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Access and usage of broadband in fast-tracking service delivery to under-serviced communities

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Access and usage of broadband in fast-tracking service delivery to under-serviced communities

Mcoseleli Nicholas Mshiywa

A Research Report submitted to the Faculty of Management, University of the Witwatersrand, in partial fulfillment of the requirements for the degree of Master of Management (in the field of ICT Policy and Regulation).

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Abstract

The current broadband and information society policy and regulatory environment is not effective in promoting broadband utilisation to improve social and economic conditions in under-serviced areas, because under-serviced communities are unable to utilise technology effectively to access government and other services.

The purpose of this exploration was to investigate how broadband has been implemented in under-serviced areas to provide services like e-education, e-health and for local economic development. The case study method - a qualitative research approach - was used to understand the current problem which is real and practical.

Broadband can enhance service delivery in education and health in under-serviced communities, improve quality of service, reduce costs, ensure flexibility, improve standards in education and health, and improve the local economy. It is possible to replicate broadband projects across under-serviced areas in South Africa cost-effectively. Although this is the case, broadband and information society policies are not fully implemented, are still in formulation stage and have gaps, despite acknowledgement of their importance by government, and this affects the delivery of e-services.

The broadband and information society policies and strategies must focus on under-serviced area and must be clear on how broadband will be implemented for development. A broadband Implementation structure - supported by an oversight committee composed of senior stakeholders from CSIR, Department of Science, ICASA, tertiary institutions, and business community in the telecommunications space - must be established or strengthened within the DOC to oversee the implementation of the information society.

Declaration

I declare that this report is my own, unaided work. It is submitted in partial fulfilment of the requirements of the degree of Master of Management in ICT Policy and Regulation at the University of the Witwatersrand, Johannesburg. It has not been submitted before for any degree or examination at any other University.

_____

Mcoseleli Nicholas Mshiywa

17 January 2014

Dedication

To Shirley, thank you for your love, understanding, support, and for sacrificing your time for me.

To Anita, Pilani, Nhlanhla, Likhona, Avile and Bavile thank you for your patience and for giving me room to complete this research work.

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To my supervisor Luci Abrahams, and co-supervisor Professor Marlene Herselman, thank you for encouraging and propelling me to complete this work.

To all friends and colleagues at the institutions of work and learning who lent a hand, thank you for your continuous assistance in more ways than one.

Abbreviations

Acronym	Meaning
1. ACTS Clinic	AIDS Care Training and Support (ACTS) clinic,
2. BB4All	Broadband For All
3. BoP	'bottom of the pyramid'
4. CMM	Capability and Maturity Model
5. CSIR	Council for Scientific and Industrial Research
6. DoC	Department of Communications
7. DoE	Department of Education
8. DoSD	Department of Social Development
9. DST	Department of Science and Technology
10. ECA	Electronics Communications Act
11. FET	Further Education and Training
12. FMFI	First Mile First Inch
13. ICASA	Independent Communications Authority of South Africa
14. ICT	Information and Communication Technology
15. ICT4D	ICT for Development
16. ISAD	Information Society and Development
17. ITU	International Telecommunications Union
18. LED	Local Economic Development
19. MTSF	Medium Term Strategic Framework
20. OECD	Organisation for Economic Development and Cooperation
21. PNC	Presidential National Commission
22. USAL's	Universal Serviced Area Licensees
23. USASA	Universal Service Agency of South Africa
24. VOIP	Voice over Internet Protocol
25. VOs	Village Operators
26. WSIS	World Summit on the Information Society

Glossary of Terms

Acronym	Meaning
1. Under-serviced or Bottom-of-pyramid (BoP) Communities	People located in areas characterised by little or no delivery of services in areas like health or education. Such areas are usually characterised by poor local economic development and exist in both rural and urban environments. Such communities are usually at the bottom of the food-chain as survival is usually a struggle (referred to as BoP)
2. Information or Knowledge Society	A society with the ability to create, manipulate and share information for economic, political and cultural activity. The society is referred to as "*Uluntu Lolwazi*" in this research because it is able to convert information into knowledge or "*ulwazi*" in isiXhosa. The Information Society concept is synonymous to Knowledge society in this research.
3. Knowledge Economy	An economy characterised by usage of knowledge skills to create wealth in the information society context. This economy relies on technology in wealth creation.
4. E-education / m-learning / e-health	Usage of ICT in education or in health. Using electronic textbooks for learning or communicating with teachers in remote areas is an example of e-education. In health patients, nurses and doctors in different locations interact to share knowledge using ICT. In m-learning, smart mobile devices like tablets or smart phones are utilised for teaching and learning. Such devices utilise mobile broadband to access the internet.
5. Broadband / Mobile Broadband	Mustafa Ergen (2009) defines mobile broadband as the term for wireless Internet access delivered through mobile phone towers to computers, mobile phones and other digital devices. The phrase is also used as a synonym for mobile Internet access.
6. Service Delivery	Service delivery is getting services as effectively and quickly as possible to the intended recipient. In most instances service delivery implies a degree of excellence. Service delivery is also defined as the provision of public activities, benefits, for the satisfaction of citizens. It is the provision of services by the government, to the citizens as expected by the citizens and mandated by Acts of Parliament.
7. Digital Divide	A digital divide is an economic inequality between groups, broadly construed, in terms of access to, use of, or knowledge of information and communication technologies (ICT). The digital divide inside countries can refer to inequalities between individuals, households, businesses, and geographic areas at different socioeconomic and other demographic levels, and the Global digital divide designates countries as the units of analysis and examines the divide between developing and developed countries on an international scale. (Menzie & Fairlie, 2004).
8. Digital Broadband "Donga"	The same as digital divide but "Donga" is a isiXhosa name for a wall which divides a house into separate sections and is synonymous to privacy or creates the feeling of location inside or outside the wall.
9. Socio-economic Exclusion	The Adler School defines social exclusion (also referred to as marginalisation) as a concept used to characterise contemporary forms of social disadvantage and relegation to the fringe of society. It is used across disciplines including education, sociology, psychology, politics and economics, and refers to processes in which individuals or entire communities of people are systematically blocked from rights, opportunities and resources (e.g. housing, employment, healthcare, civic engagement, democratic participation and due process) that are normally available to members of society and which are key to social integration. [http://www.adler.edu/page/institutes/institute-on-social-exclusion/about]
10. Local Economic Development	LED is a term used in projects that are aimed at empowering communities located in underserved areas by arming them with technical and business skills that enable them to run their businesses in an effective and sustainable manner that enables development of local economies.

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Chapter 1. Background to Study on Broadband and Service Delivery

1.1. Background to Mobile Broadband and Service Delivery

The Information Society and Development (ISAD) Plan directs the attention of governments to take services to the poor by utilising information and communication technologies (ICTs). This is to ensure that the goal of social inclusion in the information society (*uluntu lolwazi*), sometimes referred as network society, is achieved. The Medium Term Strategic Framework (MTSF) for 2009 to 2014 emphasises that economic growth and development that includes the creation of decent work and investment in quality education and skills-development, are at the centre of the South African government's approach (The Presidency, 2009).

The major challenge in achieving the ISAD Plan[1] goals and the MTSF objectives is as pointed by Day and Schuler that "policy-makers show an apparent willingness to represent the vested interest of commercial capital" with "little concern for the needs of citizens, community and civil society in the information age" (Day & Schuler, 2004). This poses a challenge when looking at using broadband that is not yet affordable to address the service delivery needs of the underserved community and civil society in areas like education, health, and social development.

The research will investigate four case studies in three geographical areas where affordable broadband has been implemented in under-serviced areas (a) to take government services like education and health to selected communities (b) to investigate the application of broadband for local economic development.

[1] The ISAD Plan is available on: http://www.pnc.gov.za/index.php/isad-documents/doc_download/1-isad-plan

The research is looking at the four case studies to try to understand how policy on broadband can be used to achieve the ISAD goals, which are also some strategic objectives stated in the South African governments' MTSF. These goals focus mainly on education, health, and socio-economic development. The government aims at the improvement of service delivery that ensures quality of life by increasing investments in service delivery areas like education, health and others by utilising alternative technologies that ensure physical and geographic impediments are overcome *(*The Presidency*,* 2009*)*.

The methodology to be used in the research will focus on the analysis of the four case studies at micro (community) level, meso (service delivery and support) level and at macro (policy) level (DoID, 2000).

1.1.1. Broadband

The broadband toolkit[2] describes broadband as an always-on high speed (Megabits or kilobits per second) internet access that is enabled by an infrastructure that delivers voice or data services and applications to the users via the broadband networks. The network infrastructure type used e.g. coaxial or fibre-optic cable, determines the data transmission rate which in turn differentiates one broadband service or function from another.

Techterms[3] defines broadband as the high-speed data transmission multi-channel technology used in a single cable to enable carrying of an amount of data all at once.

Broadband is also defined as an always on internet access everywhere provided by a range of technologies that are either fixed-line, wireless or satellite, to high bandwidths that are able to support new, interactive, and

[2] ttp://broadbandtoolkit.org/1.2#Box1.1
[3] http://www.techterms.com/definition/broadband

innovative content, applications, and services and enable the delivery of public services. (Sawyer, Allen & Lee, 2003).

The above definition will be used for the purposes of this study as it relates to the mini-case studies that are addressed in this research report. Broadband has two types - fixed and mobile, that are defined below:

a. Fixed broadband

According to comp networking[4] fixed broadband is a type of high-speed Internet access where connections to service providers use radio signals rather than cables. Within fixed broadband there is fixed wireless broadband that utilizes transmission towers (ground stations similar to cell phone towers) that communicate with each other and with subscriber transceiver equipment installed in customer premises. Transceivers consist of a small dish- or rectangular-shaped antenna and attached radio transmitters and, unlike satellite Internet systems that communicate into outer space, fixed wireless dishes, and radios communicate only with ground stations.

Fixed wireless broadband connections has limitations in that they require line of sight between the subscriber and a ground station and there is no service should hills or trees obstruct this line of sight. Rain or fog can sometimes affect the quality of the service adversely, and, the high cost for bandwidth and the fact that fixed wireless service means being tied to one physical place without any support for roaming, are facts that discourage customers from using this service. Fixed wireless broadband systems are used for online gaming, VoIP, and other applications that require low network latencies.

b. Mobile broadband

[4] http://compnetworking.about.com

In Wikipedia mobile broadband is defined as a marketing term used as a synonym for referring to wireless Internet access that is delivered to users through a portable modem that supports voice and video, to a mobile phone, a USB wireless modem, a tablet or to other mobile devices like laptops, smartphones, and PDAs.

MobileOffice[5] defines mobile broadband as a general term used to describe high-speed Internet access from mobile providers for portable devices in the form of Internet access subscriptions - also known as data bundles or a data plan – that are usually sold separately from mobile phone subscriptions.

c. Differences between Fixed and Mobile Broadband

Differences between fixed and mobile broadband are that Mobile broadband technology is faster than fixed broadband and is used for video streaming, music downloads and video conferencing. 4G promises speeds that are ten times that of 3G. Fixed broadband is reliable and provides better quality of service than mobile as it is supported by reliable fixed telecommunication lines.

Mobile broadband also provides convenience and wireless freedom and internet connectivity that increases worker productivity than fixed broadband and has no limitations like the requirement for a line of sight between the subscriber and a ground station that guarantees no service if hills or trees obstruct this line of sight. Also, the quality of the service in mobile broadband is not affected a lot by rain or fog and, the cost of bandwidth are not as high as in fixed broadband since there are less cost for implementing the technology. Fixed wireless service also means being tied to one physical place without any support for roaming.

[5] http://mobileoffice.about.com/od/glossary/g/mobile-broadband.htm

1.1.2. Broadband Technologies in SA

There are about four major technologies that are used by private service providers and government departments responsible for providing connectivity in South Africa. These are Asymmetric Digital Subscriber Line (ADSL), Third or Fourth Generation Long Term Evolution (3G/4G LTE), Wireless, and Fibre-Optic Cable (Fibre).

a. ADSL

This is a method of transferring data over copper telephone lines at different maximum data transfer rates for uploading (1.5Mbps) and downloading (256Kbps) data because end users have a tendency to do more downloads than uploads. This technology does not suit Application Webservers as they tend to upload data and such speeds would be unsuitable, and hence the usage of 3G/4G.

b. 3G-4G / LTE

This is a common international telecommunications standard used smart phones or tablets for transferring data over cellular networks at transfer rates of up to a maximum of 1 Gbps (minimum is 100 Mbps) downstream and 500 Mbps (minimum is 50 Mbps) upstream.

c. Bluetooth Wi-Fi and WiMAX

Wi-Fi and WiMAX is the most common type of a wireless technology used for long range wireless networking through a wireless card that transmits to a wireless router connected to a network, cable modem, or DSL modem, which provides Internet access.

Bluetooth is a technology used for short range networking by wireless devices like keyboards, mice, printers, and cell phone headsets. These devices must be Bluetooth-enabled or must have a Bluetooth adapter installed to be able to connect to the Bluetooth wireless network.

d. Fibre (fibre-optic cable)

This is a light-based cable made up of very thin glass filaments of glass to carry data encoded from frequency signals into light pulses of zeroes or ones through light beams from one end or node to the receiving end of the transmission where the light pulses are translated back into data that can be read by a computer. Fibre-optic cables are less susceptible to noise and interference than twisted copper wire pair but are fragile and expensive to install and often need to be completely replaced when they break.

1.1.3. Broadband as an Eco-system

The World Bank identified broadband as an eco-system with four pillars that help in the definition of the roles that governments need to play in the use of broadband as a tool in projects that utilize ICT for development (ICT4D). The four pillars are the high-speed networks that helps with availability, the broadband services users need to access, the applications that must be relevant and affordable, and the users that must increase the demand for broadband services and thus more investment into broadband projects (CSIR, 2010).

1.1.4. Broadband Penetration in South Africa

The World Wide Worx indicated in its 2012 report that South Africa's broadband penetration was low at 17% Internet penetration. There was about 8.5 million Internet users with 2.48 million of those accessing the Internet only from cell phones by end of 2011 (CSIR, 2012).

The 2012 CSIR report also alluded to a connectivity challenge in education in South African with most connections found in urban areas. An estimated 17 000 of total of 26 500 public schools are located in rural areas that are mostly outside any foreseen broadband plans and with some cases where

schools and Provincial Departments of Education are still using couriers to deliver official messages (CSIR, 2012).

1.1.5. Information Society

According to the PNC on ISAD, the Information Society concept first emerged in the outcomes of the two World Summits on Information Society (WSIS) held in Geneva and Tunis in 2003 and 2005 respectively where the Tunis Commitment, the Tunis Agenda, and the vision of the global information society were adopted. The Heads of States and Governments envisaged the formation of a people-centred inclusive and development-oriented Information Society that allows everyone to access, utilise, and share information and knowledge in order to achieve their full potential and improve quality of life (Presidential National Commission, 2006).

The five pillars that underpin the building of this information society were identified by the then Deputy President of South Africa, in an opening address to the Information and Society Conference held in Midrand, South Africa in 1996. The five pillars were Infrastructure, Content, Funding, Access to information and ICT infrastructure, and Coordination and Integration between government, the private sector, and other stakeholders (Presidential National Commission, 2006)

The strategy for an information society involved two steps, namely: establishment of the Presidential National Commission (PNC) – to recommend to government strategies to be used for building this inclusive information society and bridging the digital divide. The second was the formation of a Presidential International Advisory Council (PIAC) – a Task Force on Information and Development – to advise the President on international ICT developments (Presidential National Commission, 2006).

The study explores briefly the ten points identified in the ISAD Plan and indicates that only three (Human Capital Development, Funding, and Coordination and Integration) of these points have been explored, in the conceptual framework and data collection sections.

Thabo Mbeki alluded to the importance of proper infrastructure and delivery mechanisms that were adaptable to global development needs of people as a corner stone to the development of an information society (Presidential National Commission, 2006).

The infrastructure Development point of the ISAD Plan is also tackled briefly as this is not in the scope of this study although it is relevant to the case studies that the research is based on as it revolves around affordability and accessibility, the two elements identified in the ISAD Plan as underpinning the discussion around developing an ICT infrastructure.

1.2. Service Delivery in Education and Health

There are many programs that the South African government has embarked on through its national and provincial departments to take services to under-serviced areas in order to address the socio-economic exclusion (Mphahlele & Maepa, 2003). Service delivery is being improved constantly to ensure that South Africa is part of the global economy that is characterised by increasing reliance on ICTs. Although the above is true, the 2009 development indicators released by The Presidency indicate that South Africa still faces key transformation challenges in the health and education sectors and in poverty eradication and social development (The Presidency, 2009).

Service delivery strike actions are common occurrences in underserved-townships and semi-rural areas. The education sector is still struggling to perform at its optimum best because of shortage of skills – a claim made by the DoE. The health sector is operating in a crisis-mode in some areas where

admitted hospital patients go without food for an entire day. Although these problems seem to be experienced in townships mainly, because of media coverage, they are also experienced in other semi-urban and rural areas. Day and Schuler point out that “people are viewed as consumers of goods and services rather than citizens with the democratic right to shape and influence changes taking place in the world” (Day & Schuler, 2004).

For example in Ngqamakwe, a small town located near Butterworth in the Eastern Cape, the police and the magistrate courts do not have any Internet access points. Employees in these important public service areas rely on the traditional fax and telephone for communication. The cellular phone is not very reliable because of problems with reception. Literally you have to move around in search of a spot with a good signal if you want to make a cellular phone call. There is not a single Internet kiosk in the whole town. This raises many questions around government’s policy on access to services by government employees and by the communities in such poverty-stricken areas. The government has a challenge of housing in urban areas caused by influx of people moving away from such areas that lack everything, towards urban areas that are better off.

There are three main indicators of public service delivery that a country can be measured by, namely, education, health, and local economic development (ITU, 2010). Although South Africa is an advanced user of ICT in sectors that attempt to address social exclusion challenges facing the majority of its citizens, ICT has not been exploited fully in the delivery of services in health, education and for informal sector development.

1.1.6. ICT for Service Delivery in Education

Education in the country is in dire straits with problems ranging from crime and drug usage in schools, poor professional conduct by educators, decreasing pass rates in grade twelve, to increasing dropout rates in

secondary and tertiary education institutions (Kekana, 2002). Schools located in disadvantaged communities suffer considerably due to lack of teachers, resources, and minimum funding. There are various initiatives where broadband has been utilised to attempt to alleviate the above challenges in schools, tertiary education, and education and training bodies. These initiatives are focussed on e-learning and e-skills and are as listed below:

- ***E-learning for schools:*** The School Net SA project commissioned by the Department of Education is an example of provision of schools with Internet access and linking them together (Riordon, 2002). The Ulwazi e-learning initiative is another case where wireless broadband is used to link schools in Pretoria for knowledge sharing (Van der Merwe, 2009).
- ***E-skills for Further Education and Training*:** Motorola, a private company has implemented telecommunications infrastructure in a Further Education and Training Institute in Ekurhuleni, Gauteng. This institution has satellite branches located all around Eastern Gauteng and utilises broadband to connect them to the main campus. Students located in satellite campuses are able to listen to and interact with the lecturer at the main campus in real time by usage of digital video. Staff in both campuses (main and satellite) are able to communicate with each other freely by utilizing Voice over Internet Protocol (VOIP), thus sharing knowledge (Van der Merwe, 2009).
- ***Vodacom Mobile Education Programme:*** Vodacom in partnership with the Basic Education department, Cisco, Mindset Learn and Microsoft launched this nationwide programme around October 2011 with the aim of developing teachers and improve the quality of instruction and results in subjects like mathematics and physical science. This was in response to a recent study where the department of education had observed that numbers of school pupils taking the two subjects are dwindling (Vodacom, 2011).

The programme makes use of mobile technology to provide teachers throughout the country with better access to quality instruction resources and ICT. Other initiatives from Vodacom in an effort to lower the high costs associated with access to the Internet are as follows:

WebBox: This device is composed of a keyboard with a memory card and a built-in modem. When plugged into a TV set, it converts the set into a computer screen with Internet access.

