society. To compound this problem, one may add the differences in written and spoken languages, including mother-tongue education issues. To deal effectively with the digital divide in addition to the connectivity issues, which is in itself not trivial, information literacy is vital, in addition to traditional literacy.

Mutula (2004) emphasises the ICT Awareness, literacy and skills in Sub-Saharan Africa. He shows that Sub-Saharan Africa is in the lowest third of the world literacy rates, posing a serious challenge to developing an indigenous ICT industry with its supporting infrastructure. Importantly too, he notes that post-literacy programmes to prevent relapses into illiteracy are missing, and literacy sustainment is difficult. Compounding the basic literacy insufficiencies, libraries and publishing are underdeveloped.

Furthermore, tertiary education enrolment is poor, limiting the management expertise that could otherwise stimulate ICT developments in Sub-Saharan Africa. He quotes Botswana at 4.7%, Namibia 5.9%, Mauritius 11.4% and South Africa at 15.3% tertiary enrolment in 2001. He contrasts this with Canada and Estonia at 60% and 57.6% respectively. The low tertiary enrolment projects into poor research and scientific capacity, in turn aggravated by budgetary constraints in the region. As a result, research output diminishes and hampers the expansion of the ICT skills base to point where it becomes self-sustaining.

Mutula supports the contention that skills develop along lines of need by describing a case in Botswana where in response to a survey on technology needs, people indicated needs relating directly to their livelihoods eg where to buy and sell produce, information on anti-retroviral drugs and so on. However, they also indicated their need for clean water, electricity and roads.

Lastly, Mutula believes the HIV/AIDS pandemic acts as an “Internet retardant”, absorbing funds in direct treatment of the disease, rather than in information tools like ICT that might ultimately be more effective at halting the scourge.

Fink and Kenny (2003) accurately identify that a dividing factor is the gap in ability to use ICTs as measured by considering the skills base, but fail to develop the idea further, concentrating purely on the access component.

Van Dijk (2006) discusses three ICT skills. Firstly he discusses the operational skills, simply the ability to use the technology, the mastery of the hardware and software. He notes that these are well covered by research and are established in public opinion, with the belief that once mastered, the skills problem is solved. However, van Dijk shows that informational skills and strategic skills are equally important.

Informational skills are the skills to “search, select and process information” in the ICT space. He further distinguishes between formal and substantial skills, the former being the ability to deal with the characteristics of the Internet and its tools, computers, files and so on, and the latter being the ability to “to find, select, process, and evaluate information in specific sources following specific questions”.

Strategic skills van Dijk (2006) defines as the capacity to use the ICT tools to achieve specific goals, coupled to a general goal of improving one’s position in society.

The common theme through the discussion on ICT skills is literacy, as the underlying reason for poor ICT skills, with Sub-Saharan Africa and South Africa having illiteracy rates of 42% and 18% respectively. This discrepancy is illustrated from a slightly different perspective by the e-Readiness Rankings, placing South Africa 35th and Nigeria 62nd out of 69 countries surveyed. A question raised is the emphasis placed on ICT skills in poor communities, and that valued, and perhaps more immediately practical skills are

developed first. Age, gender, rural vs urban, education and employment, simple illiteracy, ignorance and poverty all combine to retard Sub-Saharan African adoption and usage of ICT tools.

Before valuable use may be made of the ICT technologies, it is necessary to have the basic hardware, software and network skills, referred to as “cognitive access”. This cognitive component has sub-components of literacy, numeracy and a new term “informacy”. This reflects that literacy on its own is not enough and that notwithstanding improving Sub-Saharan African literacy levels, the lack of digital literacy will hamper ICT skills development. However, there is major practical difficulty in advancing digital literacy where conventional illiteracy is high. This aggravates divisions between Sub-Saharan Africa and the rest of the world. Differences in written and spoken languages, and mother-tongue education issues, compound the problem.

Specifically, the skills sought cover operational skills, and the ability to use the technology, which are the most noticeable. Informational skills to acquire specific information, and strategic skills to achieve specific goals, begin to add real value to users’ ICT usage. A positive aspect of operational skill development is that PCs and computer networks are becoming “friendlier” through their graphical interfaces. While considering that the digital divide may not be a sharp line, the divide in terms of skills and usage may even be growing.

Stimulating ICT developments in Sub-Saharan Africa through tertiary education is similarly problematic, with low enrolment levels, and as a result, limiting the pool of management expertise. Further the HIV/AIDS pandemic absorbs funds in direct treatment that might have been spent promoting information access for longer term prevention.

Finally, Africa still has very limited connectivity to the world, and within itself, and this lack of bandwidth may be dampening demand by raising costs, and reducing performance. This will naturally be an inhibitor of skills expansion.

4.1.4 *Factor 3 ICT Confidence*

Skills and confidence are perhaps two sides of the same coin, with one affecting the development of the other. This concept can then be developed (Cullen 2001) into attitudes towards the technology per se, for instance that males and “clever” people are more likely to use computers, and the same for old vs young people. Attitudes may also be affected by concerns over information security, and issues surrounding the unsuitability of some Internet content.

Cullen (2001) indicates that while in developed societies such as Australia, USA, Singapore and UK, the gender balance is fairly good, in developing societies, gender disparities are much greater, with female access as low as 5% in some areas. She states that this wastes the potential talent where it can be ill afforded. Other cultural issues may relate to a tradition of oral communication such as in Maori communities in New Zealand, where the value of computers as a communication tool is not appreciated. Cullen suggests this might also apply to any groups emerging from an oral culture, or illiterate rural communities in the developing world.

Van Dijk and Hacker (2000) develop the confidence question more deeply, as a question of “psychological access”, considering the “fears” that potential users have of the technology. They quote a Dutch study suggesting that insecurity might exist due to concerns over personal shortcomings in using the technology, giving rise to “computer fear” or “button fear”. Mention is made of information “want-nots” as opposed to simply “have-nots” due to such fears. A German study found that perceptions of “PCs reducing social contact” and “PCs damaging health” come to the fore, as reasons for non-use.

Mutula (2004) quotes the SADC E-Readiness Task Force findings in 2002 as saying that a “paradigm shift was needed in social attitudes and skills levels vis-à-vis technology within most communities, both urban and rural, within both private and public sector organisations in the Southern African region in particular, and the rest of Africa in general”. The study quoted also points out that fax and courier is still the major vehicle for transmission of information, albeit that the countries have adequate communications networks to support email, and other Internet-based communication. This situation is attributed to an attitudinal problem.

Contrary to what is suggested by the UNICTFF (Gebremichael and Jackson 2006), in Mutula's view, wireless devices such as mobile phones are becoming Internet delivery tools, or at least have the potential to usefully play a role. However land-lines in Sub-Saharan Africa are still the major Internet delivery mechanism, despite their poor development.

Motivational access as described by van Dijk (2006) is the starting point for bridging the digital divide, before the other dividing issues. He believes that many people on the "wrong" side of the digital divide have motivational problems. This leads to a feeling that you are either in or out of the Internet revolution. Some exclude themselves, the "netevaders" who refuse to use the Internet, such as older managers getting secretarial resources to do their ICT work for them – "computers are women's work".