Webbook: This is another device designed to provide affordable Internet access that is usable in the education sector.

On the launch of these initiatives Vodacom's CEO, Pieter Uys said (Vodacom, 2011):

> We are absolutely committed to helping Government improve on the quality of education in our schools. The Vodacom Mobile Education Programme is our most ambitious project, but it is also the most important. It not only levels the playing field for rural schools that often don't have access to the same quality of teaching material that urban schools have, but it also ensures that schools, teachers, learners and communities have access to ICT and the Internet, and this is important to us because it mirrors our commitment to ensuring that Vodacom puts the power of the internet into everyone's hands

1.1.7. ICT for Service Delivery in Health

According to the South African Development Indicators (SADIs) for 2010, the Maternal Mortality Ratio ((MMR) - a measure of the deaths of women in hospital while pregnant or within 42 days of termination of pregnancy from any cause related to or aggravated by the pregnancy or its management but not from accidental or incidental causes) has been increasing since 1990. The 2010 indicators show that South Africa is amongst the twelve countries in

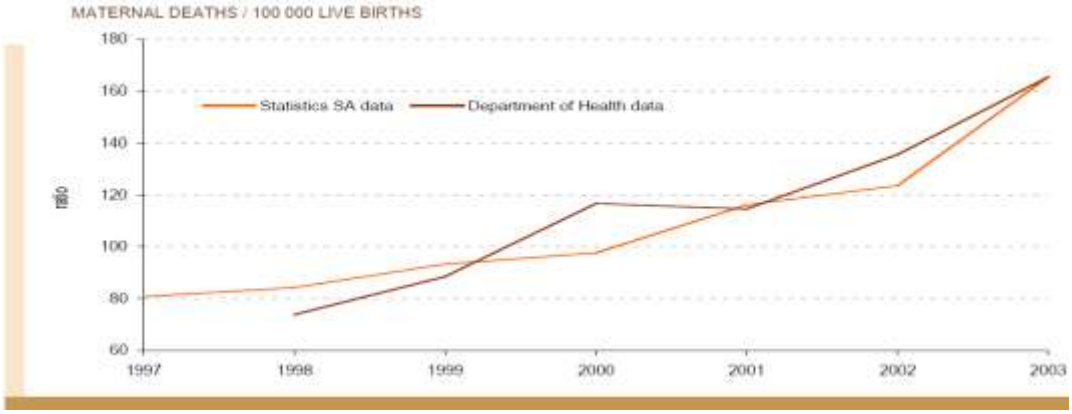
the world whose maternal mortality rate had increased since 1990 – with the ratio estimated to be as high as 625 (The Presidency, 2010).

The most common main causes of maternal mortality in South Africa for the periods 2002-2004 and 2005-2007, are HIV/AIDS, hypertension and obstetric haemorrhage (The Presidency, 2010). These figures might be shocking when one considers the budgets that are pumped into the health sector yearly, but then if one considers the amount of information about the main causes of these deaths, which trickles to people leaving in under-serviced areas, one is not surprised.

It is very important for the South African government to devise means of disseminating this much needed information in such areas that are often characterised by poor roads and far-away hospitals. The need for broadband to alleviate the crisis in health cannot be expressed in any better than by this example.

The diagram below taken from 2010 development indicators is an indication of the mortality rate mentioned in the paragraphs above.

Figure 1: Maternal Deaths per 100 000 Live Births in South Africa.



Source: *SADI 2010*

The ISAD Plan indicates that the Department of Health (DoH) has a challenge of providing "*equitable access, cost effective and quality health*

care for all citizens irrespective of race or where they live" and ICTs are seen as a "*tool that can be used for the purposes of efficient and effective delivery of health care and can improve general links and communication between developed economic centres and underdeveloped rural areas.*" (Presidential National Commission, 2006, pg. 60).

The plan goes on to indicate delivery of healthcare services as a challenge to the DoH because of a shortage of doctors, nurses and paramedics in South Africa and usage of ICT can alleviate this problem as it makes it possible to utilise the scarce resources to service people located in far-flung areas without them leaving their locations (Presidential National Commission, 2006).

According to the ISAD Plan 2006, the 58th World Health Assembly's resolution on e-Health adopted in 2005 states that:

> e-Health is a cost-effective and secure use of ICT in support of health and health-related fields...the combined utilisation of ICT to generate, capture, transmit, store and retrieve digital data for clinical, educational and administrative purposes… to contribute to the improvement of the health status of South African people through optimal usage of ICTs… in the areas of delivery of health care to people living with HIV/AIDS, surveillance of diseases and services, healthcare emergencies and hazards…(Presidential National Commission, 2006, p. 59).

According to the trend analysis done in the 2010 SADIs, there was a slight increase of HIV prevalence amongst youth between the years 2009 and 2010, although this increase is levelling off now. The main challenge is access to antiretroviral drugs, despite significant increases in access to drugs across all Provinces in recent years (South African Development Indicators, 2010).

The possible cause for this slight increase could be attributed to lack of information about collection points for antiretroviral drugs or the stigma associated with HIV/AIDS infection due to lack of information. Usage of mobile broadband technology to people located in remote areas or in under-serviced places is the best choice for information dissemination.

The objectives of e-Health cannot be achieved without usage of broadband. The following is one example of such broadband utilisation to provide the following health services to communities:

- ***Care for people living with HIV and AIDS*:** The First Mile First Inch (FMFI) Peebles Valley project in Mpumalanga was centred on a community HIV/AIDS clinic run by a non-governmental organisation (NGO), a hospice that is 5km away and commercial farmers. This involved linking the clinic with the hospice and the farmers via a mesh network to a satellite. Connection costs to the satellite were shared between the entities involved. Families and caregivers were linked with poverty alleviation programmes and support groups online (FMFI, 2006).

1.3. ICT for Local Economic Development

Introduction of ICT has been shown to reduce poverty in many developing countries like India and Brazil. Partnerships between the institutions of higher learning, and the public and private sectors have led to better utilization of ICT to improve local economies in these developing countries. Research undertaken by such partnerships has led to innovations that have improved peoples' lives. An example is the production of low-cost computers in Brazil, the cheap wireless connectivity product in India and the prepaid chip card for mobile money transfers (M-Pesa) in Kenya and South Africa. Such innovation has contributed in developing local economies in the affected countries

(UNDP, 2001). The following was another initiative aimed at using ICT for local economic development in South Africa:

- ***Broadband for all:*** Meraka institute located at the Council for Scientific and Industrial Research (CSIR) has partnered with the Department of Education and the Department of Science and Technology to undertake a BB4All project where cheap broadband is being rolled out in rural areas that are called *Presidential Nodes*[6] in order to promote local economic development. It is envisaged that *village operators*[7] will run with the business to ensure sustainability and business continuity (CSIR, 2010).

The success of this project will ensure that an information society characterised by a minimised digital broadband divide and socio-economic inclusion is created. In turn, this will make the country to be compliant to some of the targets set by ITU that need to be met by developing and developed countries to create an information society characterised by a minimised digital broadband divide and socio-economic inclusion (Presidential National Commission, 2002).

1.4. Digital Broadband '*donga'* and Socio-economic Exclusion in South Africa

Evidence suggests that significant inequities in access to telecommunications technologies and services exist globally with a number of major studies illustrating major disparities in access to the Internet for the poor people living in certain geographic areas (Mclver cited in Day & Schuler, 2004). The term 'digital *donga*' refers to the gap that exists between the 'haves' and the 'have

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[6] ***Presidential Nodes*** are areas that have the usual infrastructure challenges such as lack of access to electricity, roads and other crucial services.

[7] ***Village Operators*** (VOs) are individuals who have been identified within the local communities through a vigorous selection process and trained in ICT (mesh networks, Internet, etc.) and business-related skills.

not's' in terms of access to ICT services, resulting into a majority of poor communities lacking access to information and services.

Mehra, Merkel and Bishop (2004) defines the digital divide as "the troubling gap between those who use computers and the internet and those who do not" (Mehra *et al*, 2004, p.782). It is the gap between those with regular, effective access to electricity and thus digital and information technology, and those without it.

This digital *donga* that also exist in South Africa makes it a challenge to achieve the objective of creating a networked society in the country. The opportunity to own a computer and or to have access to the Internet is reduced for persons with low income or no jobs at all. Lack of ICT skills also reduces or prohibits usage of the Internet (ITU, 2010).

Many developing countries like South Africa face the challenge of closing this digital divide created by global markets because of technological growth worldwide. The figures below illustrate the digital divide that exists in municipal areas within South Africa in terms of household access to a computer, Internet usage, and mobile broadband subscriptions.

Table 1: *Percentage of households with access to a computer in Gauteng.*

Municipalities	2001		2007		2001	2007
	No. of households with computers	Total no. of households	No. of households with computers	Total no. of households	% of households with computers	
DC42: Sedibeng	**19 480**	**225 744**	**38 599**	**241 223**	**8,6**	**16,0**
GT421: Emfuleni Local Municipality	14 362	187 044	28 298	196 480	7,7	14,4
GT422: Midvaal Local Municipality	3 476	19 653	5 984	24 265	17,7	24,7
GT423: Lesedi Local Municipality	1 642	19 048	4 317	20 479	8,6	21,1
DC46: Metsweding	**5 244**	**45 092**	**9 127**	**46 502**	**11,6**	**19,6**
GT461: Nokeng tsa Taemane Local Municipality	1 944	14 356	3 612	14 838	13,5	24,3
GT462: Kungwini Local Municipality	3 301	30 736	5 514	31 665	10,7	17,4
DC48: West Rand	**14 688**	**151 339**	**32 150**	**186 850**	**9,7**	**17,2**
GT481: Mogale City Local Municipality	9 747	83 553	21 614	94 289	11,7	22,9
GT482: Randfontein Local Municipality	3 461	36 141	6 669	40 459	9,6	16,2
GT483: Westonaria Local Municipality	1 311	29 980	3 779	50 675	4,4	7,5
GTDMA48: West Rand	**189**	**1 665**	**189**	**1 429**	**10,2**	**13,2**
EKU: Ekurhuleni	**91 221**	**744 479**	**188 971**	**849 349**	**12,3**	**22,2**
EKU: Ekurhuleni Metropolitan Municipality	91 221	744 479	188 971	849 349	12,3	22,2
JHB: City of Johannesburg	**163 696**	**1 006 742**	**303 540**	**1 165 014**	**16,3**	**26,1**
JHB: City of Johannesburg Metropolitan Municipality	163 696	1 006 742	303 540	1 165 014	16,3	26,1
TSH: City of Tshwane	**106 538**	**561 772**	**196 352**	**686 640**	**19,0**	**286**
TSH: City of Tshwane Metropolitan Municipality	106 539	561 772	196 352	686 640	19,0	286
Gauteng	**400 868**	**2 736 169**	**768 736**	**3 175 579**	**14,7**	**24,2**
South Africa	**968 741**	**11 205 709**	**1 950 163**	**12 500 609**	**8,6**	**15,6**

Source: *Statistics SA Census 2001 and Community Survey 2007*

From these figures, it becomes clear that people in developing municipalities like Emfuleni or Kungwini are affected by the digital divide phenomena more than those found in developed municipalities like City of Johannesburg because technological devices like computers need power to be able to run. Electricity can be expensive commodity in the majority of households that have more important priorities than owning a computer. Alternative sources of energy like solar power have been researched and proven to work well, but the stumbling block has been the expense of putting these resources together.

Table 2: *Households with Internet access in Gauteng*

Municipalities	2007		2007
	No. of households having access to internet facilities	Total no. of households	% of households having access to internet facilities
DC42: Sedibeng	**13 212**	**241 223**	**5,5**
GT421: Emfuleni Local Municipality	8 586	196 480	4,4
GT422: Midvaal Local Municipality	2 306	24 265	9,5
GT423: Lesedi Local Municipality	2 320	20 479	11,3
DC46: Metsweding	**3 120**	**46 502**	**6,7**
GT461: Nokeng tsa Taemane Local Municipality	930	14 838	6,3
GT462: Kungwini Local Municipality	2 190	31 665	6,9
DC48: West Rand	**13 468**	**186 850**	**7,2**
GT481: Mogale City Local Municipality	9 797	94 288	10,4
GT482: Randfontein Local Municipality	2 111	40 459	5,2
GT483: Westonaria Local Municipality	1 444	50 675	2,9
GTDMA48: West Rand	**116**	**1 429**	**8,1**
EKU: Ekurhuleni	**89 170**	**849 349**	**10,5**
EKU: Ekurhuleni Metropolitan Municipality	89 170	849 349	10,5
JHB: City of Johannesburg	**165 989**	**1 165 014**	**14,2**
JHB: City of Johannesburg Metropolitan Municipality	165 989	1 165 014	14,2
TSH: City of Tshwane	**88 048**	**686 640**	**12,8**
TSH: City of Tshwane Metropolitan Municipality	88 048	686 640	12,8
Gauteng	**373 007**	**3 179 579**	**11,7**
South Africa	**900 612**	**12 500 609**	**7,2**

Source: *Statistics SA Community Survey 2007*

Provision of broadband to poor communities is very important to achieve the government's objective of uplifting communities. The government has a mandate to take services to poor communities often located in far flung areas where sometimes access is by means of donkeys or tractors. People in these areas have to commute for long distances in search of basic services, thus spending money that is often a scarce resource. These people are usually very poor, illiterate, old, and sick and desperately need access to education and medicine without having to travel long distances.

According to the Goldstuck report of 2010, trends indicate an increase in the number of people with broadband access, specifically in the corporate and academic markets. The report is concentrating in the broadband access provided by companies to employees and students, clearly these are located in the big urban areas like Gauteng. Under-served areas are not even mentioned, thus highlighting the point of lack of service delivery in such areas and the digital donga thereof. The table indicated below shows the increasing number of active broadband users in the two markets (Goldstuck, 2010).

Table 3: *Mobile broadband access in South Africa.*

Year	Broadband unique	Broadband additional	Cellular	Dial-up	Academic	Corporate	TOTAL
1987					< 100		< 100
1988					< 500		< 500
1989					< 1000		< 1000
1990					5 000		5 000
1991					10 000		10 000
1992					15 000		15 000
1993					35 000	5 000	40 000
1994				15 000	50 000	25 000	100 000 (150%)
1995				33 600	100 000	65 000	198 600 (98%)
1996				79 700	125 000	150 000	354 700 (78%)
1997				196 600	150 000	350 000	696 600 (96%)
1998				366 000	200 000	700 000	1 266 000 (81%)
1999				560 000	280 000	980 000	1 820 000 (44%)
2000				782 000	350 000	1 274 000	2 406 000 (32%)
2001				960 000	425 000	1 501 000	2 886 000 (20%)
2002				1 008 000	450 000	1 640 000	3 098 000 (7%)
2003	15 700			1 048 000	480 000	1 728 000	3 271 700 (6%)
2004	51 500			1 088 000	500 000	1 773 000	3 412 500 (4%)
2005	145 000			1 080 000	510 000	1 871 000	3 606 000 (5%)
2006	323 000	60 000		1 030 000	530 000	1 897 000	3 840 000 (6%)
2007	668 000	104 000		908 000	560 000	1 900 000	4 085 000 (6%)
2008	1 070 000	340 000	180 000	700 000	575 000	1 995 000	4 615 000 (12%)
2009 subs	2 124 000	756 000	3 500 000	499 000	550 000	2 060 000	9 589 000
2009 primary	1 560 000	506 000	450 000	250 000	540 000	2 060 000	5 366 000 (15%)

Source: *Goldstuck, 2010*

Provision of cheap mobile broadband to meet the information needs and enable accessibility to digital content, government services and knowledge sharing, and thus improve living conditions of disadvantaged communities in rural areas and townships, is a mandate of all governments in developing and developed countries. Socio-economic exclusion occurs where the poor are side-lined and do not reap the benefits that are brought about by ICT.

According to the UNDP (2001), human poverty and weak institutions widen the gap between technologies suited to the incomes and capacities of rich and poor countries. Low incomes, low literacy and skill levels, unreliable

power supplies, weak administrative infrastructures - are barriers to diffusing and using technologies designed for rich countries in poor ones. As a result of this, poor people pay more than the rich ones for the same services.

Throughout the years, South Africa has not been very successful to utilize ICT for service delivery, mainly because of the existing arrangements in the sector (telecommunication) characterised by monopoly and thus exorbitant profits, high prices and licensing delays.

Gillwald *et al (*2005) state that the government has not been able to leverage the advantage that was supposed to result by the amendment of the Telecommunications Act of 2001 that brought about licensing of USALS and the two mobile operators, to utilise technology to provide service delivery to communities, because of the high retail prices of telecommunication services (Gillwald *et al.,* 2005).

1.5. Information Society, ISAD Plan and Mobile Broadband in South Africa

The Presidential National Commission on the Information Society and Development (PNC on ISAD) was established by President Thabo Mbheki in 2001 following the ISAD conference that was held in 1996 that gave rise to the African Information Society Initiative (AISI). The PNC on ISAD consists of representatives from the public and private sectors of the South African society. Its objective is to advise government on the how to use ICTs optimally to address challenges of development, enhance the economy (Isaacs, 2007), and benefit from the development of an inclusive information society in Africa and the world (Presidential National Commission, 2002).

The National Information Society and Development (ISAD) Plan is a 'Proudly South African initiative that was developed by the PNC on ISAD project team and reviewed by a National working 'group of Directors-General from 26

government departments and Provincial C.E.Os of the South African Local Government Association(SALGA). Technical experts provided by governments of Finland, Mozambique, Ireland and Malaysia, under the leadership of Dr Ivy Matsepe-Casaburri, who was the Minister of Communication and Lindall Shope-Mafole, who was the Chairperson of the PNC on ISAD (Presidential National Commission, 2002).

The ISAD Plan was developed and approved in line with the Presidential International Advisory Council (PIAC) recommendation to have a plan to rally the whole country in response to the World Summit on the Information Society (WSIS) plan of Action for countries to develop plans that outline how the Information Society building was to unfold. The biggest challenge in building an inclusive Information Society had been the lack of coordination and integration between government departments and the private sector and this has led to duplications and lack of visible impact of projects aimed at creating this information society.

The ISAD Plan and its Institutional Mechanisms was developed to address this challenge by providing the country's vision everybody would work towards (Isaacs, 2007). According to the PNC on ISAD, the South African Information Society vision is defined as follows: “To establish South Africa as an advanced Information Society in which Information and ICT tools are key drivers of economic and societal development” (Presidential National Commission, 2002).

Dr Ivy Matsepe-Casaburri, the then Minister of Communication indicated that the Institutional Mechanisms of the ISAD Plan was aimed at harmonising efforts at all levels of service delivery, from national to provincial and local government. The minister also indicated that service delivery was the obligation of all spheres of government and having recognised that ICTs play a pivotal role in the roll-out of services.

The Institutional Mechanisms would serve as a conduit across all three government spheres. The Presidential National Commission (2002) indicate that the approved ISAD plan was an institutional base and a framework that had been laid down to present a united front by national government, provincial and local governments in the charge towards building an inclusive Information Society in South Africa, and move country from an industrial to a knowledge economy.

Lyndall Shope-Mafole, the former Chairperson of the PNC on ISAD indicated that the ISAD Plan was developed in South Africa by South Africans to contribute to improving the lives of the people of the country in line with the New Partnership for Africa's Development (NEPAD) principle of "relying on Africa's resources and the resourcefulness of its people" in the development of continent (Presidential National Commission, 2002).

The ISAD Plan is the framework and roadmap that guides the government in its vision to create an inclusive information society through various initiatives that will accelerate the transformation from current state to this required state through the use of digital technologies (Presidential National Commission, 2006).