Building on the concept of fear, there is the phenomenon of "computer anxiety" which manifests as stress, or a straightforward fear when faced with having to use a computer. Closely related, is technophobia, the fear of all things technical and misgivings about its value. These are major constraints to using ICT, and are found mostly among the elderly, poorly educated people and females. Interestingly, these symptoms do not necessarily vanish even with increasing ICT.

ICT confidence then is a matter of attitudes and beliefs surrounding ICT technology eg it is for males and clever people, for the young not the old. Gender disparities are very noticeable in underdeveloped societies, wasting the scarce skills. Cultural traditions of oral communication retard acceptance of the tools, afflicting particularly illiterate rural peoples.

ICT confidence is also a matter of straightforward psychological fear of the devices, to the extent that people opt out of the technology and its benefits, becoming "want-nots" or "netevaders" to avoid having to deal with ICT tools. In rural and undeveloped countries, a major shift is needed in general attitudes to make ICTs more acceptable.

Motivational problems lead to feelings of being in or out, or on the "wrong" side of the digital divide. Computer anxiety and technophobia complete the picture of people unable to come to practical terms with ICT devices and systems, even with regular usage.

4.1.5 *Factor 4 Beneficial Usage*

Beneficial usage is really the ultimate goal of ICT for most people, to obtain value from their investment in time and money in acquiring the relevant devices and services, and learning how to master them. Making content useful and relevant is also important to make usage effective.

Cullen (2001) comments that irrelevant or uninteresting Internet content will not stimulate usage which will decline. This is especially so when the users are outside the Western Internet culture. Internet content is a key component of using the Internet as an economic development tool. Using the Internet to benefit oneself and thereby society as a whole, is the basis of beneficial usage (Fuchs and Horak 2006). This divide is aggravated by the differences in education – better educated people use spreadsheets, databases and so on, and use the ICT-derived information quite differently to those with lower educational levels, who might be more likely to using the Internet for gaming.

Gurstein (2003) suggests a definition of effective use of ICTs as “The capacity and opportunity to successfully integrate ICTs into the accomplishment of self or collaboratively identified goals”. He notes that considerable development resources have been and are being committed to creating ICT infrastructure, but comparatively little effort has been invested in expanding local capacity for “developing, managing and maintaining ICT capabilities”.

Clement and Shade (Gurstein 2003) believe the three main questions are: “1) Access for what purposes?; 2) Access for whom?; and 3) Access to what?”. Without addressing the “Access for what purposes” question, the discussion about solving “access” as the means to solving the digital divide has limited value. Gurstein (2003) points out that the challenge in the usage context is that of ensuring ICT users can do “locally significant” things with their ICT tools. These may be economic, social and political. He postulates that when users can use the technology beneficially, they will find ways of getting access. Cyber cafes are a good example of this.

Gurstein believes we need to make clear distinction between the access digital divide and the “effective use” digital divide. The ICT tools can make major inroads into changing one’s situation in multiple ways: reaching new markets for small and micro enterprises,

making minorities heard, informed participation in political processes, to list but a few. He says once physical access is achieved, then “with that access having the knowledge, skills, and supportive organizational and social structures to make effective use of that access and that e-technology to enable social and community objectives”.

Gurstein continues to develop the theme, emphasising that effective use of ICTs goes beyond passive use of the technology ie simply consuming content produced by others, but includes active use of the technology for “productive, wealth creating, and transactional as well as other processes”. He underlines the point that physical access is a pre-condition for ‘”effective use” but insufficient on its own. This broadens into the complete discussion on e-readiness that encompasses the physical components as well as the issues of effective use.

Gurstein goes on to argue that an approach to ICTs based on “communications rights” is limiting as it misses the point that ICT are in reality the “production and management tools of the information economy”. He summarises by contending that by focusing more on the “effective use” issue, funding priorities may be changed away from the simplistic argument around basic access only.

Van Dijk and Hacker (2000) recognise that usage is an important parameter in measuring the digital divide. However, they caution that as Internet penetration grows, and the Internet population becomes better able to use the technology, new divisions and their associated challenges may begin to arise.

Grabill, in Gebremichael and Jackson (2006), makes the point that access to information is not the solution to the digital divide, but rather that people need to be taught how to use the information, and to produce ICT information: “Productivity and activity are where the divide will increasingly exist”. The concept of a Democratic Divide, is a related thought, spinning off the use of information for useful public engagement. Gebremichael and Jackson also quote the Okinawa Charter on Global Information Society which contains a suggestion that solving the digital divide must include developing human resources to be capable of meeting the demands of the ICT age.

A practical ICT usage which will benefit communities, discussed by Gebremichael and Jackson (2006), is that of telemedicine. It might be argued however, that this is a very

specific benefit, whereas the broader ICT usage benefits accrue when spread across the communities, with the community members themselves using the technology, rather than by proxy as telemedicine.

Mutula (2004) takes this point and develops it, quoting Woherem that “unless ICTs are integrated into the cultural milieu of African communities, the people will stand fewer chances of benefiting and therefore accepting such technologies”. This “cultural integration” reflects directly on the question of beneficial usage. Mutula continues to point out that local content, embracing locally owned and adapted knowledge, is inadequate. The cultural integration required is to bridge the gap between the tacit knowledge and traditions that are threatened with extinction, and the ICT systems. The local content gap limits the sharing of knowledge and experience via ICTs despite the communal nature of the people. The gap is filled by “western iconography”. Mutula specifically refers to the limited number of local hosts in Sub-Saharan Africa, as illustrated by Figure 15, below.

The continuing use of English as the language of “scholarship and science” is “suspected” to contribute to the low pace of Sub-Saharan African industrialisation (Mutula 2004). Even in the USA, people with limited knowledge of English were impeded in their adoption and use of ICT tools. The lack of “empowerment” in the language of the “box” makes adopting it and especially its benefits that much more difficult.

Fink and Kenny (2003) reflect very practically on the gap in the impact of use, specifically as “measured by financial and economic returns from the use of the ICT infrastructure and information”. They illustrate the concept with a practical example of the potential exclusion of Least Developed Country (LDC) players from international trading opportunities against mature players. The developed country producer goes online with a purchasing system, and the LDC producer cannot practically follow suit either from a cost or skills perspective. In this globalised electronic marketplace, the LDC producer can quickly become the loser and they believe there is at least empirical evidence to support this.

Fink and Kenny however do counter the argument by suggesting that notwithstanding the difficulties in fully exploiting ICTs, that the ICT opportunities have in fact enlarged the global trading opportunities for LDC-based businesses.