The ISAD Plan acknowledges that such an inclusive society is characterised by a capacity to transmit high volumes of data, at fast speeds. In 2010, after a decade of the emergence of fixed and mobile broadband, these advanced infrastructures are now being used for services such as electronic travel and tourism, video-conferencing, video-on-demand and movies-on-demand, telemedicine and remote diagnostics.

ICT in general and mobile broadband technology in particular plays a vital role to ensure the achievement of an inclusive information society. This is because of its ability to even reach large groups of people located in under-serviced areas without the need of connected telecommunication wires,

resulting in reduced telecommunication prices and minimised digital *donga effects*. However, millions of South Africans are off the broadband grid and only a few projects exist where mobile broadband is being utilised to take sophisticated services to low-income communities.

The ISAD Plan's goals are to build and inclusive information society to ensure that South Africa does not fall further behind the rest of the world as a result of the digital *donga* and to ensure the availability of information for harnessing cultural diversity, promoting nation building and improving the quality of life for all citizens (Presidential National Commission, 2006).

1.6. WSIS on Information Society

The World Summit on the Information Society (WSIS) held in Geneva and Tunis in 2003 and 2005 respectively adopted a commitment and agenda called the Tunis Commitment and Agenda for Information Society, which should act as guidelines for countries and states that were part of this world forum for the development of this Information Society. South Africa is a signatory to this commitment and agenda.

According to the PNC on ISAD, the country is making every effort towards meeting the commitments of the WSIS Declaration of Principles, Plan of Action, Tunis Commitment and Tunis Agenda. The three key principles extracted from this agenda that will be used in the research are as follows:

a) **B1. The role of government and all stakeholders in the promotion of ICTs for development** (Building a people-centred Information Society is a joint effort which requires cooperation among all stakeholders) (taken directly from WSIS 2005).

b) **B2. Information and communication infrastructure: an essential foundation for an inclusive information society (**Connectivity - a

central enabling agent in building the Information Society, and a well-developed easily-accessible and affordable information and communication network infrastructure,…and making better use of broadband and other innovative technologies where possible can accelerate the social and economic progress of countries, and the well-being of all individuals, communities and peoples) (taken directly from WSIS 2005).

c) **B3. Access to information and knowledge** (The ability of all to access and contribute information, ideas and knowledge is essential in an inclusive Information Society) (taken directly from WSIS 2005).

The three principles that came out from the WSIS conference are cornerstones that should be used by all countries striving to create information societies. These principles were identified by WSIS and adopted by the South African government more than five years ago since it was part of the delegation. Although there has been much progress in the usage of ICTs for taking services to the citizens, it is disturbing to note that South Africa has dropped in African rankings of the “ICT value chain” surpassed by countries like Senegal, Nigeria, and Egypt. The country is no longer a leader in ICT services rollout (ANC, 2012).

The question that we as the citizens need to ask is, what is it that the government is doing wrong to be in this position, and what lessons can be learned to surge forward in the provision of services to the under-served and thus create an inclusive network society throughout the country? How can we modify policy in such a way that it encourages public and private partnership and participation for the achievement of this information society that will make the country to regain its leadership position in Africa?

1.7. Public Policy on Mobile Broadband and Service Delivery

South Africa's ruling party, African National Congress (ANC), held a policy conference in the middle of 2012 and amongst the issues that were discussed was the communications policy. The organisation came up with a communications policy discussion document that was aimed at discussing better ways that would ensure that an inclusive and growing information society was built through the use of ICT. The policy document provided a framework or foundation for discussion of policy issues on media, communications, and ICT within the ANC and its structures in preparation for the policy and its 53rd national conferences in 2012 (ANC, 2012).

The discussion document indicates that intensification of ICT-driven globalisation has also sharpened the digital divide between and within communities and has produced winners and losers and created a rising tide of inequality between the haves and have-nots globally and in South Africa. The discussion document states that these inequalities have constrained the ability of many citizens to participate in the mainstream economy thus entrenching the spectre of poverty and underdevelopment afflicting many people in the world as a whole and in our country in particular (ANC, 2012).

The document notes that South Africa has lagged behind in a number of key global ICT indicators, like universal access to the Internet as a result of "fragmented and uncoordinated policy and institutional arrangements". It is also noted in the document that "South Africa lags behind other BRICS countries in almost all aspects of the ICT value chain and has also lost its position as a leader in the rollout of ICT services", surpassed by countries like Senegal and Egypt that have taken leading positions. In the country, mobile broadband penetration stands at 11% in households and less than 8% in business while fixed broadband below 10% (ANC, 2012).

While it is very encouraging to note that the ruling party was to discuss policy on the usage of ICT to build an inclusive information society in South Africa, one would need to be on the look-out for developments in this area a couple of years from the ANC's 53rd national policy conference. The tendency of ruling parties globally is to be more theoretical and less practical about ICT policy issues.

The National Health Act 61 of 2003 stipulates that a coordinated and integrated implementation of health information systems must be enforced through all levels of government, and this would include local governments. A quick and successful rollout of an e-health system nationally could possibly be achieved through the usage of mobile broadband since some of the under-serviced areas where such systems are needed mostly are not 'wired'. Engaging on a wiring project could take longer and delay the provision and distribution of the much needed health services to the marginalised (DoH, 2003).

There are also two policy directions that the South African government has embarked on over the last two years that prove how serious policy makers are to change the telecommunications landscape in the country. These are the Broadband Policy document and the ICASA Notice 898 of 2011.

The Government gazette number 33377 is a Broadband Policy document of 13 July 2010, that is a commitment by government to make broadband available to all South African citizens with intention to improve government services, the education and health systems and grow the economy by making available ICT services that are easily accessible and affordable to all citizens and thus bridging the digital divide.

The Independent Communications Authority in South Africa (ICASA) Notice 898 of 2011 in Government Gazette 34848 of 14 December 2011, on Section 3(2) of the Electronic Communications Act 36 of 2005, stipulates on the

exploitation of the high demand Digital Dividend and Radio Frequency spectrums for electronic communication services. In this policy directive, the 800MHz and 2.6GHz frequencies are identified as suitable bands that can help in the provision of high capacity broadband wireless coverage at a lower cost and thus make possible the achievement of BB4All and Universal access, and economic empowerment f citizens.

The ICASA Notice 912 of 2011 on Government Gazette 34872, of 15 December 2011 is a draft invitation to people with existing ECNS licenses to apply for licenses to operate in the above-mentioned frequency spectrums for the provision of mobile broadband services in both urban and rural areas. The closing date for these applications was 23 March 2012 and the date promised for the finalization of the process was 30 April 2012.

1.8. Broadband Policy, Information Society and Service Delivery

It is indicated in the National General Council Report on ICT resolutions of the ANC National Conferences held in Stellenbosch and Polokwane in 2002 and 2007respectively that all municipalities must have community radio stations and publications, and that all local communities should have access to ICT. The ICT resolutions report states that the communications infrastructure in South Africa was deployed in a skewed manner that disadvantaged and excluded rural, peri-urban and township areas from service delivery in order to serve the requirements of big business and the then security establishment (ANC, 2012)

The ANC, South Africa's ruling party, held its 53rd national policy conference around June 2012 with discussions also around the communications policy. The organisations' policy discussion document provided a framework that guided the conference discussions on policy direction that government should take to provide service delivery to all citizens and ensure achievement of the

goals of creating an inclusive information society through the use of media, communications, and ICT. The policy discussion document also noted the intensification of ICT-driven globalisation that has also sharpened the digital divide between and within communities and that produced winners and losers and created a rising tide of inequality between the haves and have-nots both in South Africa and globally. The inequalities created by this digital divide have limited citizens' ability to participate in the world's economy and thus increased paucity and underdevelopment in the country and worldwide. (ANC, 2012)

The ruling party's' discussion document is very encouraging as it speaks about basic issues on the existing digital divide created by lack of access to ICT by poor citizens, even though government is investing in this area. It would be a positive development if such discussions on ICT policy in general and on broadband for service delivery in particular, are fruitful. Their results can guide policy makers to come up with better and faster ways of creating an inclusive information society in South Africa through the use of ICTs. The problem is the tendency of South African policy makers to be theoretical and less practical on policy implementations.

The National Health Act encourages "enforced" implementation of an integrated and coordinated health information system through all levels of government, including local governments. The act indicates that usage of broadband can ensure a quick and successful national rollout of an e-health system to ensure that under-serviced areas will benefit as such areas are in need of these systems (DoH, 2003).

It is disturbing to note that the act is not very specific on the type of broadband than can be used to roll out this e-Health system. If there is no stipulation on usage of mobile broadband as a priority, it is possible that priority would be on areas that are already wired and this could delay the

distribution of these health services to people living in under-served areas since a wiring project is considered costly because of geographical reasons.

The following paragraphs also indicate the government's commitment to implement broadband for all South African citizens in the near future. The Minister of Communication stated in the General Notice number 898 of 2011 published in the Government Gazette number 2011 that, ICASA must exploit the digital dividend and radio spectrums to enable provision of less costly electronic communications services because of the fewer base stations that are used to cover a given area, thus lowering implementation costs (ICASA, 2011).

The governments' regulatory body ICASA has issued notice number 911 of 2011 where 800 Mega-hertz and the 2.6 Giga-hertz bands will be released for mobile broadband wireless access and applications will be invited for licences from new and existing service providers once the band have been released. Sections 4.5 and 4.6 of the ICASA Notice 911 states that broadband for all in South Africa is achievable through mobile telecommunications technologies if the 800 MHz and 2.6 GHz bands that have been identified worldwide for International Mobile Telecommunication (IMT) technologies could be used to provide mobile broadband wireless access (ICASA, 2011).

Section 31(3) of the Electronic Communications Act 36 of 2005, discusses the Draft Spectrum Assignment Plan for licensing the 800 MHz and 2.6GHz bands that invites applications for radio spectrum licences to provide broadband wireless access services for urban and rural areas making use of the two bands mentioned above. (RSA, 2005)

Despite of all the above acts, policies and government notices, problems have been encountered in the quest to close the digital divide and make South Africa an information society. The following section discusses this challenge in the form of a problem statement.

1.9. Problem Discussion

There are various ICT projects that have been implemented unsuccessfully in South Africa and in other countries due to high rates of hardware breakdown combined with the low locally available technical problem-solving. High maintenance (recurring) costs for hardware, software, and internet connectivity put a financial burden on other projects rendering them financially non-sustainable (van Reijswoud, 2009).

In spite of these failures, there are various successes that were registered with projects where cheap broadband infrastructure was used for interconnection between educational and health institutions to enable simultaneously communication and access to health services to patients and lectures to students who would have had to travel long distances to get to these institutions (FMFI, 2006).

Clinics located in rural areas or townships utilise broadband infrastructure to communicate with hospitals to help patients without the need to travel long distances in order to get such access (CSIR, 2006).

In spite of these successes, a majority of people in most under-serviced areas still travel long distances in order to access services like health and education. Replicating those projects where ICT was used for the development of other communities in a similar situation could benefit the economy of the country.

Other possible reasons for failure is the fact that most of the projects aimed at creating networked societies in South Africa do not have the 'human' element in them. This 'human' element is what McIver defines as the 'human rights perspective on the digital divide' where the right to communicate must drive policy and projects aimed at the digital divide (McIver, 2004).

Companies driving projects aimed at eliminating the divide must put the human factor at the front when doing projects so that these complete communities are able to sustain them. Amongst the objective of such projects must be revenue generation to ensure sustainability. Making the communities take ownership from the beginning of such projects and educating them on continuous revenue generation should ensure success.

Galperin (2010), states in his paper that there is recognition in the ICT4D policy and research agenda that the most important thing is the delivery of ICT services and increasing access opportunities in the most cost-effective manner instead of trying to connect people to devices and networks. The above statement brings to light the possibility that most of the projects undertaken in the name of taking services to the poor tend to concentrate on networks and devices to connect people instead of taking services to them.

For ordinary citizens, these networks and connecting devices can be very difficult to understand because their main concern is access to services rather than the technology that makes such access possible.

This is the major challenge to organisations seeking to close the digital divide – to take services to the underserved without exposing such communities to high prices due to high costs of implementing the underlying technology. Policy makers have to come up with policies that can tackle this challenge of taking those important services to the marginalised in a cost-effective manner.

1.10. Discussion of Chapters

The research is divided into six chapters that are defined as follows: Chapter 1 is the introduction consisting of background to broadband and service delivery in South Africa, current service delivery initiatives in education and health, utilisation of how ICT for service delivery in education and in health

and for local economic development. The chapter also looks at the digital broadband *"donga"* and socio-economic exclusion in SA. It goes on to discuss the concepts of information society and broadband in South Africa, and WSIS on Information Society. The chapter concludes by discussing the research problem.

Chapter 2 looks at the theoretical framework of the research, a survey of literature around the research topic. It discusses at broadband, digital inclusion and socio-economic development in the country, the information society policy for a learning society and partnership, broadband divide, access to technology and the information society, and the conceptual framework that guides the research.

Chapter 3 deals with the research methodology and discusses the problem statement, the research purpose, and question, the approach used in this research, and the design of the research. It also discusses at the types and sources of data that will be utilised in the attempt to dissect the problem and concludes with limitations to the research.

Chapter 4 deals with research findings on access and usage of broadband in fast-tracking service delivery to under-serviced communities. The chapter presents findings from the interviews that were conducted with respondents representing the research study population that includes policy makers, community leaders, and senior staff members in the areas of research, technical experts in telecommunications, and the academia.

Chapter 5 discusses analysis of data and interpretation of the findings presented in the chapter 4 above and how the findings help in answering the research questions. Chapter 6 deals with conclusion and recommendations on how the issues addressed by the questions can be implemented in other areas within South Africa.

Chapter 2. Broadband and Service Delivery Conceptual Perspective

2.1. Introduction

It must be stated that it has been a challenge to source literature that links broadband to ISAD because, the agenda of ICT for development is fairly new and still in “flux” (CSIR, 2006). As a result of this some community and social informatics literature dealing with usage of ICT for poverty alleviation has been included because of its relevancy to the topic being addressed.

The theoretical framework section will look at current studies on information society and how broadband has been applied in fast-tracking service delivery in education, health and for socio-economic development and in the creation of the information society. The section will also attempt to show the need for this research by interrogating current studies, discussing research question concepts and their inter-relationship, and finally linking the research to the identified gaps in the literature to expose how broadband for service delivery is tackled in academic debates.

The following concepts will be discussed:

- Broadband, digital inclusion and socio-economic development
- Partnership in creation of an Information Society
- Broadband Divide, Access to Technology and Information Society
- Broadband Policy, Information Society and Service Delivery
- Strengths and Weaknesses of Current Policy and Regulatory Environment
- Conceptual Framework

In his address at the WSIS summit, former South African president Thabo Mbeki[8] uttered the following statement on the importance of ICT in addressing social exclusion (Presidential National Commission, 2006):

> ...the creation of an inclusive and development-oriented Information Society is in the best interest of the majority of humanity because most of the peoples of the world especially from developing countries, are confronted by the challenge of exclusion in the context of global economy, in whose development modern Information and Communication Technologies (ICTs) play a vital role.

Heeks(2009) states that in ICT4D, most energies are reserved and focussed on projects that take ICT into poor communities and which seek to deliver information and services that might address poverty, health, education and gender equality. The review of literature will focus on creating the information society through the use of broadband in education, health and for socio-economic development and poverty alleviation.

It is indicated in the National General Council Report on ICT resolutions of the ANC National Conferences held in Stellenbosch in 2002 and in Polokwane in 2007 that the rural, peri-urban and township areas are disadvantaged and excluded from service delivery because of the skewed deployment of the communications infrastructure that serves the repressive requirements of the security establishment and big business. (ANC, 2012)

This chapter attempts to show how broadband has been exploited in South Africa to deliver services in the areas of health, education and for local economic development in under-serviced areas that are in dire need of such services, to ensure digital inclusion. The chapter will also attempt to show how the broadband solutions are implemented by partnership between

[8] Thabo Mbeki, former president of South Africa, addressing the World Summit on Information Society (WSIS), Tunisia, November 2005.

private and public institutions and affected communities in an attempt to create '*learning communities'* in the selected study areas that will develop into information or '*networked society'*. This will be done in conjunction with taking a swipe at access *to technologies* by communities affected by the '*broadband divide'* and how this divide will be minimized in the creation of this '*information society'.*

The chapter will also discuss how current implemented broadband policies support the establishment of an information society or how the policies become stumbling blocks in alleviating service delivery problems in under-serviced areas. This will be done in conjunction with looking at the strengths and weaknesses of current policies and regulations on broadband in terms of value creation in areas like education, health and local economic development.

The chapter will conclude by discussing the conceptual framework that will guide the research in its effort to check the existence and applicability of information society and broadband policies in service delivery automation through e-education and e-health and for local economic development, core government commitments to those citizens, located in under-serviced areas.

2.2. Broadband, Digital Inclusion and Socio-economic Development

> Networks change relentlessly: they move along, form and reform in endless variations. Those inside have the opportunity to share and overtime, to increase their chances to succeed. Those who drop out or become switched off will see their chances vanish (Castells, 2000).

In this statement Castells (2000) points the components of an information society, how dynamic it is, and the advantages of becoming part of such society, these being sharing, and success. He points out the disadvantage associated with not being part of such a network, “become switched off”. Underserviced communities are ‘switched off’ in the networked society since access to essential services is non-existent. Broadband seems to be the viable vehicle or the way forward in these cases to switch these communities back onto the information society or community networks.

Broadband connectivity is widely accepted as important and strategic because of its ability to accelerate economic growth, improve social and cultural development, and enhance innovation (Teppayayon & Bohlin, 2008). Castells (1998) theories of digital and social exclusion warn governments of developing nations to take steps aimed at closing the digital divide to avoid digital exclusion and thus minimise dependency on donations and grants. Castells’ views are relevant when one considers the investments by the South African government in ICT to try to minimise the digital divide and social exclusion and expose the country’s citizens to digital content and to international developments via the Internet.

Digital inclusion is the objective the SA government is striving for when investing in ICT skills to counter the effects of ‘digital exclusion’. Education, skills development, and training are amongst the priority focus areas listed in the Information Society and Development (ISAD) Plan that was approved by the South African Cabinet as a framework for development of the country’s information society (Presidential National Commission, 2002). As pointed out by literature above, broadband has the ability to improve conditions in underserviced areas affected by the digital divide and create an information society (digital inclusion) that would contribute to the global economy.

In the current era and for the next decade 2011 - 2020, broadband is becoming very important to South African government in its bid to bring services to the under-served and build local economies so that communities are involved in the main stream of the economy. The broadband policy and the spectrum policy approved in the middle of 2010 are examples of such dedication and intention by government to build an information society.

Mphahlele and Maepa (2003) confirms that conditions in under-serviced areas can be greatly improved by utilisation of ICT as affected people can be enabled to participate in the economy by using broadband to launch their products and services through websites. The South African government needs to debate more about policy and regulation strategies on usage of ICT as a platform for extending services in health, education and to develop local economies and thus create more successful partnership with institutions involved in the creation of the information society in both the public and private sectors.

The availability of relevant content becomes important for development purposes, but today most content, which includes voice, data, video and graphic design requires broadband access. Health and education needs in under-serviced areas are likely to require rich content in order to be effective and relevant. An example would be voice, data and video conference needs for interaction between stakeholders involved in the two areas (nurses/scholars and doctors and lecturers) located in different geographic areas. Development of relevant content that promotes culture development and diversity becomes more important for under-serviced communities. Failure to develop policies that ensure the development of such relevant content can lead to failure to attract more people to utilise broadband services (Van Audenhove, 2009).