To measure progress in bridging this aspect of the digital divide, van Dijk (2006) proposes some practical measurements. This is the goal of the whole process and is illustrated by Figure 4 above. The measurements are of:

- Usage time: the actual daily usage time, best measured by time diary studies. Van Dijk (2006) quotes the Dutch Social and Cultural Planning Agency study which through this process identified that in 2001, males used the Internet twice as much as females;

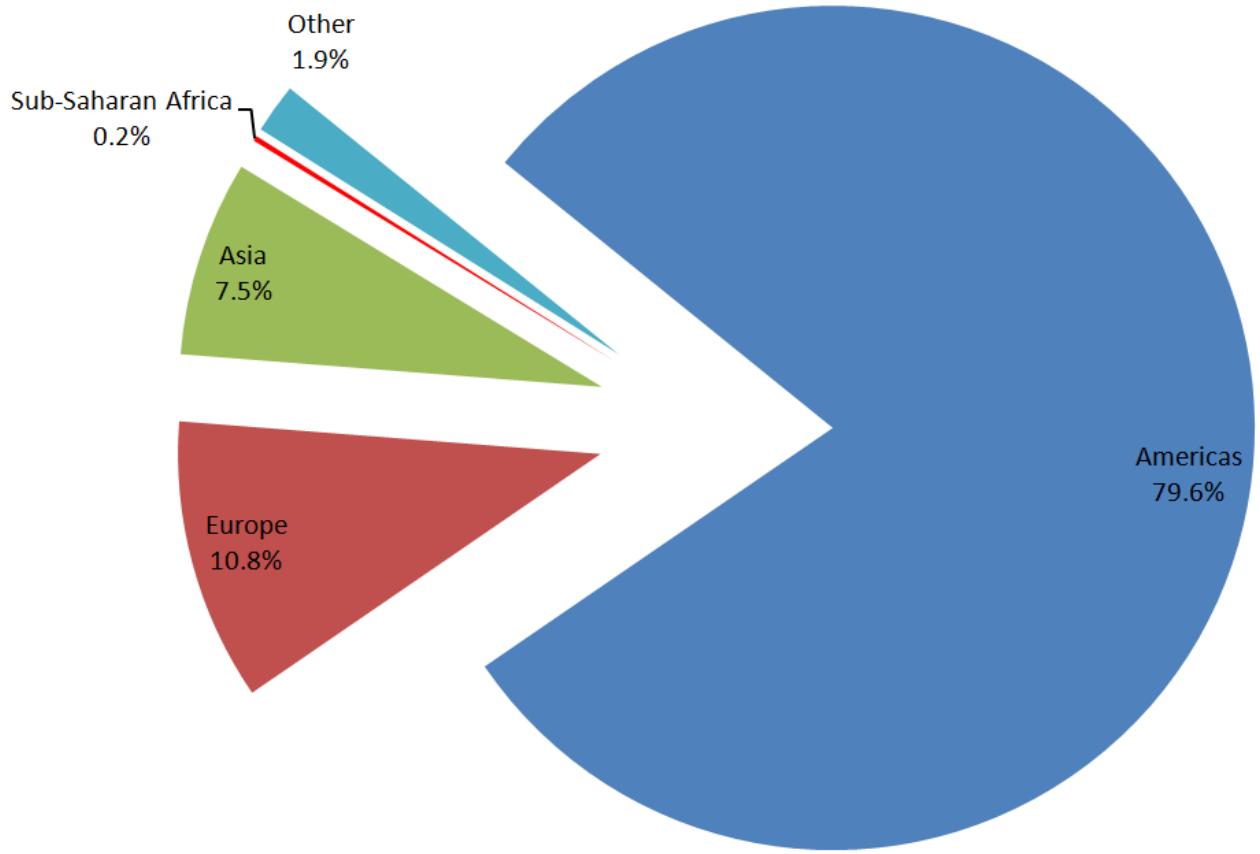


Figure 15 – Global Internet Hosts

(Mutula 2004)

- Usage applications and diversity: users' demographics have a strong influence in this category - social class, education, age, gender and ethnicity all playing a role. Van Dijk (2006) highlights that some investigators perceive a usage gap between social classes which may be compared to the knowledge gap previously identified in the 1970s;

- Broadband vs Narrowband use: while both technologies give physical ICT access, van Dijk (2006) notes that broadband users are able to make better use of the opportunities afforded by the medium. They are less influenced by cost, they use a wider range of applications for longer, and they make more creative use of the Internet;

- More or less active or creative use: the bulk of Internet usage is passive and users are mostly consumers of the content. The exception is email. Active contributions include personal websites, weblogs, postings to bulletin boards and exchanging music and video. Tools such as YouTube enhance this capability noticeably.

Van Dijk (2006) concludes that Internet usage reflects all our “familiar social and cultural differences in society”. He briefly develops three themes around information, which is directly relevant in considering the usage divide:

- Information as a Primary Good, and thus necessary to our very survival;

- Information as a Positional Good which by definition is scarce, despite the feelings of information overload. Quality, targeted information can be scarce in particular situations. Those able to gather and process information, enhance their positions in society, creating an “information elite”;

- Information as a source of skills implies those who can successfully exploit the ICTs and create a skills premium around themselves. This skills premium is already regarded as causing income inequalities between developed and undeveloped countries.

We can therefore conclude by agreeing that beneficial usage is really the definitive goal of ICT technology, to use the Internet to benefit oneself and the community as a whole. To support this, relevant and interesting Internet content is critical to increase beneficial usage. This is especially so when the users are not from the Western Internet culture. This implies integrating ICT concepts into the cultural setting of African communities, making them relevant, increasing the probability that people will accept and use the technology. This will allow people to do the things “locally significant” to them. There is a

view that when potential users see the benefits in ICTs, they find ways around the physical access limitations.

In the Sub-Saharan African region, there is a limited number of Internet hosts, which needs overcoming. This emphasises the point that effective use of ICTs is more than passively consuming content produced by others, but includes active contributions to the ICT world through various means. People therefore need to be taught how to use the information, and how to produce ICT information. This poses the practical difficulty that differences in education result in the better educated people using the information more effectively through additional supporting tools. All players, developed and undeveloped, need to strive to achieve high levels of beneficial usage, to be able to participate fully in the global village.

Measuring the usage poses challenges and the measures of usage time, applications usage and diversity, broad vs narrowband connections and the levels of creativity need scrutiny.

Finally, recognition of where information is situated in modern society and economic life is critical, to be able to accord it its rightful place and value: that is a primary good, and a positional good, and a source of skills. Achievement of this understanding may help in devising the optimal solutions to this aspect of the digital divide.

4.1.6 *Summary*

The digital divide has been explored from four specific angles: Connectivity, Skills, Confidence and Usage. Each has been analysed in the literature to differing extents, and an attempt has been made to reflect the learning here. The concept of “divide” reflects the inequality of how people experience the digital world, examined from the perspectives listed.

Connectivity or Access is clearly a dominant theme in many studies, and is the easiest to explore. It is dominated by the availability of infrastructure and affordability. These constraints reflect the differences between developed and undeveloped countries. Education, income, age and access to the ICT world correlate well, whereas in Sub-Saharan Africa, the educational institutions suffer from lack of connectivity. The greatest

area of penetration of modern technology in this region is mobile telephony, which although not considered beneficial to Internet penetration, may ultimately bring the desired connectivity, albeit mobile connectivity.

ICT skills and basic literacy go hand in hand. The regional literacy rates are very low, and this affects the regional e-Readiness ranking. Skills are developed where they directly add value to peoples' lives, leading to a preference for practical skills in rural areas. Skills distribution by age, gender, rural/urban, education and employment, combined with ignorance and poverty, retard Sub-Saharan African ICT take-up. Concepts of cognitive access and informacy have been developed, built on basic literacy. Developing these in the face of high illiteracy rates is a major challenge. The skills extend from the technical skills to drive the technology, to the informational skills to use the information garnered. The poor connectivity of educational institutions compounds these problems.