To demonstrate how technology can be used for deployment of broadband infrastructure in rural communities the DST and CSIR Meraka Institute have embarked on a project that is about roll-out affordable broadband in selected rural areas termed 'Presidential Nodes' in order to promote local economic development. It is envisaged that village operators who have been trained in various skills, will run with the business to ensure sustainability and business continuity. This BB4All project is described bin an ANC discussion paper highlighting recent world-class achievements in South Africa as follows (ANC, 2012):

> A flagship project that demonstrates the use of alternative, cost-effective, and innovative technologies and models to deploy broadband infrastructure and services for rural communities is currently underway in Nkangala District Municipality in Mpumalanga. The project uses Wireless Mesh Network technology to connect close to 200 schools and a few other sites. 114 of these connections have been commissioned to the Internet. The project incorporates a business model that promotes local economic development. Unlike with conventional telecommunication network operator model, the Wireless Mesh Network uses the out-of-school youth who show entrepreneurial and technical potential to operate, support, and maintain the network in their own communities.

Another good example of how broadband has been utilised successfully lately for the benefits of many under-serviced schools was broadcasted on the e-TV news channel where Siyavula[9], has come up with a very interesting innovation for education where electronic mathematics and science textbooks named 'WebBook' by Siyavula (Bridget, 2011) are kept in a database and

[9] *Siyavula* is a Mark Shuttleworth company based in Cape Town. Website: www.siyavula.org.za

provided to students and teachers over the internet and over mobile cellular phones at a nominal fee.

A teacher or student is able to log into the site and browse the prescribed textbook online free of charge. The ability to download such text books is at a reader's fingertips with payment of nominal "royalty" fee of about thirty-two rands for an e-textbook. Many schools have benefited out of this venture by downloading, printing, and binding the prescribed books at their own cost. This is a good example of partnership between government and the private sector to use broadband for the benefit of society. *Siyavula*, commented about this initiative in their website as follows (Bridget, 2011):

> We have coined the term "WebBook" for our series of Maths and Physical Science textbooks, which will apply to the Life Sciences book too. This is due to the online videos, simulations and assessment items that will be linked to in the book in the appropriate places – we've done this for our Maths and Physical Science textbooks the same will be done for Life Sciences! We've built the pipeline to elegantly produce a print version that has short codes to link to the online resources. This will help educators who are struggling to integrate ICT in their lessons – we'll put links to the right resources, in the right place in a curriculum-aligned textbook.

The developments mentioned above are excellent examples of exploitation of ICT and broadband for the upliftment of people located at the 'bottom of the pyramid' (BoP), defined by Smith and Spence (2009) as a sector with very low-margin and high-volume business models. Although this is the case, the challenge is how to broaden the scale of this project into under-served areas, as the service is benefiting school children located in affluent areas characterised by high speed networks and easily available internet access. In

schools located in these areas, possession a smartphone or tablet is a norm since parents can afford to buy their children these internet enabled devices.

The school child located in under-served areas does not have access to the internet most often, let alone ownership of a smart phone or tablet. According to Castells (2000), such children will be “switched off” and “will see their chances vanish” and will have a problem to compete during matric examinations and during tertiary education. It is in cases like this where the government should intervene by way of policies and regulations to ensure that schools located in underserved areas are not discriminated against by providing regulations that will ensure that broadband providers install broadband infrastructure to these ‘*Bottom of the Pyramid*’ areas and provide broadband services at affordable at affordable prices.

Introduction of regulation that encourages more competition in the broadband sector could also help in ensuring more innovation and total access to affordable services. Such a policy could also be applied to ensure availability of affordable or subsidized smart phones or tablets to school children located in these underserviced areas.

According to documentation from the Department of Communications, the South African government has plans of introducing more competition and more operators in the telecommunications space in general and in mobile broadband specifically because of its envisaged advantages of reaching inaccessible areas. The governments’ regulatory body ICASA has issued a notice number 911 of 2011 where 800 Mega-hertz and the 2.6 Giga-hertz bands will be released for mobile broadband wireless access and applications will be invited for licences from new and existing service providers once the band have been released. Sections 4.5 and 4.6 of the ICASA Notice 911 states that (ICASA, 2011):

> It can therefore be concluded that broadband for all citizens in South Africa can be achieved mainly through mobile telecommunication technologies. The 800 MHz and 2.6 GHz band have been identified worldwide for International Mobile Telecommunication (IMT) technologies, which should provide mobile broadband wireless access.

The research supports the usage of mobile broadband to take services to the unconnected, the “switched off” in order to ensure sustainable growth in the country and benefit local communities affected by the digital divide.

In order for the South African government to close the digital divide, access to technology must be available to all citizens. The current telecommunications infrastructure has not been able to fulfil this objective because of various factors. Creation of an information society in the country can be achieved if firm foundations for implementation and improvement of broadband infrastructure have been put in place and these foundations include broadband policies and regulations that will ensure that this objective is attained.

The general belief that mobile broadband has the ability to uplift under-serviced communities and minimise the digital donga, is contradicted by Sclove (1995) on an article titled ‘*Cybersobriety*’ in Day and Schuler (2004) on the inability to create an equitable society in commercialised broadband internet, who makes use of the example of automobiles whereby road congestion and reliance on oil is a global problem. Sclove (1995) argues that universal access might create similar problems in that people might experience ‘over-dependence’ to the internet and be exposed to cybercriminals and other negative effects of the internet. This is an interesting argument on universal access to mobile broadband topic when one considers the level of training and education of people located in these under-served areas, particularly on ICT Security in particular (Day & Schuler, 2004). This

lack of '*cybersobriety*' has the ability to disorganise mobile broadband projects in many aspects and is a subject of further research.

It is the prerogative of governments to ensure that ICT security considerations are made when deploying broadband in under-serviced areas to ensure that citizens feel safe when they access content from government and other relevant websites. ICT security must be considered when formulating broadband policies and must be embedded in such policy documents to cater for the vulnerable and the week, so that they access content with confidence.

2.3. Partnership in Creation of an Information Society

The Minister of Communications, Honourable Roy Padayachie, stressed the importance of partnership between the public and private sector in including all South African citizens in the economy and thus bridging the gap created by the '*digital divide*' in the following statement made on the 2010/11 Annual Report of the Department of Communications (DoC, 2011):

> Our government has, since the advent of democracy, consistently identified ICTs as one of the drivers of economic growth and social development. Complimentary public and private sector interventions are needed to increase uptake and usage of ICTs, especially in rural and poor urban areas. Without this, it will continue to be difficult to integrate many South Africans, living in abject poverty, into the economic mainstream, thus increasing the inequality gap between the haves and have not's within and between communities.

Mphahlele and Maepa (2003), state that populations are improved by their ability to take part in the global economy through the utilisation of Information and Communication Technologies (ICTs) to ensure effective functioning in the political, social and economic spheres and to ensure good quality of life. This

statement puts into perspective the underdevelopment experienced in under-serviced areas of South Africa because of lack of utilisation of ICT.

Because information society is a learning society where education and training plays a vital role, policies in education, health, universal service and access, and infrastructure layout, would need to change to ensure that the objectives of bridging the broadband divide and of creating such a learning society are achieved (Van Audenhove, 2009).

Failure to review policies on the areas of education, health and universal service can hinder broadband growth in many ways, a typical South African example is the failure to implement the e-rate (special rate that schools are supposed to be charged for broadband connectivity) that has resulted in very slow broadband uptake in schools. According to Van Audenhove, the information society policy is divided into two areas: infrastructure extension and services. Failure to ensure that there is synergy between the two areas can lead to broadband failure (Van Audenhove, 2009). The private sector owns and controls most broadband infrastructure and provide services to the society, whereas the public sector makes the relevant regulations to ensure compliance by the private sector.

For broadband implementation to be effective, partnerships between the public and private sectors must be created and concretized as this partnership is very important to ensure successful implementation of policies that will encourage broadband expansion to improve conditions in under-serviced areas and advance the goals for an information society in South Africa. The importance of a solid partnership between private companies and government is emphasised to ensure that initiatives aimed at easing the burden created by the broadband divide are successful (Conradie, Morris & Jacobs, 2003).

Most of the projects have not been effective in closing the digital divide because of lack of partnership between government, the public, and the private sector. This lack of partnership has resulted in lack of access because of issues like high prices, poor regulations and lack of coordination between the implementers and the communities. The importance of a solid partnership between government and the private sector was stressed to ensure that initiatives aimed at easing the burden created by the broadband divide are successful (Conradie *et al*., 2003).

Although such partnership exists in South Africa it is often characterised by lack of coordination on the projects in execution possibly because of lack of policy guidance: there is no policy to guide the donation of computers by private companies to schools or community establishments and thus “box dropping” continues unabated.

An illustration of such partnership is the NEPAD e-Schools consortia, where Hewlett Packard (HP), Cisco Systems, INMARSAT Limited, Oracle Corporation, and Microsoft Corporation are involved in laying down the infrastructure to interconnect schools together to enable knowledge sharing (Presidential National Commission, 2002).

The research aims to study how the current policy on information society can be improved so that it encourages partnerships and initiatives, aimed at improving service delivery in education and health, and enhance socio-economic development. The research will also look at how policy can support the replication of successful initiatives to other areas affected by broadband divide and social exclusion to enable participation of such areas in the local and global economy.

Value of government and the private sector forming partnership with the communities in implementing projects that help in creating a learning society is realised in a converged technological era since the focus now has shifted

from delivery of simple basic telecommunications services to delivery of high speed infrastructure capable of allowing access to the mixture of rich data digital and voice content that will make it possible for all citizens to access services from government, the private sector and community organisations.

Both government and the private sector are already custodians of such network infrastructure but the majority of under-serviced citizens do not have access to such because of the associated high costs. It is thus a prerogative of the two parties to work on policies and strategies that will bring in the "switched-off" communities to have access to the national 'infostructures' so that they can engage in the global economy. In his convergence paper, Gillwald describes the technological developments as (Gillwald, 2002):

> ...characterised by integrated broadband networks offering high speed access to a multitude of customised services and content to meet a variety of needs across the economy and society from finance to education….national 'infostructures' serve as nodes in a global high speed communication network allowing the economies of those countries to engage in the global economy.

It is true that the '*switched-off*' communities that, according to Gillwald form two-thirds of the global population are not able to take part in decision-making in their own countries. Their rights to take part in the local and global economy and to equality as citizens and consumers is undermined and this has resulted in the increase in the '*digital divide'*, defined as '*the increasing gap between those with access to global information networks and those without access*'.

According to Gillwald this '*digital donga'* represents a major challenge to policy makers across the world (Gillwald, 2002), and it is for that reason that the South African government established the PNC on ISAD whose mandate is "to facilitate the coordinated and integrated development of an inclusive

Information Society in South Africa and, to support efforts aimed at making South Africa and Africa integrated and equal members of the Global Information Society" (Presidential National Commission, 2002).

The importance of the partnership between the public and private sectors become even more important when attempting to address the challenges of access to technology that is prevalent in under-served communities. These challenges are easily addressed if such broadband partnership happens at both national and local levels to create the information society throughout the country and prevent problems of having certain areas better than others in terms of access to technology.

The lack of partnership between national departments creates problems of duplication of effort and wastage of resources and, there is no knowledge sharing about lessons learned in broadband implementation project so that mistakes are not repeated. This is a common problem that seems to dodge current broadband implementation projects aimed at bridging the digital divide and create the envisaged information society in South Africa.

2.4. Broadband Divide, Access to Technology and Information Society

Universal access - which is the primary goal on South Africa's vision for an information society - needs to be included in the scope of a broadband policy to ensure that the broadband divide is bridged (Van Audenhove, 2009). According to Teppayan and Bohlin (2008), new interactive services brought about by broadband must be accessible to every citizen in the country regardless of location or demographics, so that society at large can benefit in the overall economic efficiency. Access to broadband services by school learners at home has the capability of spreading its importance and its use to parents and other family members as the learners research their home works,

thus in a way marketing and spreading usage of broadband services (Van Audenhove, 2009).

Accompanying the accessibility of broadband services is literacy of involved stakeholders. Bertot (2003) indicates that access to technology and content are not enough as individuals also need to know how to locate and retrieve relevant information, evaluate its relevancy and synthesize it to solve a particular problem. If people particularly the elderly are not taught how to do this, then the likelihood of broadband project being a white elephant is highly possible.

Bertot's statement is evident in many broadband projects implemented by both government and the private sector, where the project which was aimed at helping the poor ends up being a white elephant because of lack of people involvement and lack of training on proper usage for gain. It is important to aim broadband projects at solving problems existing in the communities where implementations take place and then train the communities on the usage of the broadband systems on resolving the encountered problems (Bertot, 2003).

Another important issue that is fundamental to broadband project sustainability is that of proper marketing of broadband services offered to communities (Kekana, 2002). Positioning of a broadband offering clearly can result to early adoption of such an offering. People located in areas affected by broadband divide and social exclusion tend to be ignorant of services provided at public centres like MPCCs because of the belief that such services do not address major community concerns, which include job creation for poverty alleviation, free education and health information or service.

Kekana supports the research in its attempt to look at broadband as a solution that is cost-effective, replicable, and sustainable and that will be able

to deliver e-education and e-health to communities affected by broadband divide and social exclusion and thus improve the local economy.

Van Audenhove indicated the two divisions of the information society policy namely: infrastructure extension and service provision. Not ensuring synergy between the two areas in a broadband project results in failure. If the implementers do not recognise the two distinct areas identified by Van Audenhove, the project tends to be more biased on one area ignoring the other. It is this failure to recognise and ensure this synergy between the two areas that has led to most broadband project failures (Van Audenhove, 2009).

If project concentration is on infrastructure extension and not on service provision, affected communities tend to ignore such implementations and the project will fail no matter how extensive the underlying infrastructure is. The same occurs if the project focuses more on service provision and less on infrastructure extension because an unstable infrastructure can lead to problems of poor service due to performance issues on the technology or network side, e.g. an underperforming server or transmission errors (Van Audenhove, 2009).

The NEPAD e-Schools consortia, where Hewlett Packard (HP), Cisco Systems, INMARSAT Limited, Oracle Corporation and Microsoft Corporation are involved in laying down the infrastructure to interconnect schools together to enable knowledge sharing is another example of a project that concentrated more on infrastructure extension and less on the provision of service(Presidential National Commission, 2002).

Evidence of this is the fact that all the companies in this consortium are mostly infrastructure providers than broadband service providers. There is a stark difference when one compares this project to the ‘Siyavula’ project run by Mark Shuttleworth’s company in Cape Town where school textbooks are

provided to learners through downloads at a nominal price. This project could be an extension of the NEPAD e-schools project if the latter was still in existence, because such an infrastructure could have been used for such downloads and knowledge sharing thereafter.

In conclusion, although many 'broadband-for-all' projects have been undertaken to address the digital divide problem, the majority of these have not been very successful in doing that. Communities located in under-serviced areas still experience service-delivery problems in the areas of health and education because the broadband policy and regulatory framework is not stable for operation by the industry, and, there is little or no interaction between government and the private sector for stimulation of local content development (Broadband Commission, 2011). Recently, only fewer projects have been able to deliver the envisaged services to local communities although at a very limited scope because of this unstable regulatory space.

The research will attempt to establish how implementations of broadband-for-all projects can be improved for the benefit of 'switched-off' communities, and how lessons learned from successful projects can help other projects and how these projects can be replicated to other areas of the country in need of government services like health and education. This will also look at how the existing policy can be enhanced to support those projects aimed at closing the 'digital divide'.

The table below indicates broadband strategies that have been implemented by five countries including South Africa. It is clear from this table that although the country is ahead of Brazil in subsidizing nation-wide ventures and promotion of facilities-based resale competition, and France on the improvement and expansion of public private partnership, it lags behind Singapore and France in in implementing local loop unbundling – one of the

most important strategies that enhance broadband implementation and penetration and that have a tendency to reverse the gains made as far as the other broadband strategies are concerned - as indicated in the tables below (Infodev, 2011).

Table 4: *Elements of Broadband Strategies*

Broadband Strategy	***S. Africa***	***Brazil***	***France***	***USA***	***Singapore***
Establish open-access wholesale networks					
1. Encourage private sector investment	✓	✓	✓	✓	✓
2. Include broadband under universal service definition	✓	✓	✓	✓	✓
3. Encourage demand for broadband services	✓	✓	✓	✓	✓
4. Promote, improve and expand public private partnerships	✓	✓		✓	✓
5. Subsidize local (citywide), regional, or national ventures	✓		✓	✓	✓
6. Promote facilities-based resale competition	✓		✓	✓	✓
7. Mandate local loop unbundling (LLU)			✓		✓
8. National Broadband Strategy	2010 Broadband Policy	2010 National Broadband Plan	2008 France Numérique 2012	2010 National Broadband Plan	Intelligent Nation 2015 (iN2015)

Source: *Rob Frieden for the World Bank and Telecommunications Management Group, Inc.*

PNC on ISAD indicates on its plan that there are ten main important points that should be considered when attempting to develop an information society in South Africa. The ISAD Plan's ten points are listed below (Presidential National Commission, 2006):

a) *Policy and Regulatory environment*

   This refers to the creation of an investor friendly, and enabling environment that supports the WSIS principles (indicated in 1.6 of Chapter 1). It also refers to the creation of market conditions, a strengthened legal and regulatory framework, and strategies for ICT and national broadband.

b) *ICT infrastructure*

   This indicates the necessary networks for broadcasting, for fixed line and mobile broadband, taking into consideration the high costs involved in acquiring and deploying such infrastructure, technology interoperability, scalability and adaptability, and the lack of application or local content in the country.

c) *Access to information and ICT infrastructure*

   The above can promote competition as lower prices (affordability) means more community-based access points. This would strengthen USASA as it is in line with the Universal Service Policy and Strategy development.

d) *Security and Confidence and e-Awareness*

   This refers to a safe and secure ICT environment (secure transactions) that enables the prosecution of cybercriminals, and involves e-awareness campaigns.

e) *Science, Innovation, Research and Development*

This involves promotion of investment in innovation, development of an ICT R&D innovative strategy and development of knowledge-intensive industries.

f) Human Capital Development

The point indicates the provision of an opportunity for development in Information Society and Knowledge economy. It encourages all concerned parties to explore the establishment of a purely ICT institute/university in the country.

g) Funding

This discusses the Digital Solidarity Fund aimed at funding Information Society projects.

h) Measuring Information Society Development and impacts of ICT in SA

This discusses the establishment of comprehensive databases and data collection strategies for supply of unavailable time series data. Such databases can help in reaching agreements on indicators and measures on information society development. The development of impact assessment, monitoring, and evaluation systems is also discussed.

i) Coordination and Integration

This highlights the development of a coordination & integration framework of information society and promotion of cooperation among key role players. It discusses the usage of different planning instruments that are not aligned by the three spheres of government. Examples of such planning tools are: the MTSF used by National, the Provincial Growth and Development Strategy (PGDS) used by Provincial, and the Municipal Integrated Development Plan (MIDP) used by local governments that contradicts this goal.

j) Digital inclusion of the Special Group

Here the discussion is about the: Youth and Women ISAD programme, Technology Advisory Forum, Youth ISAD village (techno park), and, Media and ICT to address children needs and challenges.

It must be noted that due to the scope of this research, only three of the above ten points will be covered in the research analysis. The three points are: (f) Human capital development, (g) Funding, and, (i) Coordination and Integration.

2.5. Strengths and Weaknesses of Current Policy and Regulatory Environment

Local policies and regulations meant to govern the telecommunications sector have the effect of either supporting or blocking service delivery and the creation of an information society through the usage of broadband as we move through the ICT lifecycle. The InfoDev report of 2007 indicates that policy focus by developing nations in the 1980s and 1990s was 'on increasing penetration' of technology, whilst focus of developed countries was 'on establishing competition and lowering prices' (InfoDev, 2007).

This shows how backward developing countries have always been but the problem arises when such policy focus does not change although the objectives have been achieved more or less although at a much slower pace. Governments in developing nations must now follow the example of developed countries by way of changing policy to now focus on the promotion of 'innovation in new applications, in content and in services' offering as well (InfoDev, 2007). This is not to say that country-wide telecommunications technology penetration has been achieved, but nothing stops policy makers to widen the scope so that the country is not caught napping.

The lack of focus on innovation is becoming an issue now as programs like e-government, e-citizens, e-commerce and e-business are maturing in areas where access to ICT services is not a challenge because offered services and the content are of lower standards, and available applications do not deliver value to consumers. In South Africa, the majority of both government and business websites are still not able to allow citizens to conduct serious transactions – similar to the banking sector – in areas like education and health even in well ICT-enabled urban areas. This calls for urgent focus of policy and regulation that will 'contribute towards opening the sector' and promote innovations (InfoDev, 2007).

Another area where policy is a hindrance is what Galperin describes as '*platform agnosticism*', which he defines as:

> *"…the recognition that the important thing is not to connect people and businesses to specific networks or devices, but to deliver ICT services and increase access opportunities in the most cost-effective manner".*
> (Galperin, 2010)

Current policies of government and strategies of private sector entities engaged in BB4All projects focus on the underlying technology that will be used to take services to the under-serviced communities instead of focusing on extending the services that should be rendered effectively through the use of broadband and, on lowering the associated costs. There are elements of this tendency on the Meraka DST BB4All project that is currently running at Enkangala, in Mpumalanga, and other projects that have been implemented before where the objectives have not been achieved.

Upgrading broadcasting networks from using analogue to digital infrastructure and modifying policy to support this migration is an enabler as this will enhance the deployment of mobile broadband to under-serviced areas located in inaccessible areas thus lowering the cost of doing business and

open a number of ICT opportunities for citizens as barriers to market entry will be lowered.

Lowering of barriers will create favorable conditions for attracting investment and also bring about the much-needed competition in the telecommunications space which in turn will encourage innovation and lowering of prices in telecommunications and increase universal access, and thus make the objective of closing the digital divide and creating an information society in the country reachable (Galperin, 2010). Opportunities that will be brought about by the digital migration will be felt more in the health and education sectors and will ensure social upliftment. Projects like community radio stations will suddenly have frequency space to operate on where various service offerings will become possible.

Another example of a policy being a stumbling block is regulatory interference which is described by Southwood as a '*political framework that governs whether the service operates or not and the reasons given for closure'* (Southwood, 2011). In South Africa, this interference is characterized by the government and the regulator not doing enough to lower the barriers to telecommunications market entry and their failure to promote competition that will bring about innovation and lowering of telecommunication prices. In other African countries like Egypt and Uganda, regulatory interference occurred during revolts where government closed internet and the SMS service (Egypt) or networking sites like Facebook and Twitter (Uganda) to suppress protests against the respective governments.

The commitment of the ruling party, ANC on national broadband implementation emerging from its discussion documents on telecommunications and broadband that was explored during its conference in Mangaung, Bloemfontein in November 2012, is a positive factor that could

see changes in telecommunications policy and regulatory environment in future (ANC, 2012).

The National Health Act encourages “enforced” implementation of an integrated and coordinated health information system through all levels of government, including local governments (DoH, 2003).

The support shown by the current Minister of Communication is evident when he stressed in the General Notice number 898 of 2011 published in the Government Gazette number 2011 that, ICASA must utilize the high demand spectrums known as the Digital Dividend and Radio Frequency spectrums to lower costs, is another strength for the current regulatory environment.

ICASA has issued notice number 911 of 2011 where 800 Mega-hertz and the 2.6 Giga-hertz bands will be released for mobile broadband wireless access and applications will be invited for licences from new and existing service providers once the band have been released (ICASA, 2011). This will encourage competition as the market is going to be opened for participation by more operators.

The Electronic Communications Act 36 of 2005 is a section on Draft Spectrum Assignment Plan for licensing the 800 MHz and 2.6GHz bands and invites applications for radio spectrum licences to provide broadband wireless access services for urban and rural areas making use of the two bands mentioned above (RSA, 2005).

Failure by government to empower and strengthen the regulator is a weakness that has resulted in a weak regulator (Southwood, 2011). Currently, ICASA lacks proper funding to employ and train enough resources that will ensure effective functioning of the regulator more especially now that broadcasting is moving away from analogue to digital infrastructure.

The regulator is not efficient in issuing out new licences for operation in the spectrum that will be released as a result of digital migration. It has no direction in the regulation of Internet content to ensure that such content is relevant and controlled. Currently, there are no answers coming from ICASA and SABC on how the Internet TV and TV enabled mobile phones are going to be controlled.

Failure by the South African government to recognise and appreciate the value of subsidies in the private sector to encourage local investors to implement infrastructure projects in remote low density areas considered unworthy of business investments, but encouraging overfunding of pilot projects that benefit fewer people, hinders the development of an information society. Spence calls this as 'lack of investment in the sector through incentives in education and infrastructure' inclined projects (Spence, 2010).

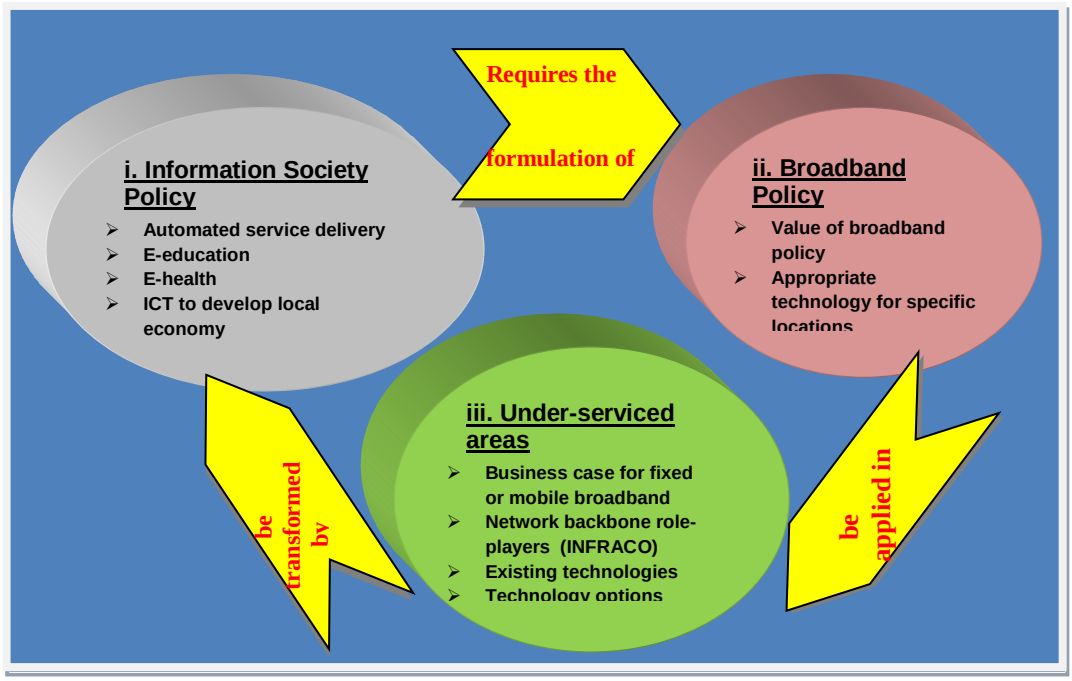
As it can be noted from the statements above, there are more strengths than weaknesses that put South African in a better position to can tackle the digital divide problem and create a networked society. The research will look on the conceptual framework that can be used to tackle the challenges as expressed above

2.6. Conceptual Framework

The research will be based on the policies applicable to information society development, digital inclusion and broadband extension, and the relevance of these policies for under-serviced areas. The research will verify the existence and applicability of information society and broadband policies in service delivery automation through e-education and e-health and, the value brought about by broadband policy in local economic development. This verification will be achieved by using the ISAD's ten point Plan and WSIS's three Key

Principles as a measure of success or failure of plans aimed at achieving the objective of establishing the information society in South Africa.

Figure 2: Diagrammatic representation of the Conceptual Framework



Source: Taylor & Marshal in Day & Schuler, 2010

These are core service delivery commitments by government to the citizens, in particular those located in under-serviced areas. Since information society implies new services and new ways of doing things through learning, it is important to note how the information society policy will have a bearing on e-health and e-education on implementation.

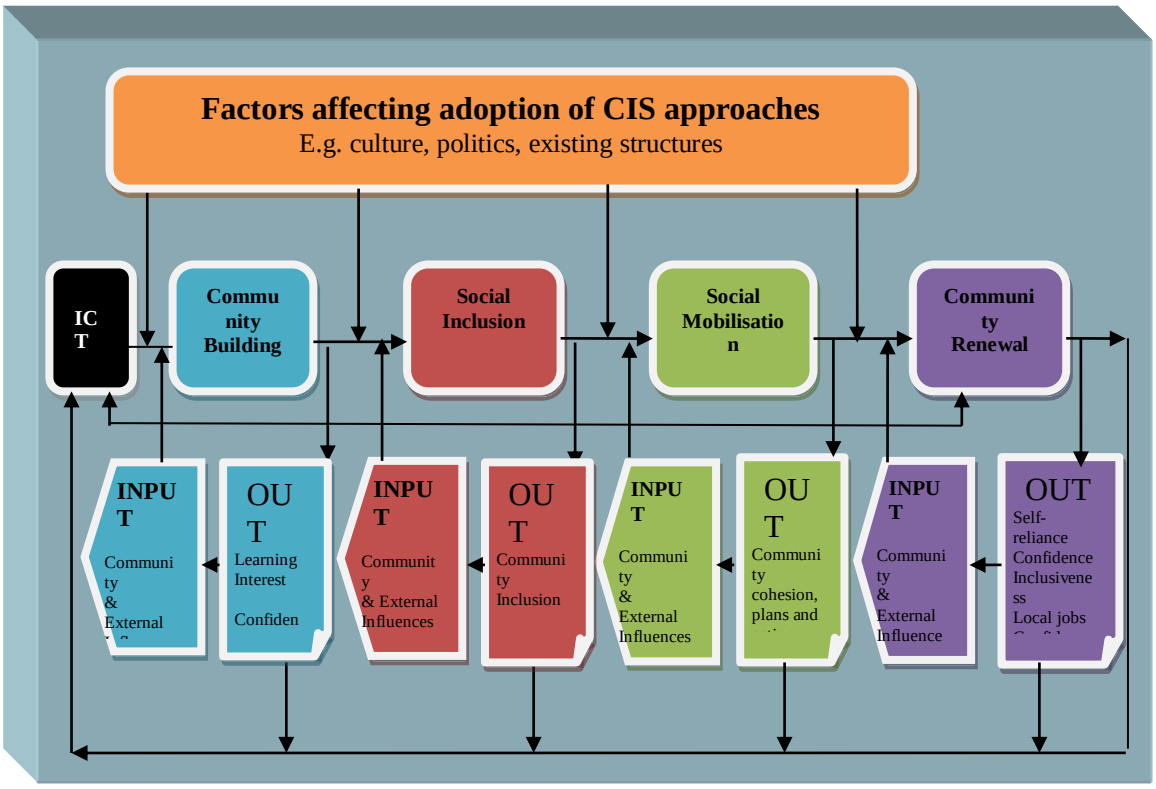
Also, since the above literature review indicates that an information society is a networked society characterised by economic growth and social prosperity to all (Van Audenhove, 2009), it becomes imperative to discuss what and how ICT is going to be utilised to develop the local economy in underserviced areas located in South Africa in the backdrop of an information society policy

that has not been fully implemented as indicated by Melody in his abstract as follows (Melody, Currie & Kane, 2004):

> South Africa has announced clear information society policies, but has not yet implemented them.

The conceptual framework indicated in figure one above will guide the research in looking at the flexibility of broadband policy for its applicability in under-serviced areas so that the digital broadband divide is minimized and that the areas are transformed into this desired information society and that local economic development is achieved through the utilization of ICT and mobile broadband.

Figure 3: Framework for CIS Practice and research

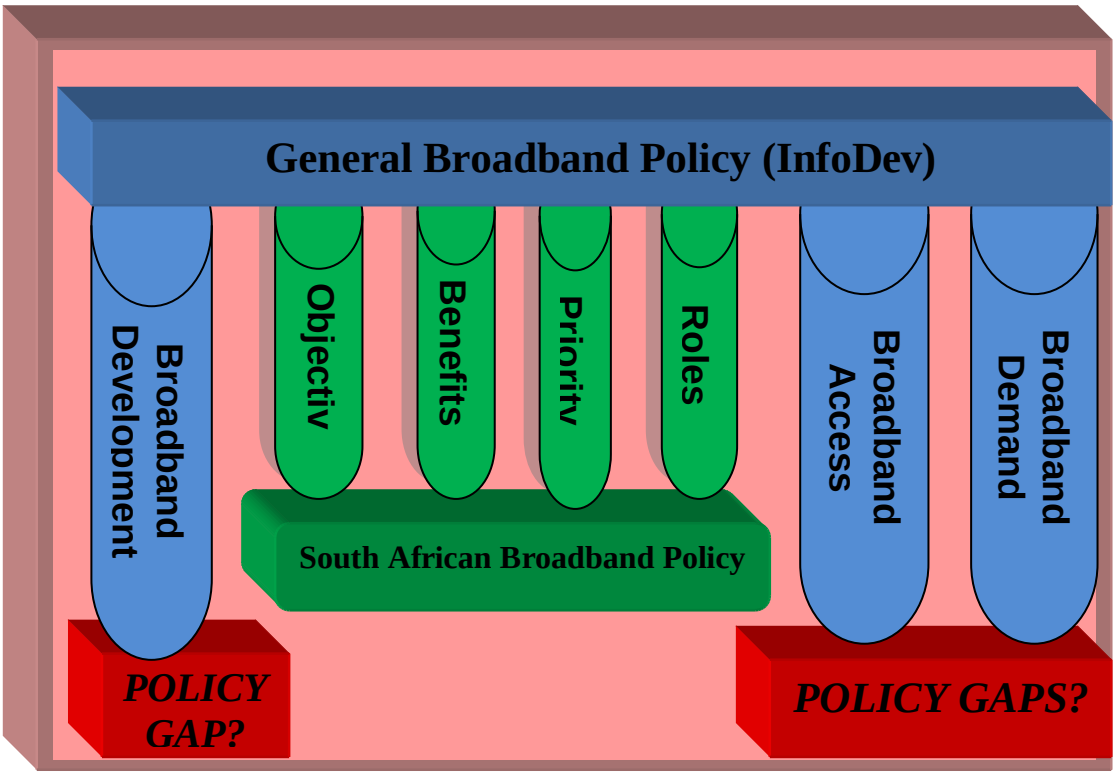


Source: Taylor & Marshal in Day & Schuler, 2010

Figure 3 above is a representation of factors that affect the adoption of a Community Information Systems (CIS) which, according to Taylor and

Marshal cited in Day and Schuler (2010), is an emerging discipline covering the impact of ICT on society. This discipline "discusses the concept of community practice as a delivery mechanism for local engagement" (Taylor & Marshal cited in Day & Schuler, 2010), a relevant discussion in the creation of an information society, that the research will pursue as it is part of the conceptual framework around broadband and service delivery.

Figure 4: Possible Policy Gaps on South Africa's Broadband Policy



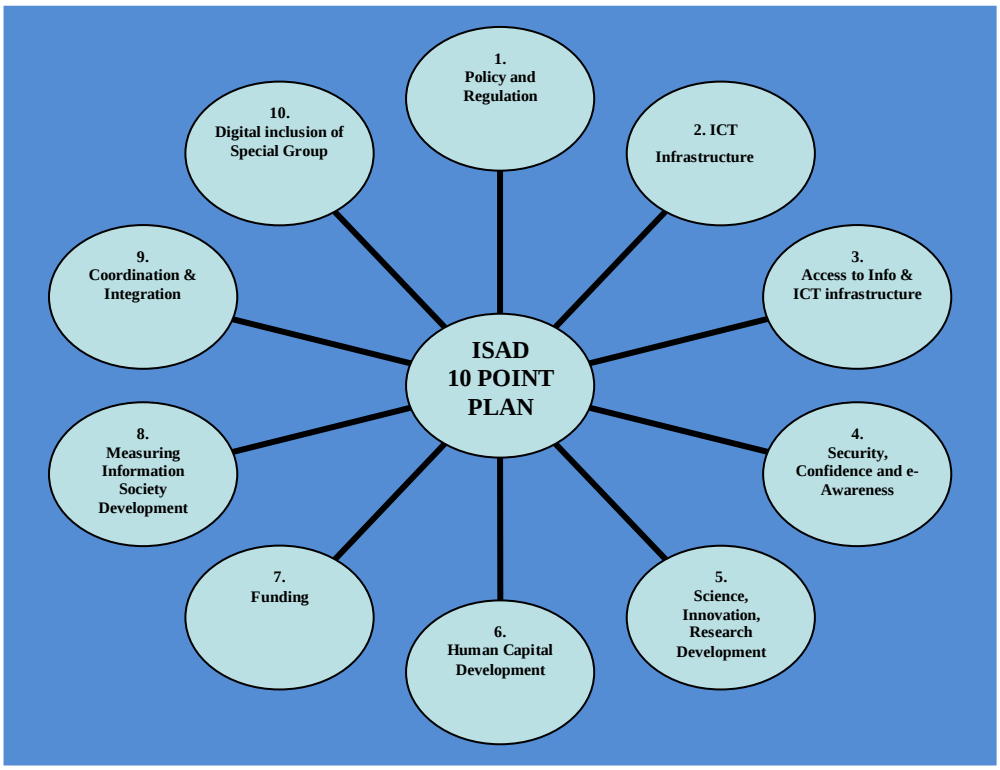
Source: Author

This discussion will be followed by exploration of the broadband strategies as discussed in InfoDev (2011), by way of policy approaches to promote broadband development, law and regulation, extension of universal broadband access, increase of broadband demand in the areas of content, services and applications, and finally broadband opportunities and bottlenecks, as depicted in figure 3 above.

The purpose of exploring these broadband strategies will be in an attempt to uncover weaknesses of the SA's broadband policy and how these can be turned into strengths to help in creation of the information society policy, which does not exist in the country. The aspects of South Africa's broadband policy (green) and infoDev's broadband strategies (blue) discussed above are depicted in the above diagram that also indicates possible gaps that need addressing in South Africa's broadband policy (Doc, 2011).

PNC on ISAD indicate the main ten points of importance to develop an information society in South Africa (Ten Point Plan) as follows: Policy and Regulatory environment; ICT infrastructure; Access to information and ICT infrastructure; Security and Confidence and e-Awareness; Science, Innovation, Research and Development; Human Capital Development; Funding; Measuring Information Society Development and impacts of ICT in SA; Coordination and Integration; and Digital inclusion of the Special Group (Presidential National Commission, 2006). These points indicated in figure 4 below, are also taken into consideration in this research.

Figure 5: ISAD 10 point Plan



Source: Author

The conceptual framework will also guide the research whilst exploring how transformation of under-serviced communities into information societies can influence changes of broadband and information society policies in the areas of education, health, and local economic development. This will be achieved by first discussing South Africa's broadband policy objectives, benefits, key priority areas, and roles between government and the private sector.

2.7. Conclusion

Broadband is crucial for the creation of an information society in South Africa. The service delivery problems germinating throughout the country are a result of 'neglected citizens' or those people that are often located at 'the bottom of the pyramid' because of lack of important services like health, education and lack of local economic development. It is also clear that in order to create this

envisaged information society in South Africa, solid partnership between government, the private sector, and citizens is imperative. Lack of this partnership results in failure of any endeavours aimed at bridging the '*digital donga'*.

Castells (2000) identified the problem of rapid changes in the ICT space in general and in telecommunications in particular as far back as 2000. He indicates that people '*inside*' the network get the opportunities and benefits provided by knowledge sharing and chances of them succeeding are much more than those 'outside' the loop. He goes on to state that people not in the loop '*become switched off*' meaning that they miss out on the opportunities provided by broadband services in areas like education and health and usually there is no local economic development in such areas (Castells, 2000). This statement is still true even today in South Africa and elsewhere.