Confidence and the attitudes needed to make use of the technology are key criteria to converting the basic access and skills to beneficial usage. ICTs need to be perceived as useful and not just for select individuals. Fear of the complex, "clever" devices is a major inhibitor, compounded by ignorance and cultural issues. Even regular usage may not overcome the technophobic fears.

Lastly, but not least, beneficial usage is really the defining goal of bridging the digital divide. This transforms the technology from simply being technology to being a useful tool. Culturally relevant content is critical to achieving this. Importantly, it is necessary to create an environment where Internet content is created as well as consumed. Information is a valuable commodity in today's society and beneficial use gives the opportunity to transform what may simply be data into something of use.

Overcoming these limitations will enable the bridging of the digital divide.

4.2 Municipal Telecommunications

Having extensively reviewed the digital divide and its components, it is necessary now to consider the other portion of this study, viz Municipal Telecommunications. The review below will consider what Municipal Telecommunications is, where it arose, and what its

goals generally are. This will enable us to understand the potential of Municipal Telecommunications operators to contribute to bridging the digital divide.

4.2.1 *Municipal Entry into the Telecommunications Market*

Around the globe, many municipalities have attempted to enter the telecommunications provider space. The reasons in detail are many, which will be reviewed here. Most are associated with attempts to increase “broadband” penetration. Gillett (2004) provides a simple definition of broadband access as follows: “access is ‘‘broadband’’ if it represents a noticeable improvement over standard dial-up access and, once in place, is no longer perceived as the limiting constraint on what can be done over the Internet”.

Municipal or Local Government are the “stewards of local economic development” (Gillett et al. 2004), and have a need to improve their efficiency through concepts of e-Government, and through their responsibilities for electricity and water infrastructures. The stimulation of telecommunications access services, and especially broadband access, may take the form of direct provision, or incentivising commercial providers. Government can measure demand and if necessary demand can be stimulated through training or technology centres (Gillett et al. 2004). In addition, local government could aggregate demand to reduce costs and pass the benefit on to residents. Alternatively through the awarding of government tenders, the opportunity exists to place conditions on infrastructure provision. Public-private partnerships are possible and in South Africa are supported by the new Electronic Communications Act, as reported by Mochiko (2006). A peculiarly South African driver is explained by Engelbrecht (2008) as being a substitute for the potential loss of electricity revenue with the consolidation of the South African electricity industry and the removal of municipal control over electricity in municipal areas.

In terms of incentivising commercial providers, local government has two key mechanisms (Gillett et al. 2004): they make the rules and they can play a financial role. As policy maker, government grants access to facilities such as rights of way, access to utility poles and cable tunnels, and zoning of wireless installations. Municipal planners may encourage conduit installation during road construction to minimise disruptions. Financial roles include providing grants or loans to service and network providers,

subsidised or free equipment and services to users, and support for community groups (Gillett et al. 2004).

Traditionally, telecommunications access infrastructure, as part of the local loop, has been provided by the incumbent operator, or operators, where a competitive environment exists. These operators are driven by competitive instincts, whereas municipal provision of services may derive from other factors such as political considerations, a desire to provide an alternative to the traditional operators, and may not always be profit driven (Hauge et al. 2008). William French (2006), reporting on the UNCTAD Information Economy Report 2006, notes that UNCTAD have declared Broadband as a new "utility" service, comparable to water and electricity. This is supported by work done by Sullivan (2005) who claims it is a vital part of the 21st century city.

When municipalities decide to become involved in infrastructure and services, they need to carefully choose their mode of involvement. Table 8 below, derived from Gillett (2004) illustrates the main decision components and the opportunities associated with them.

Municipalities enter the markets as wholesalers or retailers (Sullivan 2005). As wholesalers, the municipality may own and fund the network but lease it to private sector operators to distribute the service, who can enter the market without large financial commitments to infrastructure. As retailers, the municipality undertakes the whole value chain, from network through to services such as Internet access, video, telephony and so on. Sullivan states that the Wholesale model has been more competitive and "politically durable", especially when competing with incumbents. In South Africa, several municipalities are already pursuing this model (McLeod 2007).

According to Gillett (2006), it is the municipal electric utilities who are driving the municipal entry into the telecommunications marketplace, especially as owners of the last mile, or more correctly the "first mile" connection ie Access. Gillett considers a number of specific findings, based on US experience, including:

- Where an institution, such as a municipal electric utility, already owns and operates a telecommunications network, they are likely to offer the service to the public. This exploits their experience and attempts to achieve economy of scale, and "economy of scope"

- Conversely, in municipalities where the electricity provision is by others, the municipality is less likely to offer services based on municipally owned wired infrastructure

- If there is effective competition, the municipalities do not tend to enter the market, suggesting that their entry is in reaction to inadequate service offerings from the incumbent operators

These findings are reflected in South African experience, as reported by Czernowalow (2007), describing the “Joburg Broadband Network Project” (JBNP), which is an attempt to take advantage of Johannesburg’s Private Telecommunications Network (PTN) and associated PTN licence, to enter the telecommunications market in partnership with a private sector partner with a value-added network service (VANS) licence. The private network is owned and operated by City Power and the Johannesburg Roads Agency, and includes optical fibre and copper networks. Ekurhuleni sees themselves as an “enabler” of broadband provision to residents, schools, clinics and hospitals (Engelbrecht 2006).

The following summary of services provided by municipal telecommunications departments (Gillett et al. 2006) is the springboard for the development of public services:

- Internal telephone services

- System control and data acquisition (SCADA) for electricity and water networks especially

- Automated meter reading

Gillett et al observe, somewhat cynically, that municipal justification for broadband telecommunications networks is “more likely to win local support when the need for broadband infrastructure is either totally unmet, or poorly met by an unpopular monopoly provider”.

Table 8 – Modes of local government infrastructure development

(Gillett et al. 2004)

Decision Factor	Opportunities
Targeted Users	• Government (including schools, municipal facilities) • Businesses • Residents
Type of Infrastructure	• Ducts or conduit (possibly with dark fibre) • ‘‘First mile’’ network (connections to customer premises) • Interconnection point(s) (eg neutrally administered ‘‘carrier hotel’’) • ‘‘Middle mile’’ connection (backhaul links to other locations)
Technology (when applicable)	• Wireless (unlicensed or licensed) • Wired (copper, hybrid fibre-coaxial cable, fibre)
Services	• Broadband (Internet access, other data communications) • Video (cable TV) • Voice (telephony)
Government responsibility	• Finance (bonds: special issue or general obligation) • Build (may contract to private sector) • Operate (may contract to private sector)
Business Model	• Wholesale (local government sells capacity to carriers, or leases dark fibre to anyone but with no associated service, or provides ‘‘open access’’ platform to multiple ISPs) • Retail (local government sells higher-level services to end users)

Sullivan quotes the Yankee Group saying that at least 200 US cities are investing in municipal wireless networks, with a combined value of over $700milion. In South Africa,

Cape Town, Durban, Knysna, Johannesburg and Pretoria are active in municipal broadband networks, including wireless (McLeod 2007).