Other authors (Mehra *et al*., 2004; Teppayayon & Bohlin, 2008; Heeks, 2009) surveyed in the literature above attest to the fact that broadband divide is directly proportional to socio-economic exclusion and that policies that enhance implementation of broadband have been proven successful in creation of information or networked societies throughout the world. Countries like South Korea and China are typical examples of success stories where mobile broadband was utilised successfully to close the digital divide and create knowledge societies. Although this is the case literature also indicates that incorrect implementation of broadband policies can result in failures.

Galperin gives us an example where focus by governments and other stakeholders involved in implementation of broadband projects is on the 'underlying technologies', and not on increasing access by affected communities to ICT services in 'the most cost-effective manner'. He calls this 'platform agnosticism' (Galperin, 2010). There is also the problem of lack of innovation and poor content in current broadband services provided by both

government and business websites, probably because of weaknesses on current broadband policies to promote innovations (InfoDev, 2007).

Another policy problem identified by Southwood is regulatory interference which he describes as ‘a political framework that governs whether the service operates or not and the reasons given for closure’ (Southwood, 2011).

Although there are problems in the broadband policy and regulatory environment in South Africa, there is still room for improvement because of the commitment that is shown by the ruling party on national broadband implementation. Amongst the issues that the party discussed in its 2012 policy conference in Mangaung was a national broadband policy which as laid out in its communications policy discussion document titled ‘*Building an Inclusive Society through ICT’* (ANC, 2012). It must be noted however that although this is not going to be the first time that such a discussion is held in the ANC’s policy discussions, there is hope that bigger decisions will be taken as information and communication technologies in general, and telecommunications in particular are highly regarded and viewed as a solution to current service delivery challenges.

Another positive point is the commitment shown by government departments in the usage of technology for service delivery. In the National Health Act, the health department speaks about the ‘encouragement of “enforced” implementation of an integrated and coordinated health information system through all levels of government’. (DoH, 2003), a good sign for areas located in under-serviced areas although benefits of such might be realised in these areas if broadband policy recognises the importance of mobile broadband and stipulates how it can be utilised in these areas that are always at the end of the tail when it comes to technology implementation due to their geographical location.

The Department of Education is much more advanced in the utilisation of broadband technology for service delivery in under-serviced areas. Past and current e-education projects indicate this commitment. Examples of projects are: NEPAD e-Schools, SchoolNet SA, Shuttleworth's 'Siyavula' project, Motorola's E-skills for FETs, and Vodacom's current Education Programme.

All relevant policies on broadband and information society must be precise and yet flexible enough and be aimed at minimising the existing 'digital donga' and promote the creation of information society in South Africa through the utilisation of broadband that is affordable and accessible to the under-serviced populations – this is the subject of this research. Lessons learned on past ISAD projects must be used to improve the implementation of current and future broadband projects to ensure that this objective is achieved.

Although South Africa is considered to be a developing country, she still suffers from the challenges that are mostly found in LDCs (Least Developed Countries where the majority of citizens live on less than two US dollars per day). In ITU's 2011 report on LDCs, the challenges in such countries are in the provision of voice and data connectivity to populations located in dispersed areas that have little disposable income to pay for such services.

The ITU report indicates that a proper solution must not be aimed at addressing a purely technological challenge, but must be on addressing an affordable-technology challenge, where prices must be dropped down by radically reducing costs at backhaul networks, access networks and terminal devices that would be appropriate for the intended users. Benefits of such cost reductions should be passed to such users under competitive or highly regulated conditions (ITU, 2011).

Chapter 3. Case Study Methodology

3.1. Introduction

This chapter discusses the detrimental effects of the digital divide on the development of local economies in under-serviced communities and identifies how this has resulted into a problem resulting in concentration of people in advanced urban areas like Gauteng and Western Cape. This discussion is followed by the research purpose and question and later by the approach that was followed in the research of the four mini-case studies located in under-serviced areas.

This is followed by a discussion of how the research is designed using a qualitative case study approach that involves interviews and observations as central methods of gathering data. Research tools like interview questionnaires and collection of public documentation are also discussed followed by the types and sources of data that have been identified. This section is followed by data analysis defined by Creswell (2009) and Leedy & Ormrod, (2010), as the process of making sense out of text and image data through data preparation using a bottom-to-top linear hierarchical approach, or a data analysis spiral with six identifiable steps.

The chapter goes further by defining the research setting and the relevance of the research topic to public development to show its suitability in the South African context. Limitations of the research are also discussed in the final section of the chapter.

3.2. Problem Statement

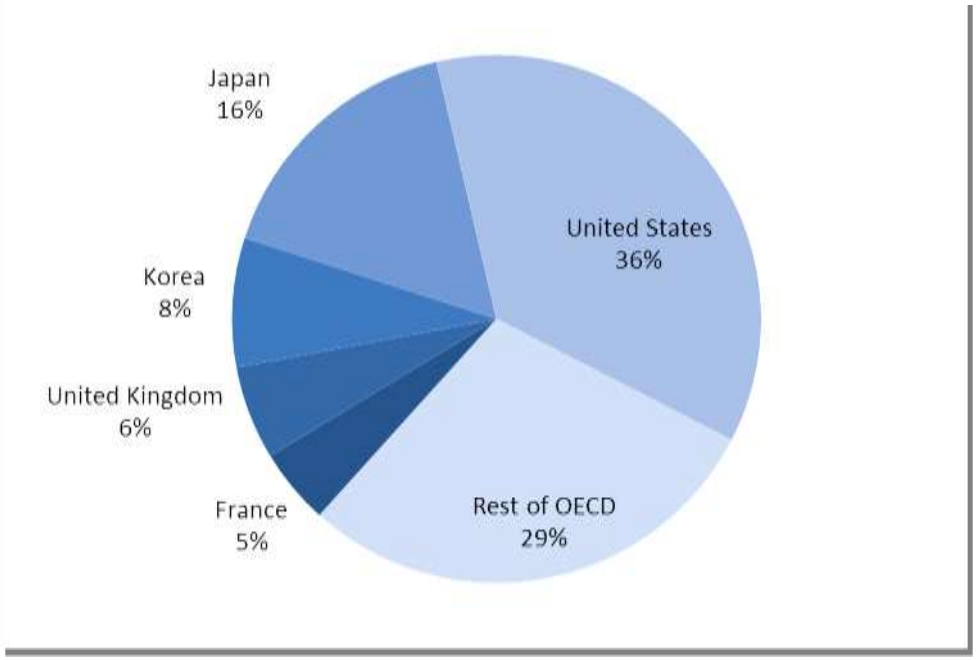
Although broadband infrastructure and access technologies have been available in South Africa for almost a decade, through companies like Telkom,

Vodacom and MTN, broadband Internet access is either very limited or non-existent in most under-serviced areas whether urban or rural.

The discourse on broadband deployment for information society evolution (Teppayayon & Bohlin, 2008; Heeks, 2009; Mehra *et al.*, 2004) suggests that low-income communities can be transformed into active participants in the economy and take part in the information society.

Furthermore, as regards the demand-side, under-serviced communities mostly located in less accessible areas require broadband Internet to access electronic content for important services such as education and health and to promote local economic development.

Figure 6: Representation of mobile broadband penetration in top 5 countries

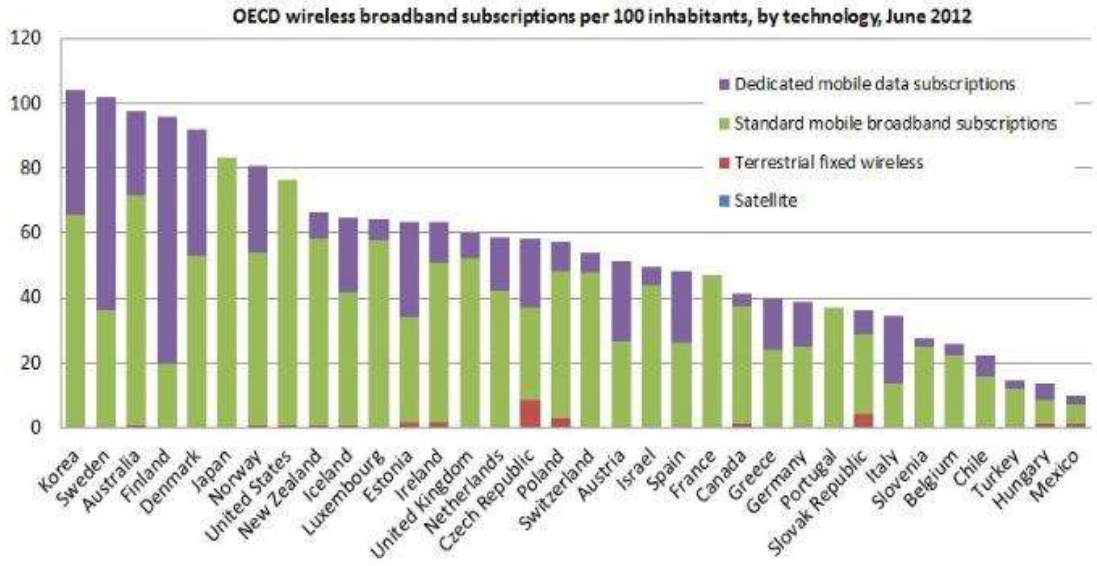


Source: OECD

Demand for mobile broadband continues to increase globally in the last twelve months between June 2012 and 2013. This demand is driven by

growth in the usage of tablets and smartphones. According to OECD report of June 2012, the top five leaders in broadband subscriptions in millions are France (30.6), United Kingdom (37.6), Korea (51.9), Japan (107.5) and United States (190.8). The report indicates that the average penetration in the OECD area is 56.6 subscriptions for every 100 dwellers, for a total number of 698.6 million subscriptions (OECD, 2012).

Figure 7: OECD wireless broadband subscriptions for June 2012



Source: OECD

In developed economies, service delivery initiatives where broadband is utilised are found in sectors like agriculture, health, mobile finance, and government services. In the agricultural value chain, broadband is utilised for provision of agricultural information between commodity exchanges, traders, buyers, and sellers of agricultural produce making use of the agricultural trading, tendering, and bartering platforms. In health, broadband is used in decision-making by health care professionals, for real-time and location-based data gathering, for health care provision to remote locations, for knowledge exchange, and for promoting public health through delivery of

information to allow self-management of health and improve awareness of health threats. In finance, broadband is utilised by mobile money applications like m-pesa for savings, insurance, and credit management; for mobile banking transactions and for mobile payments between individuals, government, and business. In government, it is utilised to connect more citizens to existing e-services (InfoDev, 2011).

Although the objectives of the South African government have been directed at improving social and economic conditions in urban and rural under-serviced areas, there has not been much success because of high broadband prices, little or no access to basic services like water and electricity, and other reasons. These limitations have contributed to the preservation of the 'digital donga' in under-serviced areas resulting in exclusion of these communities in the main economic stream. The problem is how to distribute government services like education and health and to ensure economic activity of communities located in under-serviced areas. Current policies on information society and broadband have not assisted in ensuring that people located in under-serviced areas have affordable Internet access, as a result, the digital broadband divide and social exclusion has increased. The exploration of a limited number of case studies can give an indication of the viability and particular benefits and challenges of broadband in addressing this problem.

3.3. The Research Purpose and Question

The purpose of the research is to investigate how broadband has been implemented in under-serviced areas to provide services like e-education, e-health and for local economic development. The research will further investigate whether the particular benefits and challenges encountered offer lessons for replication of such broadband projects in other under-serviced areas in the country. This would enable the researcher to provide

recommendations for broadband policy and therefore, for information society policy of the country.

The research will use a bottom-up approach by using findings from the case studies indicated above to analyse issues that might contradict or that might not be reflected in current policies and come up with policy lessons and implications emerging from experiences learnt in the project implementations. These policy issues might be challenges and stumbling blocks towards the successful implementation of projects to underserviced areas and thus will need to be brought to the fore for possible interventions by stakeholders involved in policy formulation.

The research is also aimed at identifying the existing gaps in the broadband policy, and to propose ways of addressing the challenges to ensure that people located in under-serviced areas can have access to government services like e-education and e-health, and to ensure that the local economy develops so that these communities can be part of the information society.

In light of the above, the research will answer the following questions and sub-questions:

- How can broadband policy be amended to support the introduction of appropriate infrastructure to enhance service delivery in under-serviced communities and enable participation in the economy and information society? The sub questions are as follows:
  a) How is broadband being utilised to fast-track service delivery in e-health, e-education, and local economic development for under-serviced communities?
  b) In which ways do the broadband solutions implemented in the selected study areas benefit the communities?

c) Are these solutions cost effective, sustainable, scalable, and replicable to other communities?
d) How do current policies on broadband support or inhibit the transformation of underserved communities into an information society?
e) What are the strengths and weaknesses of current policies and regulations on broadband with respect to the value for e-education, e-health, and local economic development?

3.4. Research Approach

The methodology that was used is the case study method, a qualitative research approach. Literature indicates that this is the most appropriate method to use when the nature of the research problem is real and complex and needs a detailed analysis (Tellis, 1997). The problem that was studied is real and practical because up until today, under-serviced communities are still unable to utilise technology to access government services effectively because of the associated high costs of telecommunications in South Africa. Stakeholders that want to run projects aimed at providing affordable alternative technologies face challenges because of limitations caused by current telecommunications policies and regulations that tend to hinder usage of certain telecommunications equipment that operate in certain frequency bands.

A good example of such limitation is that, the usage of Wi-Fi in the 2.4GHz ISM band, referred to as spectrum of commons or unlicensed spectrum, is forbidden where it cuts across public boundaries and where the power emission of the antenna exceeds 100 micro watts (FMFI, 2006). This on its own brings complexity to the problem and requires interventions from policy bearers to ensure that objectives of creating an information society are

achieved. The selected methodology will enable the researcher to study the processes that take place in the selected case studies to identify policy and regulation issued that need improvement to minimise bottlenecks.

The case study approach was chosen as it allowed the researcher to focus in depth on specific case studies whose objectives were to provide government services to the poor by utilising information and communication technologies in an effective and affordable manner. Such case studies are utilizing alternative technologies than those provided by the local telecommunications service providers like Telkom, Vodacom, or MTN.

The methodology involved identifying and interviewing critical stakeholders engaged in projects implemented in under-serviced areas identified as case studies, as indicated below. It also involved observing what was taking place within those areas where projects are running. Results of such observations will help in realigning answers received from interviews and come up with valid conclusions.

In order to achieve the objectives of the research, four case studies were examined as follows:

a) ***MobiPad E-learning Initiative***: a partnership between schools and private companies where leading private schools located around Pretoria, use MobiPad – a tablet that enables access to online resources and interaction between local and distance learners through a high-speed broadband wireless network. This has enabled sharing of resources, culture, and knowledge between teachers and interaction between teachers and learners and has led to improved learner results. It also enables children to learn anywhere, anytime making use of e-books, SAQA aligned step-by-step video instructions that are web-based and mock exams (ITSi, 2012).

b) ***E-skills for Ekurhuleni East College of Further Education and Training:*** In this case study, a private company has implemented

telecommunications infrastructure in a Further Education and Training Institute in Ekurhuleni, Gauteng. This institution has five satellite campuses that were as a result of a merger of technical colleges that serve underprivileged communities located in a 30km radius around Eastern Gauteng. A wireless broadband network connects the campuses to the main campus and enables students located in the satellite campuses to listen to and interact with specialists lecturing at the main campus in real time by usage digital video conferencing. Staff in both campuses (main and satellite) are able to communicate cheaply to share knowledge and skills by utilizing e-mail, data transfers and Voice over Internet Protocol (VoIP).

c) ***E-health - Care for people living with HIV and AIDS****:* This *FMFI*[10] case study is in Peebles Valley in Mpumalanga and centred on a community HIV/AIDS clinic run by an NGO, a hospice that is 5km away and commercial farmers. It involved linking the clinic with the hospice and the farmers via a mesh network to a satellite. Connection costs to the satellite were shared between the entities involved. Families and caregivers were linked with poverty alleviation programmes and support groups online (FMFI, 2006).

d) Broadband for local economic development*:* The case study looks at a BB4All project spearheaded by Meraka institute, a Council for Scientific and Industrial Research (CSIR) entity and the Department of Science and Technology. It is characterised by deployment of cheap broadband in rural areas called 'Presidential Nodes' for local economic development utilising mesh networks connecting these to a wireless broadband backbone.

Presidential nodes are areas that have the usual infrastructure challenges like lack of access to electricity, roads, and other crucial services. People

[10] FMFI is a research partnership between South Africa (CSIR Meraka Institute, University of Western Cape, University of Cape Town, Translate.org and Tshwane Metropolitan Council), Mozambique (Centre for Informatics at Eduardo Mondlane University (CIUEM), the Catholic University of Mozambique (UCM), Mozambique Information and Communication Technology Institute (MICTI), Higher Polytechnic and University Institute (ISPU), Ministry of Education and SchoolNet Mozambique), Angola (AngoNet) and Zimbabwe (Connect Africa).

within the communities (village operators) were identified and trained in business-skills with the aim of handing the project over to ensure continuity and sustainability. The village operators will have to operate, promote and expand the businesses to generate jobs and reduce poverty. The success of this project will ensure that an information society characterised by a minimised digital broadband divide and socio-economic inclusion is created (CSIR, 2006).

The four case studies will enable the researcher to look at lessons learnt and investigate how these projects can be improved and replicated in other under-serviced environments affected by high telecommunications costs often associated with broadband services in the country.

In particular, the research looked at possible implications for public policy and regulation of broadband together with some interventions that can help address encountered problems when utilising broadband to bring access to digital content and to take government services to disempowered communities. Results of this research can help other researchers or policy makers to create a model or template that can be used to bridge the digital divide.

3.5. The Research Design

The study followed a qualitative case study approach where interviews and observations are the central methods of data gathering. Questionnaires were designed in such a way that they reflect the population that is being studied. These questionnaires were in both English and the local language, e.g. Xhosa or Sotho or Zulu where necessary. This is mainly because most people in under-serviced areas are not well conversant in English. Interviews exposed the researcher to current problems and experiences encountered when utilising implemented solutions.

The subjects that were interviewed were able to offer suggestions on how to improve on the identified problems. The observation method enabled the researcher to look at the processes taking place in each case and link this with the outcomes of the interviews to ensure validity of data that helped in making conclusions. Questionnaires were only used to supplement interviews in cases where identified stakeholders did not have the time to attend scheduled interviews or in cases where researcher was not getting enough information from some of the individuals that were interviewed. The researcher always tried to observe culture of the population that was involved in the study.

The process of observing the culture involved consideration of the environment when engaging with communities for an example, not engaging subjects directly without speaking to their head or chief first where there were Chiefs or a King. Involving the Chief or the traditional leader of a particular area where the research was conducted became very important when the researcher needed to engage his or her subjects. Introductions that sometimes involved having to bring a small gift for the Chief or traditional leader were done accordingly when the need arose as this is a sign of respect in other cultures.

Some of the following tools were utilised to assist the researcher in trying to understand how broadband has assisted the identified communities. This also includes how the tools helped (van Reijswoud, 2009):

- **Situational analysis**: – helped researcher in understanding the current situation;
- **Idea generation:** – helped in the involvement of more community members to help with generation of ideas;
- **Cultural environmental and impact study:** – used to check the impact of the BB4All project on the culture and the environment;

- **Participatory Design:** – this helped to understand if communities participation in the solution design enhanced project objectives;
- **Community readiness analysis:** – this helped with assessment of the readiness of the community for similar projects;
- **Training analysis and evaluation:** – used to assess effectiveness of training
- **Monitoring and evaluation:** – this was used to check progress against set objectives
- **Outcomes mapping:** – tool helped in verifying if outcomes were according to requirements.

Three areas where cheap broadband solutions have been implemented successfully to the advantage of poor communities were targeted. The main reason for targeting such areas was based on the possibility of further follow-up research work that could be done to help with replication of projects to other similar areas. Specific focus was on the urban townships and the rural areas where most people do not afford to access broadband as currently provided by service providers like MTN, Vodacom, and Telkom.

3.6. Research Tools

The data collection process utilised included visiting of sites for observations, interviews, document collection, and semi-structured questionnaires. According to Creswell, observations involve noting activities and behaviour of individuals on the field and recording these in a notebook or recording device to gain ’first-hand experience and record information’’ in real-time. In all the settings, the researcher’s role ranged from that of an observer-as-participant to that of a complete observer to gain the advantages of ability to notice unusual aspects and to exploit topics that are uncomfortable to participants, as indicated by Creswell (2009).

Interviews were utilised to clarify some of the observations made on site and to get data from some participants that could not take part in the process of the case studies because of time constraints or because of levels of seniority in the projects. Telephonic interviews had to be conducted in fewer cases as a result of the reasons mentioned above.

Collection of public documentation relevant to the research was also done by visiting offices of entities involved in the case studies to enlighten the researcher about issues discussed in meetings, and to help in the preparation for interviews. There were some limitations in obtaining some public and private documentation as indicated in the section on limitations of the research below.

Interview questionnaires were utilised in situations where the researcher could not gain access to respondents because of unavailability, or where the researcher wanted to get clarity on certain aspects of the case studies. The content of the questionnaires focused on the four case studies on e-skills, e-learning, e-health and local economic development, to identify the extent of project successes or failures.

The questionnaires were chosen to help researcher in understanding the current situation, to check the impact of the BB4All project on the culture and the environment, to understand if communities' participation in the solution design enhanced project objectives, to assess the readiness of the community for similar projects. They help to assess effectiveness of the training given to these communities, to involve more community members to help with generation of ideas for future projects, to check progress against set objectives and to verify if project outcomes are according to stated requirements.

The questionnaires were distributed to various members of the involved communities that are at different levels of experience and age, and joint community sessions were held to ensure that the obtained data is reliable.

The questionnaire that was developed to gather all relevant data addressed most of the following items:

- Demographics
- Education
- Economic activity
- Health
- Time Use
    - Sleeping, food preparation & eating
    - Working, volunteering & school attendance
    - Travelling, shopping & church
    - community activities
- Transportation
    - travelling time to work, school or clinic
    - mode of transport used example, walking, bicycle, bus or taxi
- Infrastructure & service delivery
    - main source of water and electricity & payment thereof
    - how long it takes to get to water, toilet, electricity, street light, community road, storm drainage
- Social capital & community participation
    - Volunteering, local politics, religious groups, women or youth group, school governing bodies, community security
- Satisfaction levels with
    - water (quality & distribution) and electricity (frequency of supply & charges)

- access to education and to health facilities
- local employment opportunities
- business opportunities or income generating activities

3.7. Types and Sources of Data

In order to achieve the objectives of the research, the researcher visited the areas of the four case studies that were examined as follows:

a. ***MobiPad E-learning Initiative***: Garsfontein High School in Pretoria East was visited to check how the partnership between government departments and the private sector has helped in raising the standards of education through the use MobiPad – a tablet enabling access to online resources and interaction between local and distance learners through a high-speed broadband wireless network (ITSi, 2012).

   The Principal of Garsfontein High School was interviewed and he gave permission to interview Maths and Science teachers to understand how the MobiPad initiative helped in improving results for 2012 matriculates. A couple of 2012 matric high achievers were also interviewed to verify if this MobiPad initiative enabled them to learn anywhere, anytime and if they made use of the downloaded e-books, the web-based SAQA aligned step-by-step video instructions and the mock exams provided in the MobiPad solution from IT Schools.

b. ***E-skills for Ekurhuleni East College of Further Education and Training:*** In this case study, the Deputy Principal of the institution was interviewed in order to understand how the Motorola Canopy Series project helped the institution. Questions were asked about how communication was flowing between the head office and its five satellite campuses that serve underprivileged communities located in a 30km radius around

Eastern Gauteng through the wireless broadband network connecting the satellite.

Some students allocated to the researcher by the principal, were also interviewed to understand how the digital video conferencing technology helped them and how this could be improved and be made ready for implementation in other campuses somewhere in the country to help students located in the satellite campuses to listen to and interact with specialised lecturers at the main campus in real time. A few staff members in the main campus and one satellite campus were interviewed to understand their ability to share knowledge and skills by utilizing e-mail, data transfers, and Voice over Internet Protocol (VoIP).

c. ***E-health - Care for people living with HIV and AIDS****:* This *FMFI*[11] case study is in Peebles Valley in Mpumalanga and centred on a community HIV/AIDS clinic run by an NGO, a hospice that is 5km away and commercial farmers. The interviews involved talking to the personnel manning the clinic, those at the hospice and the farmers that are in this network. Common questions to these individuals were those related to resource sharing including connection costs and performance of the network due to loads. Some families that have members needing caregivers were also interviewed. Questions that were related to the ease of access to the poverty alleviation programmes and support groups online were asked from this group.

d. ***Broadband for local economic development****:* The case study looked at a BB4All project spearheaded by Meraka institute, a Council for Scientific and Industrial Research (CSIR) entity and the Department of Science and

[11] FMFI is a research partnership between South Africa (CSIR Meraka Institute, University of Western Cape, University of Cape Town, Translate.org and Tshwane Metropolitan Council), Mozambique (Centre for Informatics at Eduardo Mondlane University (CIUEM), the Catholic University of Mozambique (UCM), Mozambique Information and Communication Technology Institute (MICTI), Higher Polytechnic and University Institute (ISPU), Ministry of Education and SchoolNet Mozambique), Angola (AngoNet) and Zimbabwe (Connect Africa).

Technology. The project manager who is also the co-supervisor of the researcher provided a number of documentation linked to this project and seconded a resource within her team to whom the researcher could ask further questions.

One of the areas that was visited is the ‘Presidential Nodes’ called Enkangala, where cheap broadband has been deployed and small businesses are managed by village operators. An interview with some village operators was conducted to identify if there have been positive developments in their small businesses resulting from demand for the provided services through the utilisation of the mesh networks connected to the wireless broadband backbone.

Central figures were identified within the communities as participants and interviewed to get different opinions about successes or failures of the implementations in the four case studies. People will be identified in management, within the staff involved in the day-today running and the communities affected by the projects. Some interviews were conducted in the form of focus groups in order to verify uncertain information.

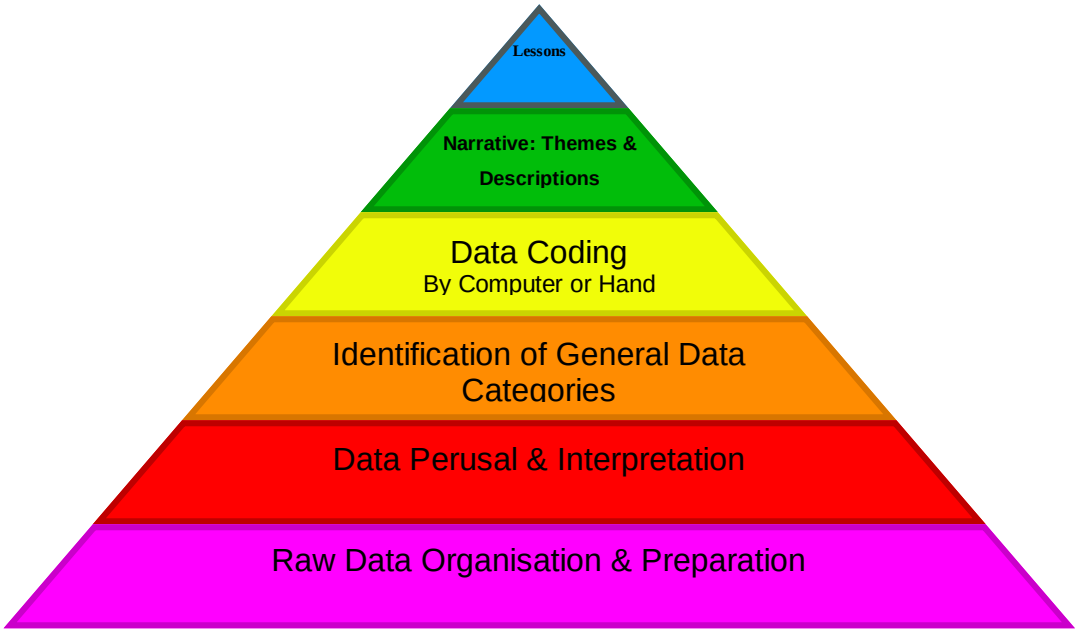
The research did not look specifically at USALS in the targeted areas and thus, engagement with USASA or the USALS in the areas was not done because of the research scope although such data could have been very useful for the general research fraternity.

3.8. Data Analysis

According to Creswell (2009), data analysis is the process of making sense out of text and image data through data preparation, conducting different analyses that go deeper and deeper into the data (peeling the onion), representing the data, and interpreting the meaning of the data. In trying to

'peel the onion' to make sense of data, the researcher will use a data analysis process defined in Creswell (2009) as a bottom-to-top linear hierarchical approach, and defined by Leedy and Ormrod (2010) as a data analysis spiral, but depicted as a bottom-to-top pyramid in Figure 8 below.

Figure 8: Data Analysis Process



Source: Creswell (2009)

According to Creswell (2009) and Leedy and Ormrod, (2010) there are six identifiable steps of the data analysis process indicated above are as follows:

Organizing and preparing raw data for analysis: this involves typing field notes and ensuring that everything is documented using cards, folders or a database. Large bodies of text are divided into smaller data units that are words or sentences.

Perusing and possible interpretation of data: Reading through all the data just to get the general sense of the information and obtain a general sense of the meaning through writing memos on margins.

Identifying general categories of the data: at this point the researcher would have an idea of what the general themes and patterns are and a sense of what the data mean - general sense of patterns.

Coding data: Integrate and summarise the data, and describe the relationships between different categories to give a holistic meaning of the data. Coding process is used to generate description(detailed information about people, places, events) of setting and 5-7 themes/categories for analysis that will be major findings of the study (the 5-7 themes will be headings in the findings section).

Advance how the descriptions and themes (findings including quotations, illustrations, subthemes, tables, figures, drawing of research site OR descriptive info about each participant-case study) will be represented in the narrative to convey the findings of the analysis in a chronology of events.

Make an interpretation or meaning of the data detailing 'Lessons Learned' that could be a meaning derived from literature and the findings could be "confirming past information" or "diverging from it." The interpretations can call for action agendas for reform and change - action meanings.

3.9. Research Setting

Although the '*Digital Donga'* created by adoption of broadband is a phenomenon that is experienced worldwide in general and particularly in developing countries, the qualitative research was executed in the South African setting and the selected case studies were in and around Gauteng, and in Mpumalanga mainly because of the limitations that are indicated in the section 3.11 below.

The case studies were aimed and conducted in semi-urban areas with communities that are affected by service delivery problems mainly in education and health, defined as under-serviced communities. The research also looked at how the implementation of broadband has affected communities positively in terms of local economic development, and this is depicted by the case study in Mpumalanga.

3.10. Relevance of the Research Topic to Public Development

Morgan and Smircich (1980) maintain that a research method is judged as suitable based on the social phenomenon that is to be explored. Literature indicates that this is the most appropriate method to use when the investigation is done on a social problem that is reality. The broadband divide is a real problem in developing countries in general and particularly in South Africa and the situation becomes more visible as the gap between the rich and the poor widens. The research will be able to identify existing policy gaps that could be closed to ensure usage of broadband to bridge this digital divide and enable government to take services to the under-serviced communities.

Yin (1989) defines a case study as an empirical inquiry that investigates a contemporary phenomenon within its real life context using multiple sources of evidence. The scenarios studied and presented in this research are real and a cause for concern by government policy makers in South Africa and by other international organisations like ITU operating in the country. Solutions to issues raised by the research will assist when further studies are done by other researchers and will be useful when programs aimed at bridging the digital divide are implemented in the country.

Gummesson (1991) points out that a case study method provides a holistic view of events so that the researcher can get a picture of the whole problem making use of a variety of sources. The research is aimed at providing this

holistic view by utilising four case studies as indicated in the background of the research so that the whole problem is visible to others who elect to use the research.

Stake (1995) states that case studies are used as a strategy of enquiry in which the researcher explores in depth a program, event, activity, process, or one or more individuals. Researchers collect detailed information using a variety of data collection methods over a sustained period of time. The methods that were used include semi-structured interviews with people in and around the identified areas and observing their actions and behaviours to be able to understand the real issues that are experienced by the participants in the areas where broadband has been implemented.

Collection and examination of existing documents is part of the researcher's activities so that these can be compared to the observations on the ground and the responses from the interviews and documents can be interpreted to produce a holistic picture of the scenarios and this in turn ensure reliability of data as it is generated from different sources.

3.11. Limitations of Research

The area of study has some limitations in that, although most researchers have been looking at the digital divide that exists between the urban and rural population of South Africa, the main focus of such studies has not been on broadband implementation in under-serviced urban and rural areas. The researcher had challenges in finding literature that addresses this specific topic in such areas.

Another area of concern is the impossibility of visiting all the under-serviced areas that are implicated in the research question due to financial constraints since this research does not have any sponsorship. The research will develop

in the form of a case study, and this will involve practical observations conducted in the chosen areas, and because of lack of sponsorship, reaching all the desired areas will be a challenge.

Another challenge is the researcher's unfamiliarity with the under-serviced areas found in the Gauteng region since he is from the Eastern Cape. The researcher feels that the number of site visits might not be sufficient to conduct interviews to all the relevant stakeholders and to make observations of what is taking place on the ground because of these financial constraints and work commitments.

Another concern is the ability to gain access to people involved in the area of study to do data collection. This challenge includes gaining access to documentation from organisations like Meraka. At the time of writing, the researcher has failed to get information from Meraka about the projects in Gauteng. It has also been almost impossible to get data out of the eKurhuleni East College of Further Education and Training as the director if the program was always very busy with meetings that he perceived as more important. Getting an appointment to see him was only possible once and the researcher has not been able to secure a second appointment so far.

Chapter 4. Findings from Four Case Studies of Broadband and Service Delivery in Under-serviced Areas

4.1. Introduction

This chapter will present research data that follows the thread as indicated in the theoretical framework.

4.1.1. Three Principles of WSIS

The research data is related to the three key principles of the WSIS declaration indicated on the plan of action agreed in the Tunis agenda. The research only looks at items B1, B2 and B3 because of their relevance to the research and the related data for these items is stipulated in tee four case studies that are stipulated in the section below. The three WSIS principles are:

The role of government in promoting ICT4D (B1)

This refers to the joint roles that the government and other stakeholders have in ensuring that a people-centred information society is built.

ICT infrastructure, an essential foundation (B2)

This item is an essential foundation and a central enabling agent for building an inclusive information society as it enables an easily assessable and affordable network connectivity (WSIS, 2005). The research data shows how this commitment is supported or negated in the four case studies.

Access to information and knowledge (B3)

This principle looks at the ability of communities to access and contribute information, ideas, and knowledge and this is an essential element for identifying an information society.

4.1.2. ISAD's ten point plan

The ISAD plan identified ten points that are essential in order to create an information society in South Africa (Presidential National Commission, 2006), which are: policy & regulatory environment, ICT infrastructure, access to information and ICT infrastructure, security of transactions, science innovation research, human capital development, funding, measurement, and coordination and integration.

For the purposes of this research, we only considered three of those in the process of acquiring research data. The rest are addressed by the three key WSIS principles indicated above. Security and digital inclusion of the special group are subjects for another research. The three elements of ISAD's ten point plan are:

- Human capital development,
- Funding, and,
- Coordination and Integration.

4.2. Case Study A: E-learning at Ekurhuleni East FET College

The Deputy Principal of the college Dr Johan Groenewald, who was the project manager during implementation, was interviewed. He gave leads on who to speak to in other satellite colleges of EEC. It is important to recognise this actor to be wearing two hats – that of a project manager during project implementation and that of a Deputy Principal currently.

A Motorola Canopy point-to-point wireless series is the technology utilised to connect five EEC College campuses located in KwaThema (HQ), Springs, Benoni, Daveyton, and Brakpan, together and is depicted in Figure 9 below.

This wireless network consists of point-to-point links that enables the five campuses to transfer bandwidth-intensive information like voice and video at high speed and low latency, and allows a lecturer in one classroom to teach

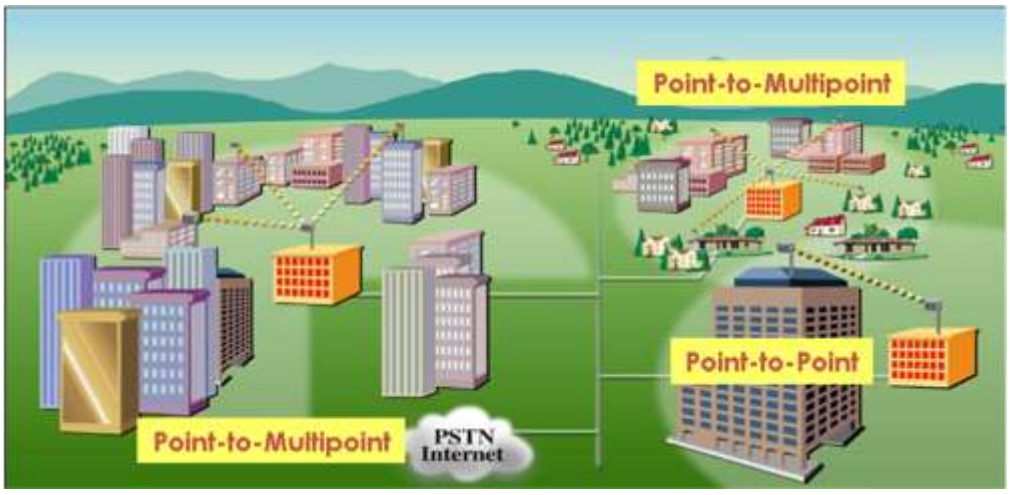
and interact with students at other EEC campuses that are between four to twenty kilometres away from each other.

According to Dr Groenewald, the Deputy Principal of EEC, who was the project manager, all telephones in the five campuses that were expensive analogue Telkom lines, were replaced with cheap Voice over Internet Protocol (VoIP) phones.

The usage of VoIP allows all the campuses to communicate with each other free of charge and external calls from other campuses are routed through a service provider link located at the main campus at KwaThema – meaning one telephone number for all campuses. This has allowed the college to spend allocated budget or funds on other necessary activities like facilities.

The Motorola point-to-point wireless system is simple and rapid in installation, and operates in the free unlicensed frequency spectrum that is more reliable and has faster data rates and manages to maintain almost 100% uptime in and around the EEC network.

Figure 9: Motorola Point-to-point Wireless Technology



Source: Motorola SA

According to Dr Groenewald, the project was a Department of Communications (DoC) e-skills initiative implemented by using Motorola's point-to-point wireless communication infrastructure that enables EEC to

centralise operations in its headquarters and share resources between its satellite campuses to address the shortage of specialised lecturers.

> The ability to connect and communicate with each other is vital to the success of an organisation such as EEC. With the legacy systems, inter-campus communication could be completely cut off if a site went down. This made it extremely difficult to co-ordinate activities and maintain productivity, (Van der Merwe, 2009).

There is an IP-based data and video communication between computers and computer peripherals on different campuses, including interactive smart boarding, videoconferencing, and video surveillance for monitoring of security.

Memela[12], issued the following statement in the media after the successful implementation of the project at Ekurhuleni East College:

> By connecting to the existing network, we will create an e-learning platform that provides these schools with access to science and maths teachers at EEC, thus addressing the lack of resources we face in the education sector. (Van der Merwe, 2009).

The Department of Communication had future plans to extend this broadband project to five surrounding schools that were already identified. These schools were to be provided with connectivity to the EEC wireless network and have access to scarce resources like Maths and Physics lessons. It emerged that these plans did not materialise because of the political changes after ANC Conference in Polokwane that resulted in the change of Minister of Communications and subsequently in Memela's resignation from the DoC.