4.2.2 *Municipal Technology Usage*

Municipal technology usage reflects municipal network origins. According to Sullivan (2005), municipal telecommunications offerings are based on networks comprising mainly optical fibre, DSL (Digital Subscriber Line), Wireless (Wi-Fi and WiMAX), and Broadband over Powerlines (BPL). These technologies are where municipalities often already have expertise, and of course, rights of way. Bakowski (2006) completes the list with Cellular networks and Satellite – these are less likely from the point of view of cost and competition. Research performed at Massachusetts Institute of Technology (MIT) (Gillett et al. 2006) notes that municipalities responsible for electricity distribution are the most likely to branch out into telecommunications services such as “Public Broadband”. This is clearly logical, as these cities and towns may already have fibre in the ground for power network control and meter reading. This seems to make the economics of entering the telecommunications business an obvious extension of existing activities.

Functional needs of the residents to be served are also technology selection drivers. Mobile broadband access is offered via wireless, often Fibre-to-the-Home (FTTH) with a wireless overlay, according to Sullivan. Gillett points out that 32% of Fibre-To-The-Home (FTTH) infrastructure in the US is provided by municipalities.

South Africa has followed this pattern. Durban municipality, also known as eThekwini is building a wireless network overlaid on a city-wide fibre optic network (McLeod 2007). Cape Town is rolling out Wi-Fi and WiMAX to cover the greater Cape Town metropolitan area. Voice over Internet Protocol (VoIP) integrates Durban’s municipal offices, offering savings to the municipality that it wants to exploit. Durban intends next to build an access network based on a combination of fibre optic, wireless and powerline communications to serve businesses and residents. Ekurhuleni, to the east of Johannesburg, has already laid some 1500 km of fibre which will be used to enable service provision (Engelbrecht 2006).

4.2.3 *Municipal Telecommunications Goals*

Goals of municipalities entering the telecommunications market are varied. Bridging the digital divide is one of the reasons, and in some examples practical steps are taken to achieve it. Bakowski (2006) has proposed four main goals of such operations for municipal operators:

- Investing in Cutting Edge Technologies – to benefit service provision and e-government firstly;
- Creating economic development – attracting business to the city and preventing others from leaving, due to poor telecommunications infrastructure;
- Reaching underserved areas – a "broadband for all" type of initiative. Interestingly, the US slipped from 13th to 16th place in the ITU's world penetration rankings (Lai and Brewer 2006)
- Increase revenue for the city – when offered as a city-owned or city-backed project.

As previously noted in Table 1 above, there is a set of stakeholders (Bakowski 2006) that needs consideration. These include the municipality itself, phone and cable companies (including Telecommunications Network Providers), ISPs, electric utilities (if not part of the municipality already), and the user community including businesses, consumers, citizens and educational institutions. These resonate clearly with the findings in Section 4.2.1 above.

Gillett (2004) describes Ohio's broadband initiative, eVantage, begun in 2002, to help advance the use of e-commerce in small business, in co-operation with Ohio's Small Business Development Center. A South African example is Durban, where McLeod (2007) reports that the city further intends to host portals to support schools and also to locally host such tools as Wikipedia for quicker access.

Another common goal is to attract business and entrepreneurs. Vecchiatto (2006) reports that Cape Town views improved communications as being essential for making Cape Town a good place to do business. The municipal network plans are designed to achieve this. Job creation and the reduction in the R100million annual telecommunications bill are

additional benefits. This may be as much as a 40% saving on annual telecommunications expenditure (Senne 2006a). A particular business focus of the city's management is supply chain management that they view as requiring "extremely good communication". Senne quotes the city's infrastructure manager, Douglas Gelderbloem, as saying incumbent telecommunications operators have "no commitment to delivering services to the poorest. Municipalities, on the other hand, have this as a constitutional mandate, and are better placed to deliver". Government commitment to providing the poor with basic services is illustrated by the free basic water and electricity allowances of 6kl and 50kWh per household per month (SA Government Services 2008).

The practical way in which Cape Town and Durban wish to assist businesses and residents is by a reduction in broadband costs and "free local phone calls" (McLeod 2007). Engelbrecht (2006) further describes Cape Town city's desire to "deepen democracy" by "promoting citizen participation in decision-making". Practically, Cape Town now offers free email and Internet access at some 100 libraries. Durban wishes to offer voice and data to the population from R150 per month. By these methods, these cities hope to improve citizens' lives and encourage business growth. Smit (2006) describes free or cheap Internet access via municipal Wi-Fi as the means to bridge the "digital chasm", for start-up businesses.

Supporting the argument around bridging the digital divide, the Shpigler Group (2002), in a study specifically focused on the Municipal Telecommunications and its impact on the digital divide, suggests that a 10% increase in Internet access, will increase household income by an average of S1437 on average, and as much as US$1793 in smaller towns. The report suggests three key benefit areas:

- Job Creation – The ability to attract and retain business in the community through improved infrastructure
- Competitive Impact – The benefit felt by residents and businesses due to the presence of a new service provider to keep prices low and service quality high
- Output Effect – The ability to generate additional output due to efficiencies created by superior infrastructure

The Shpigler Group suggests, based on their analysis, that the number of municipalities, especially smaller municipalities, involved in providing telecommunications services will grow. This is clearly a US view, but nevertheless interesting as South African cities are following the US lead.

This potentially very large value-add is however challenged by Bast (2005). He believes that benefits supposed to accrue to residents and businesses will not materialise, based on municipal telecommunications operations. His argument is based on the following points:

- Broadband services are widely available already in a form sufficient to satisfy both business and residential needs

- Broadband speeds are rising and the price is falling, revealing the presence of fierce competition, major new investments, and continuous technological change. This is arguably true in South Africa as well, considering the variety of service offerings from Telkom, Neotel, the Mobile Operators, and the many ISPs which may enter the market following its recent liberalisation

- There is no evidence showing municipal investments in broadband lead to faster economic growth or higher personal incomes. This directly challenges Shpigler Group's assertions, and damages a cornerstone of the justification for municipal telecommunications

- Very few cities have actually built their broadband telecommunications networks, with those that have, experiencing higher than expected costs and large operating losses borne by taxpayers

- Municipal networks are risky ventures based on their cost and the effort involved in establishing them, inaccurate business projections of the number of consumers, and so on

Bast therefore concludes that "Generally speaking, municipal ownership of broadband networks is probably not in the best interests of residents and most businesses". When compared with the stated goals, both in the US and in South Africa, there is little reason to expect that the South African situation will be much better, given the failure of the

USALs, the Universal Service Agency, and the levels of municipal delivery of existing electricity, water and sewerage services.

4.2.4 *Summary*

The modes of entry of Municipalities into the telecommunications market, their technology choices and their goals have been considered above. Municipalities enter the telecommunications market with the goal of increasing broadband penetration, and encouraging business and entrepreneurship in their areas. They hope also to bridge the digital divide by offering more widespread, cheaper services. Specific interventions are the connection of libraries and schools. They either build their own networks, usually based on their existing municipal electricity telecommunications networks, utilising various optical fibre and wireless technologies. In many cases they partner with others to market the services, with the municipality restricting its intervention to the backbone network and the partners handling the retail side.

While the motives appear sound, actual benefits accruing from this activity are difficult to judge, given the number of players in the telecommunications market all competing in the same space. Concerns remain that this activity becomes a costly millstone around ratepayers' necks.

5 ANALYSIS OF FINDINGS AND ADDRESSING THE RESEARCH QUESTIONS

5.1 Research Question 1:

5.1.1 *Overview of the Question and Approach to Answer*

Why can the incumbent telecommunications operators not bridge the digital divide in South Africa?

To answer this question, it is necessary to match the four major parameters of the digital divide against the motives, licences and goals of the major incumbent operators in South Africa. The operators are (in the order in which they were established):

- Telkom SA, the “incumbent” fixed line telecommunications operator
- Vodacom, the largest cellular operator
- MTN, the second cellular operator
- Cell C, the third cellular operator
- Neotel, the “second” fixed line telecommunications operator

In addition, there is a number of ISPs and a collection of USAL (Under-Serviced Area Licence) operators. As these are not “incumbent” operators, either as their license restricts their operations (the ISPs), or because they are highly niched or not even operational (the USALs), they will not be considered in answering this question.

Bridging the digital divide will require the four digital divide parameters to be acknowledged and addressed by these operators. The parameters are:

- ICT Connectivity
- ICT Skills

- ICT Confidence
- Beneficial Usage

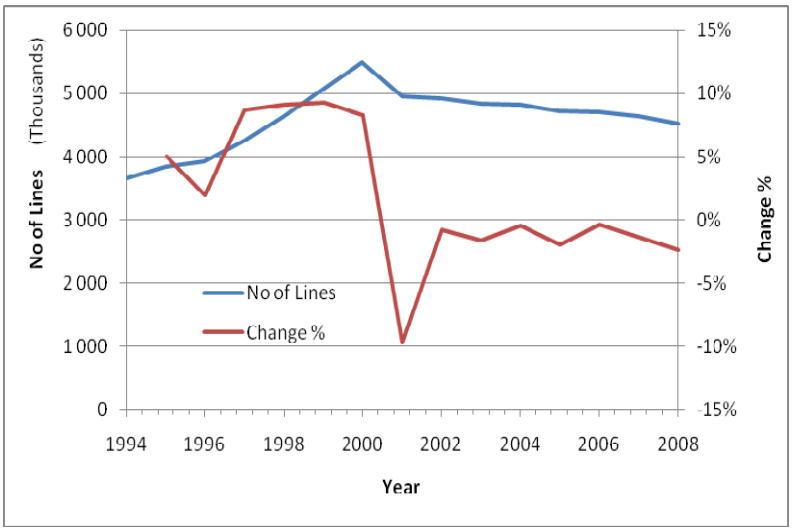
The objectives and operators listed will be reviewed briefly below

5.1.2 *Telkom*

Telkom South Africa is the incumbent fixed line operator, with a long monopoly history. In 1997, Telkom was awarded a fixed line operator's licence by the Department Of Communications (Department of Communications 1997). Included in this licence was an obligation to roll out new telephone lines to the extent of 2.69million lines between 1997 and 2002. See Table 9 below for the actual performance, extracted from annual reports and the Telkom Journey web page (Telkom SA 2008b).

Table 9 – Telkom Fixed Lines

Year	No of Lines	Change %
1994	3 659 863	
1995	3 844 529	5%
1996	3 919 084	2%
1997	4 258 639	9%
1998	4 645 650	9%
1999	5 075 417	9%
2000	5 492 838	8%
2001	4 961 743	-10%
2002	4 924 458	-1%
2003	4 844 000	-2%
2004	4 821 000	0%
2005	4 726 000	-2%
2006	4 708 000	0%
2007	4 642 000	-1%
2008	4 532 000	-2%



The table and graph illustrate quite clearly the shortfall in performance, with the target number of lines never being achieved, and in fact Telkom only operates 24% more lines today than in 1994 and 6% more than when their licence was issued. Currently, Telkom's fixed line penetration is 9.5% (Telkom SA 2008a). Given that South Africa's population has grown by 27% over the period 1994-2008 (NationMaster.com), this reflects a decline in fixed line penetration from 9.8%.

If the Telkom objectives according to recent annual reports are considered, we see the following statements: “We are committed to becoming a world-class communications group and delivering sustainable shareholder value by focusing on our key strategic objectives” (Telkom SA 2002). These objectives are listed as:

- Growing and defending core markets
- Exploiting convergence opportunities
- Driving operational and capital efficiencies
- Improving the customer experience
- Investing in our people

Updating this to the 2008 Annual Report (Telkom SA 2008a), we see the “primary objectives in defending profitable revenue objectives” by:

- Maintain[ing] fixed-line net revenue.
- Retain[ing] our leading fixed-line market share.
- Increase[ing] annuity revenue as a percentage of total fixed-line operating revenue.

There is now a strong emphasis on staving off competition from all sides as well as service convergence and the provision of outsourced corporate data services. Social obligations do not appear. The focus has clearly shifted to pure business.

5.1.3 *Vodacom*

There are three mobile operators in South Africa, of which Vodacom has by far the largest subscriber base. Vodacom at the time of writing was just in the process of being sold by Telkom to Vodafone of the UK. Vodacom’s subscriber base in 2008 was 24.8million, having grown at a compound rate of 26% since 2004, of which 85% are pre-paid subscribers (Telkom SA 2008a).

Vodacom, and MTN, have weakly defined Community Service Obligations, based on their operating licences issued in 1993 (Department of Posts and Telecommunications 1993). No specific roll-out targets are included in the licences.

Currently, Vodacom's strategic objectives, as listed in parent company Telkom's Annual Report for 2008 (Telkom SA 2008a) are:

- "Continue to maintain its leadership position in its core mobile voice and data business
- Seek out new horizontal expansion opportunities
- Seek out new vertical expansion opportunities
- Increase revenue from geographic expansion opportunities"

These are clearly very business-focused goals. However, Vodacom does pursue a programme of corporate social responsibility with attention to education, health and welfare in their customer communities (Vodacom 2007). Much focus is laid on the health aspect with Vodacom contributing to life-changing operations.

5.1.4 *MTN*

MTN is the second largest mobile operator in South Africa with a subscriber base in 2007 of 14.8million in South Africa, out of a total subscriber base internationally of 61.4million subscribers. MTN have experienced 23% compound annual growth since 2005. MTN is active in at least 21 countries across Africa and the Middle East. Of the South African subscribers, 83% are pre-paid subscribers (MTN Group 2007).

MTN's expansion strategy is "actively seeking value-creating opportunities in emerging markets". MTN has a Sustainability Vision which, while wishing to be the "leading provider" of telecommunications services in the areas it serves, aspires to be a "valuable partner to individuals, communities and businesses in increasing access to quality communication services, enhancing universal access for remote customers and contributing to the general quality of life of the people and communities it serves" (MTN

Group 2007). MTN is not specific about what it does in the context of being a “valuable partner”, and the dominant theme of a fast growing enterprise permeates the document.

5.1.5 *Cell C*

Cell C is the smallest of the South African mobile operators, only having received their licence in 2001 (ICASA 2001). Cell C is not a listed company, nor is it owned by listed entities, so detailed information on their performance is hard to obtain. Their subscriber numbers are reported as 5.4million, up 58% on the previous year (Wireless Federation 2008). What is clear, however, is that the obligation on Cell C is quite substantial in terms of Community Service Telephones (CSTs). Cell C was required to install at least 52 000 CSTs by 2008 (Cell C 2008b). Cell C have however, gone substantially further, rolling out 110 000 CSTs in a bid to “bridge the digital divide”. They maintain they are turning “an obligation into an opportunity”.

Cell C also pursue programmes in their customer community focusing on issues wider than just telecommunications. In their case, it is the “Take A Girl Child to work day” programme (Cell C 2008a).

Cell C is the only company describing statistically what it has done and is doing, to “bridge the digital divide”. This to some extent is directly part of their business strategy “to focus on the lower end of the market” and obtain “good performance from its community service telephones” (Lourie 2008).

5.1.6 *Neotel*

Neotel is the newest addition to the South African major operator community. It is the Second National Operator envisaged in the Telecommunications Act of 1996 (Republic of South Africa 1996), and like Telkom, is a fixed line operator. Neotel’s strategic intent is to be the first converged “communications network operator” and to become the “preferred provider of leading-edge telecommunications in South Africa” (Neotel 2006b). Neotel had a long gestation period and was originally intended to be licensed in 2002 when Telkom’s exclusivity expired (Republic of South Africa 1996), but was only finally established and licensed in 2005 (ICASA 2005).

Like Cell C, a latecomer to the scene, Community Service Obligations as described in the licence (ICASA 2005), appear heavier than for the previously licensed operators. As Neotel describes the objectives of the obligations, they are to “address the digital divide by providing universal service and universal access to all South Africans regardless of their location in the country” (Neotel 2006a). In Neotel’s case, the obligation is to provide “high speed internet connectivity to 5000 Public Schools, Further Education Training Institutions (FETs) and Rural Medical Clinics in South Africa”.

Neotel asserts that they regard this obligation as “part of its continuous effort to bridge the digital divide”, and “Neotel is exploring partnerships…to increase opportunities for economic development and growth especially in rural areas”. However, given the low penetration ratios of Telkom, the incumbent fixed line operator, connecting only 5000 institutions may not make a large impact in the divide.

5.1.7 *Answering Research Question 1*

It is now possible to answer the question: “Why can the incumbent telecommunications operators not bridge the digital divide in South Africa?” component by component of the digital divide:

- ICT Connectivity: all the operators are heavily focused on connectivity, and improving the range and scope of their networks, to connect additional customers, with the exception of Telkom SA, which is focusing on “maintaining” its position. This is perhaps natural given Telkom’s historical monopoly now under threat from multiple competitors. It may therefore be argued that this aspect of the digital divide is being addressed by everyone except Telkom. Notable are the mobile operators that claim some 45 million subscribers between them, approximately 1 per person in South Africa, notwithstanding their obligations to Community Service Telephones-which it may be argued do not bridge the digital divide. If everyone is connected somehow, then ICT Connectivity is potentially satisfied to some degree.

- ICT Skills: in the area of ICT Skills development, Vodacom claim to be involved in “education”, but are not specific as to what type of education, and what skills are being developed. The context of the wording in conjunction with health, suggests

broader education rather than ICT Skills development. However, as discussed in Section 4.1, basic literacy is a contributor to ICT Skills. Therefore any educational contribution is probably positive in this context. MTN wish to partner with other companies to improve quality of life. Again, no reference to bridging ICT Skills gaps. Likewise Neotel mention partnering for growth, in the context of bridging the digital divide, but do not detail what such partnership entails. Telkom makes no mention of a digital divide and does not address the skills base of it's customers at all. Cell C likewise, while it has a positive involvement with its community, this is not in the context of ICT skills development. Therefore it is clear that this aspect of the digital divide is not being substantially addressed by any operator.

- ICT Confidence: Where the situation prevails that no operator is focusing on ICT skills development, it is logical that they do not focus on the confidence factors of their users, and thus this area is not addressed.

- Beneficial Usage: as for ICT Confidence, this is not being considered, except peripherally through the education activities. Neotel's obligation to connect schools to the Internet does not explicitly go further to address the development of a user community able to exploit the facilities provided in a meaningful manner.

The conclusion must therefore be reached that the digital divide cannot be bridged by the incumbent telecommunications operators unless they understand the full extent of the digital divide and address the specific components of the digital divide. Universally their core business objectives are growth and development of new products and services, and the focus, with the exception of Cell C, is on the upper end of the market. This restricts their ability to make a real difference in bridging the digital divide. It is clear that their licences focus them on the ICT Connectivity aspect of the problem, somewhat to the exclusion of other aspects of the divide. The telecommunications operators are not obligated in terms of their licences to complete the exercise.

On their own therefore, it is unlikely that the incumbent telecommunications operators will successfully bridge the digital divide.

5.2 Research Question 2:

5.2.1 *Overview of the Question and Approach to Answer*

What is the potential for municipalities to help bridge the digital divide in South Africa?

As for the first question, the answer here again depends on matching municipalities' telecommunications goals and what they are actually doing with the realities of the digital divide. This is a more generic question as there are many municipalities in South Africa, not all of which are entering this space. What is intended here is to look at the characteristic reasons for entry and the stated goals of municipalities when entering the telecommunications market, and to judge whether in the light of the digital divide parameters, the municipal operators may be more successful than the incumbent operators.

Six South African municipalities are rolling out networks of one sort or another:

- Cape Town: Cape Town is investing R400 million in a optical fibre telecommunications network (Vecchiatto 2006) with a view to saving 40% of their annual telecommunications bill (Senne 2006a). Cape Town wishes to be a "good place to do business" as reported by Vecchiatto, especially for global companies requiring good telecommunications to manage their supply chains. Cape Town aims to offer cheaper broadband and free phone calls to residents (McLeod 2007), and will also connect libraries, clinics and other facilities. Wireless networks based on Wi-Fi and WiMAX are planned, overlaid on the fibre optic backbone, covering the greater Cape Town metropolitan area. The city plans to adopt an "open-access model" and lease capacity to third party operators. Finally, Engelbrecht (2006) notes that the city wishes to drive service delivery costs down while deepening democracy through improved communications ability.

- Durban (eThekweni): Durban, or the wider metropolitan area known as eThekweni, has connected its regional offices and facilities, such as clinics, to a fibre-optic citywide network. Like Cape Town, an overlaid wireless, wide-area network complements the fibre network (McLeod 2007). Voice over Internet Protocol (VoIP) is used to carry their internal voice traffic, delivering savings to the municipality. In

addition to the fibre and wireless networks, Broadband over Powerlines (BPL) will form part of the access networks. In addition, McLeod reports, the city will host international content locally, such as Wikipedia and also educational content (the works of William Shakespeare are mentioned as an example) to improve access speed and reduce access cost. Durban plans to partner with an operating company that will act as the wholesaler of Durban's services.

- Ekurhuleni: Unlike the major municipalities like Cape Town, Durban, Johannesburg and Pretoria, the Ekurhuleni municipality will not play host to the 2010 Soccer World Cup. However, given that South Africa's major international airport is within the Ekurhuleni boundary, the city is also laying a fibre optic backbone (Engelbrecht 2006). Their view is that although broadband provision is not a core municipal function, the enabling of the provision of such services to residents, schools, clinics and hospitals is an important role the municipality should play.

- Johannesburg: Johannesburg seems a late starter although in 2006 it announced big plans to roll out broadband capacity to all 350 000 households (Engelbrecht 2006). However this seems not to have materialised as yet.

- Knysna: Knysna is an early entrant into the municipal telecommunications arena (McLeod 2007) and has partnered with a large VANS operator to provide services to residents (Mochiko 2006), and especially businesses via a wireless network, achieving estimated savings on local and cellular calls by up to 40% (EE Publishers 2008).

- Pretoria (Tshwane): Pretoria is a very active municipality in the telecommunications space, and also an early entrant (McLeod 2007). Like the other players described above, Pretoria is using a fibre backbone extended by BPL and wireless, with pilot sites established in Rooiwal, Hatfield (van de Groenendaal 2005) and Soshanguve (Senne 2006a), in practical attempts to bridge the digital divide.

It is notable that most of the articles referenced above are around 2006, and the sector has quietened down in the interim. However, Neilson (2008) of BMI-T notes that the municipal telecommunications business model is not easy to structure and presents "almost insoluble problems". He believes though that "progress will be made" and that

provinces have a role to play. This may be borne out by recent statements on the Gauteng province's G-Link (Engelbrecht 2008) (Gauteng encompasses Ekurhuleni, Johannesburg, and Pretoria) which seeks to integrate the municipal initiatives and improve services to the under-serviced areas. Perhaps the provincial space is the one to watch in future, especially the city-province of Gauteng.

Cities and the city-province of Gauteng have rapidly growing populations as discussed in Section 2.4.1 above, and illustrated in Figure 3 above. This would seem to position the municipalities well to address the digital divide, provided they do the "right" things. In the next section, the digital divide parameters will be applied against the actual stated telecommunications aims of the municipalities to determine whether the whole digital divide problem is being adequately addressed to close the gaps.

5.2.2 *Municipal Potential to Bridge the Digital Divide*

The municipal contribution to bridging the digital divide may be examined separately for each of the digital divide parameters as follows:

- ICT Connectivity: like the conventional telecommunications operators, the initial starting point for the municipalities is to exploit their existing networks as access networks to improve the ICT Connectivity of their citizens, by offering reduced pricing and perhaps bundled services such as voice and data. Given that cost is a component of the connectivity problem, this may contribute to increased connection rates. It is perhaps unlikely that municipalities will have a greater coverage than the mobile operators, but depending on their choice of technology, municipalities may well offer wider coverage than the fixed line operators. This potential is of course being reduced by the moves by the fixed operators to wireless networks themselves such as CDMA and WiMAX. For this parameter, a qualified "yes" may be awarded for positive contribution to bridging the digital divide.

- ICT Skills: from the research into municipal telecommunications, the municipalities do not specifically involve themselves in education. However, they focus on the connection of schools and libraries to the Internet, which will certainly contribute to the improvement of ICT Skills. This reflects the discussion earlier about the lack of

connectivity at educational institutions. It is interesting to note that some 15 years after the establishment of Vodacom and MTN, and 11 years after Telkom's privatisation, Neotel has been given a major target to connect schools, in 2005. This reflects the poor penetration of connectivity to such institutions. Should this prevail in urban areas, municipalities can certainly improve the situation. In addition, some South African municipalities have proposed hosting important learning tools such as Wikipedia, and thereby improving access speed while possibly reducing cost of access. There is clearly an effort being made to bridge the digital divide, although no explicit recognition is given to the role of ICT Skills in the divide.

- ICT Confidence: The focus on schools and libraries, while not directly confidence building, may give some enabling support to the development of ICT Confidence through the development of skills in a protected environment. Such institutions are by their nature non-threatening environments and have the staff to assist Internet users on their premises in acquiring not only ICT Skills, but also the confidence to use the tools. This is not purely a municipal benefit, but will spin off the focus on schools and libraries.

- Beneficial Usage: the challenge will remain for municipalities, to inspire ICT users to extract benefit from the tools they use. A stated municipal goal is to stimulate business and entrepreneurship in their communities. Clearly established businesses know already how to beneficially use the ICT capability. Historically disadvantaged entrepreneurs may need considerable assistance with this aspect though and nothing in the municipal telecommunications manifesto suggests that they will be supporting this aspect of the digital divide.

5.2.3 *Answering Research Question 2*

It is now possible to answer the question: "What is the potential for municipalities to help bridge the digital divide in South Africa?"

A tentative conclusion may be reached that municipal telecommunications might help to bridge the digital divide. This is based on the stated intentions of municipalities, as it is too early to judge by results as none has yet gone into operation. Municipalities have a

service mandate, not always based on full cost-recovery and the mandate includes provision for assisting the poor, such as in the fields of electricity and water. This mandate contrasts with the operator perspective which is fundamentally business focused.

Having said this, the municipalities efforts might be better employed in developing ICT Skills, Confidence and promoting Beneficial Usage, than by providing access services, which may end up costly and beyond their capability to manage. Access is also a very competitive environment, with multiple players.

6 CONCLUSIONS AND RECOMMENDATIONS

6.1 Conclusions

This report has analysed the digital divide to understand the components of connectivity, skill, confidence and usage, and laid these against what the incumbent operators are doing to determine why it is that these large, well-funded organisations do not bridge the gaps in South Africa.

It is clear that the major incumbent operators are not bridging the digital divide because it is not a business or regulatory imperative for them. Many of the operators talk about bridging the digital divide, but their business objectives do not reflect the talk. Their social obligation business component does not address the dividing parameters defined in this study.

The emerging municipal operators were then considered and it appears as if they might be more likely to adopt policies which will close some of the digital divide gaps, because of their service orientation in their communities. Practical cost and profit complications may of course deflect them from their more lofty goals. Only time will tell.

The drive towards e-government and the benefits of access to information in a large and dynamic country like South Africa, suggest there is much to be gained for individuals in pursuing ICT skills and that these skills will bring tangible benefits to the wider population.

6.2 Recommendations for Future Research

This study has explored an international base of literature to understand generically the problems of the digital divide. It has drawn on quantitative and qualitative studies to construct a point of view. It would be appropriate to follow up this study by researching the South African digital divide parameters in a more qualitative and quantitative manner.

Secondly, the impact of the licensing of in effect vast numbers of VANS operators to build and operate networks on both incumbent and emerging municipal operators, and

their abilities to bridge the digital divide, should be investigated. Such an analysis would contribute to better targeting of licence obligations to these new operators.

Finally, given that much of the digital divide problem is of a skills and confidence nature, it would be appropriate to consider how schools and other institutions of learning, such as adult education centres, might contribute to closing the skills and confidence gaps.

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