[12] Dennis Memela was the Chief Director, ICT Skills Development Programme at the Department of Communications during the implementation of the EEC Wireless Project.

Figure 50: Ekurhuleni East College HQ in KwaThema



Source: Motorola SA

When asked about progress on this project, the EEC's Deputy Principal commented as follows:

"The Connectivity of schools project was rolled out to one school, namely, Hlakula High school, which connected and worked for only one week. The main reason was that there was no person who was earmarked for maintenance or support for the school. Schools in Daveyton and KwaThema were also linked to the EEC Point-to-Point network, but school staff was not utilizing this advantage."

"The political changes in government after the Polokwane conference resulted to changes in the presidency and in most ministries and a reshuffle in the DoC. The project took a back seat after the resignation of Dennis Memela, who was very passionate about this project. It would appear that there was no proper project handover in that process within the Department of Communication."

Figure 61: The Primary Network of the five Ekurhuleni East College Campuses



Source: Motorola SA

The college had future plans to extend this broadband project to local communities and help in the transformation of these communities to digital societies by deploying a mesh network to connect local communities and support broadband services. When asked about progress on this aspect of the project, Dr Groenewald responded as follows:

> *"The college does not have the capacity to support delivery of broadband services to surrounding communities, but there is an existing Youth Advisory Centre within the college. This centre helps the youth and community members by allowing access to browse Internet and by assisting community members with CV compilation and online job searches."*

On policy and regulatory matters, the Deputy Principal of EEC agreed that the policy environment during the implementation assisted in the delivery of project within the expected time because of support the college received from the Department of Communications.

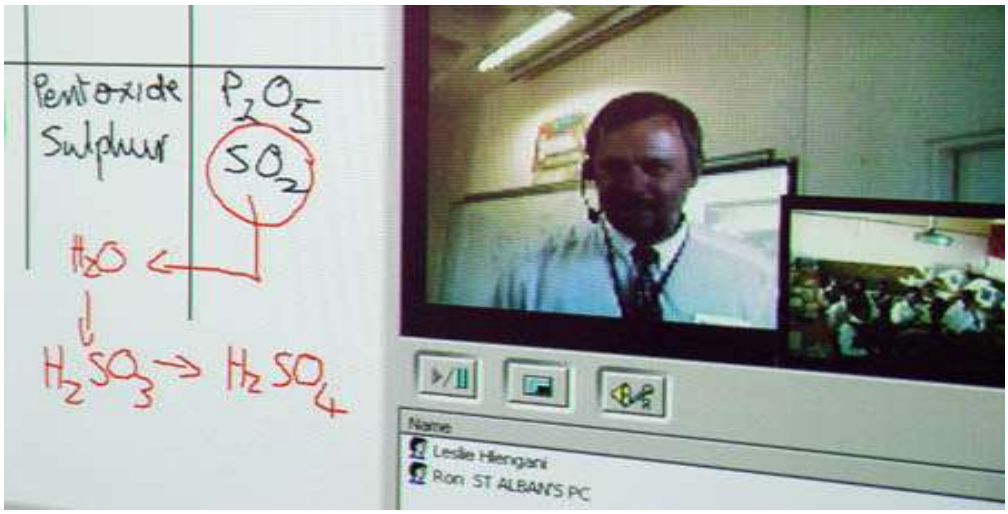
Figure 72: Motorola Canopy Link at Ekurhuleni East College



Source: Motorola SA

The fact that the deployed broadband network operated on unlicensed spectrum meant little interaction between the college and ICASA - the government regulator.

Figure 83: A teacher at Ekurhuleni East College communicating with students at a far school



Source: Motorola SA

The Ekurhuleni East College's Deputy Principal also acknowledged that freeing up the spectrum released by the conversion of television from analogue to digital television can also assist in the reduction of noise levels, but it would help if government fast-tracked this process so that similar projects that are aimed at assisting the disconnected communities, can be implemented elsewhere in the country without any reinvention of the wheel.

4.3. Case Study B: BB4All for LED in Kwaggafontein, Moutse and Verena

A total of nine people were interviewed to solicit information about the BB4All project and amongst this group four were found on the various sites where the project was implemented. This group included the following:

- Tumelo Moepya – a Village Operator in Verena;
- Timothy Segopolo – a Village Operator in Moutse extension 1;
- Pinkie Mthimunye – a Village Operator in Kwaggafontein; and
- Neil Oosthuizen – a private consultant on the BB4All Project.

The other group of five people were interviewed telephonically because they are school representatives and they were not available at the time of site visiting since this was done during the March/April school holidays. A telephonic interview had to be done with the CSIR employee because of his very busy schedule. These people are as follows:

- Gibson Makin – Physical Science Teacher at Hlomani Secondary School, also named the Gateway School for Kwaggafontein;
- Lolly Mnguni – Circuit Manager for Kwagga East and Verena;
- KT Phetla – Principal at Mbedlwana Senior Secondary School; and
- Silindile Dlomo – a community member in Kwaggafontein; and
- Paul Geldenhuis – a CSIR employee focussing on BB4All policy issues;

The first group of people can be classed as the operations group because they are very much involved with the day-to-day operations of the BB4All project. They are the engine that keeps the BB4All machine running. The second group (except for the CSIR employee) can be classed as the end-users or consumers since they utilise the BB4All services for their operations. Different questions were asked to the two different groups since their needs differed because of the classification indicated above, and answers are listed in the following paragraphs.

Although mention was made of other VO office visits, the report will concentrate on the first visit since concerns raised by other VO's were similar. The first site visit began with the Village Operator offices located in a building housing two government departments and a post office not far from a taxi rank in Verena.

The departments of Home Affairs and Social Development (DHA & DoSD) had satellite offices that were very busy at the time of visit, but although this was the case, Tumelo Moepya, the VO at Verena, managed to get a free

office in the Department of Social Development – his small office was full of busy customers. This signified the trust relationships that have been built between the DoSD and himself. This VO was very precise and shared information without doubt and the following was discussed:

On the achievement of the VO vision which is *"to become the ICT service provider of choice for schools, business, government institutions, NGO's and individual households in rural areas"* - the VO at Verena objected, indicating that they were only servicing the schools which had the Meraka broadband. Other entities were only getting photo copying and faxing services. He also added that although there were broadband services in his offices, these were only for provision of internet access to end-users, in competition to two heavily funded entities – UNICO and HOPE around the area that were charging less prices for the same services. It must be noted that the other two VO's raised the same concern.

On addressing demand for broadband services, the VO indicated that there was huge demand for Internet connectivity in his area that he could not address, but the demand was from businesses and individuals wanting Wi-Fi services at their premises, a service he could not provide although his office was a Wi-Fi hotspot. The VO at Verena also indicated that he was getting reports that "*smart people*" positioned nearby his office were able to hack into his WiFi hotspot and surf free of charge, although CISR was addressing this security breach. It must be noted that the other two VO's raised the same concern on provision of a secure WiFi and service.

On the issue of self-sustainability the VO's were vocal as they felt that they were living a life of survival since they were not really earning much from their businesses and were mainly depended on the monthly stipends of R1500 from CSIR that were for services rendered to schools allocated to them. The VO's agreed that this situation could change if they could be able to provide other broadband services that were in demand.

The VO's also raised the concern that the project completion time was being extended constantly, thus prolonging their demise. Here the belief is that project completion will mean broadening and commercialization of their services and this could mean more profits and sustainability of the businesses.

On the question of challenges that the VO's faced, three major issues were noted, namely: mobility (connectivity to customers), lack of technical skills, and marketing of services to clients.

Mobility: – this was a challenge because all the VO's depended on public transport, and the distances they travelled between their offices and the schools they serviced were long, thus affecting their quality of service as they took longer times to reach a reported fault or point of failure. This was exacerbated by bad roads and by the number of reported faults to address in a day. Failure to respond to faults in time meant deduction from their meagre stipends.

Lack of technical skills and replacement equipment: - this issue was also a major concern to all the interviewed VO's as they felt that it would take less time to resolve incidents if they had these technical skills, but now they relied on a technical helpdesk that was based at CSIR offices in Pretoria. This meant that a technician had to travel from this office located two to three hours' drive away to attend to issues, that they could resolve if they had the skills. They also lacked replacement equipment to assist in the resolution of errors.

Marketing of services: - all the VO's felt that not enough was done to sell their services to government departments located around their areas of operation, and they could not market as they did not have time and or budgets for this. It was felt that although departments located nearer knew about certain services they could get from VO's they did not have a mandate or an obligation to prioritise the VO's as their service providers.

As indicated above, the second group of consumers of the BB4All services were interviewed telephonically because of constraints like time and finances. This group consists of Mr Makin, who is the Physical Science teacher at Hlomani Secondary school – also known as the Kwaggafontein gateway school; Mr Mnguni, who is the circuit manager of Kwagga East and Verena; Mr Phetla, the principal of Mbedlwana Senior secondary school; Mr Geldenhuis, a CSIR employee who focuses on policy issues in the BB4All project; and Mr Dlomo, who is a community member and a consumer of the project services.

On the effects of the BB4All project on the school, physical science teacher indicated their plan to use the BB4All services by publishing a school magazine and by later establishing an Internet radio station for the school and surrounding communities. He also indicated that the free broadband services the school gets from the BB4All project are essential for the schools' day-to-day running.

The physical science teacher also noted that the project had opened up many opportunities for school learners, like, being linked to the *Siyavula* learning channel, the ability to take part in online practical work, and ability to download student notes. He added that the school was responsible for uploading a school schedule for other schools in the circuit.

The circuit manager of Kwagga East and Verena agreed on the positive effects of the BB4All project and the fact that it had opened up many opportunities for schools in his circuit, although he raised concerns about incidence resolution times that are a challenge sometimes because of distances that have to be travelled by VO's to reach affected schools. The circuit manager also pointed to the innovation that the project had brought about in the form of capturing examination results online and receiving reports from circuit office online.

Turn-around times were improved as communication between the circuit office and the governed schools improved as a result of reduced travelling times by teachers and the circuit manager to and from the circuit offices.

Pass rate for learners taking grade 12 Mathematics was considered to have improved since the introduction of the BB4All project as learners got more exposure to examinations information through educational portals like the Thutong[13] where learners are able to download textbooks and other helpful resources.

Communities were also benefiting from the BB4All project as some schools in the circuit were providing services like Internet access, printing and faxing to locals during weekends at very much affordable prices or free of charge, assisting them with improvements on their resumes and online searches for jobs.

The project was implemented with very minimal disturbance to the day-today running of the schools that were involved. The circuit manager praised the project team in "observing protocol" in dealing with the schools and the circuit office. There were no occasions of '*fluidity*' or *messiness* or unpredictability'[14] during implementation of the BB4All project in the schools located in this circuit - a fact that Paul Geldenhuis of CSIR attributed to the use of the Information Technology Infrastructure Library (ITIL) and the Capability Maturity Model (CMM) methodologies during project implementation.

Most of the above sentiments were shared by the Principal at Mbedlwana Senior Secondary School in the Kwaggafontein circuit and the community member who was utilising the services from that school.

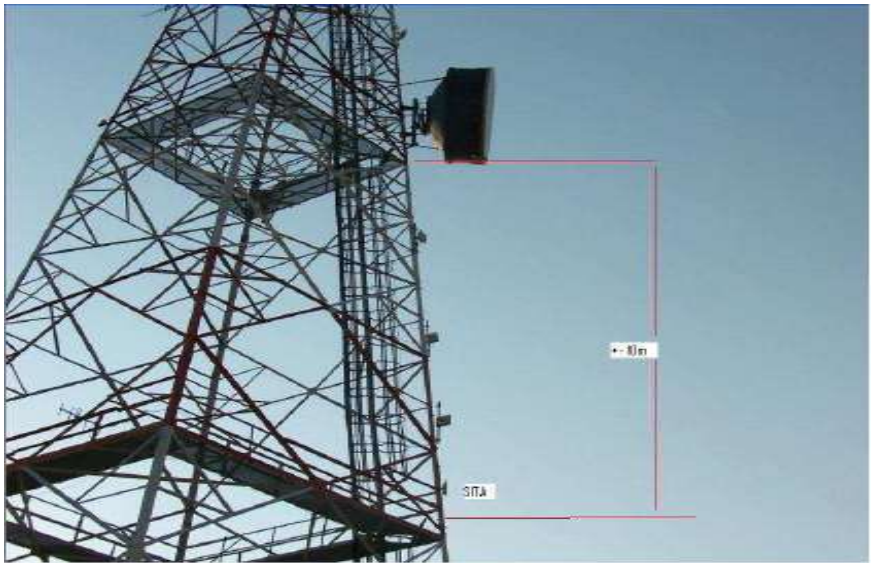
Challenges that the project team encountered were more policy oriented in that access to high points where towers had to be erected became an issue

[13] Thutong is the Department of Education Portal. Available: http://www.thutong.doe.gov.za/

[14] Unravelling the text book as embodied curriculum: An Actor-Network Theory view - Dr J Liebenberg. Available: ceur-ws.org/vol-955/papers/paper-36.pdf

that tended to delay the project since land ownership in these areas sometimes belonged to government institute like SANDF, Paul Geldenhuis, a CSIR employee focussing on BB4All policy issues confessed.

Figure 94: A BB4All CSIR Radio Tower in Mpumalanga.



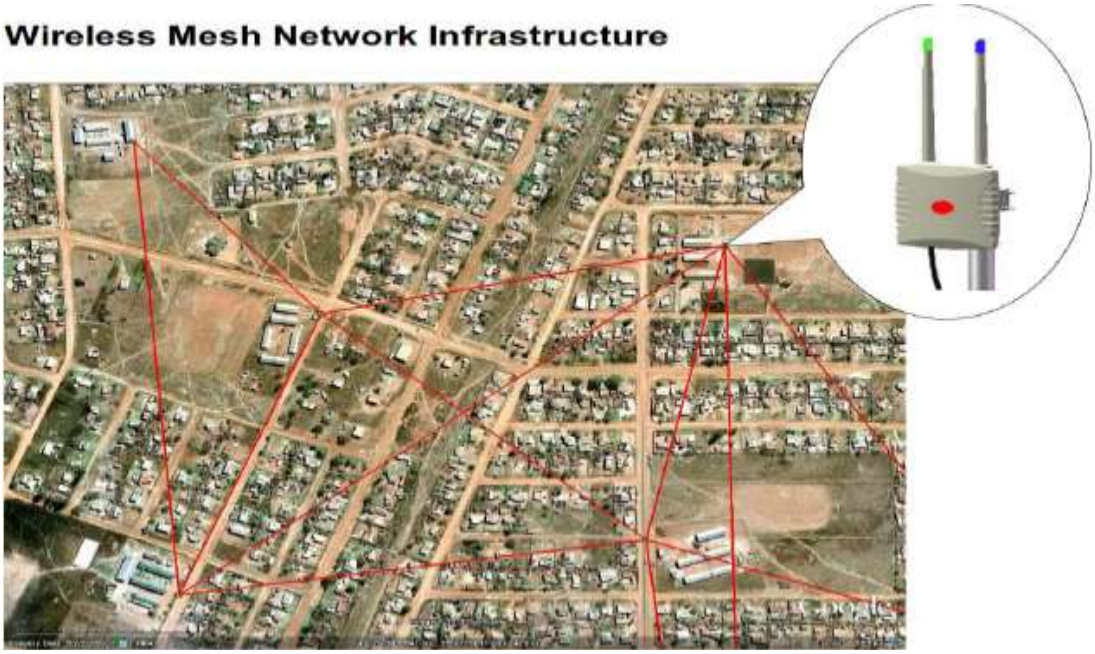
Source: CSIR

According to Paul Geldenhuis, ICASA policies around licenses to enable VOs to operate as service providers and restrictions on the traffic allowed on the SANReN[15] network operated by CSIR, were other concerns that hindered operations of the BB4All project.

Paul also pointed that the ICASA legislation governing broadband operation of the high performance nodes used to connect schools together was another issue of concern that needed further research and communication between involved government entities.

[15] SANReN - South African National Research Network, a new National Research and Education Network in South Africa. Available: http://www.sanren.ac.za/

Figure 105: The BB4All Wireless Network in Kwaggafontein, Mpumalanga



. **Source:** CSIR

Paul also attributed the fact that Village Operators could not provide fully fledged services to unavailability of a billing system, but this issue was being addressed by the BB4All project team in preparation for the handover or commercialisation of the project.

Figure 116: Young entrepreneurs or Village Operators (VOs) at a Conference at Meraka Institute.



Source: CSIR

Other challenges that were pointed out by Paul were policy-related and included issues of security in schools that had the BB4All equipment. These related to the fact that government did not sponsor any security activities and thus schools had to rely on their mundane budgets resulting in little or no security.

This also related to school locking policies where access to fix a connection was impossible on week-ends because some schools were locked during certain weekends or holidays.

Figure 127: The Village Operator at his self-bought office in Moutse



. **Source:** CSIR

4.4. Case Study C: M-Learning Solution by ITSI in Pretoria

This mini-case study proved to be very elusive in terms of gathering data on site although it is based locally around Pretoria. The only place and person the researcher was able to access without challenges was Dr Jacobus Liebenberg the CEO and owner of IT School of Innovation (ITSi), the company that is busy with implementation of this initiative in schools

nationally. The solution has become so important to current crisis in education in SA and yet the DoE has not shown any indications of interest to take part in the project.

Although the researcher has access to this important resource, it has been almost impossible to secure an appointment with a principal and arrange to get access to a school where the solution has been implemented possibly due to tight schedules at the schools or due to unknown reasons. It is possible that amongst other reasons for failing to get access is the fact that this is not a government initiative, but that of the schools that have implemented the m-learning solutions, and this meant that they had to dig deep into their budgets without government support.

Therefore, the information that is presented is based on three things: an interview of Dr Liebenberg, the owner and CEO of IT School of Innovation; data gathered from the company's website; and on an interview with the Principal of Doxa Deo private school. It is important to note that the CEO has presented a paper[16] linked to the m-learning project although the document does not go into detail about the project. The figure indicated below contains a paragraph extracted from the introduction of this paper presented at an m-learning conference somewhere in Europe, and sets a tone to the mini-case study.

The m-learning initiative is a solution that embraces mobile tablet technology in combination with mobile broadband to deliver an 'interactive, multimedia' anywhere teaching and learning solution for both teacher and student. The solution from ITSi runs on tablet computers running Google's Android operating system and uses MobiReader, a locally developed application that distributes and displays content published by Via Afrika.

[16] Unravelling the text book as embodied curriculum: An Actor-Network Theory view of an Android-based eBook implementation in a South African Secondary School. - Dr J Liebenberg.

Figure 13: Dr Jacobus "Lieb" Liebenberg, CEO of ITSi and his Conference Paper Extract

 **Dr J Liebenberg** *CEO of IT School of Innovation (ITSi) in Pretoria*	*In January 2012, a high school in the East of Pretoria South Africa issued all of their Grade 10 learners with Android Tablets. In doing so they became one of the first schools in the country to replace traditional printed learner text books with interactive digital (Tablet-based) text books aligned to the local curriculum. From the outset, the school administration was clear that if the pilot project (named "MobiLearn") proved successful, it would become the cornerstone of a process envisaged to transform the entire school from a "traditional 'chalk-and-talk' school" to a "digital school" by 2013. As early as the last week of May 2012, the MobiLearn project was deemed such a success that the decision was taken to start planning for "MobiLearn 2013 and beyond".*

Source: Education Southern Africa

The following statement was issued by Dr Liebenberg, the CEO of ITSI during an interview by a TechCentral correspondent[17]:

> *"It is unthinkable that the vast majority of today's youth are still taught through traditional means only, given that technology plays such a central part in their existence. With MobiLearn and e-books, learning becomes an interactive, multimedia and full colour experience, blending the best of traditional education with the exciting possibilities offered by the digital technologies of the 21st century."*

The figure below gives a picture about the modules[18] that constitute the m-learning initiative that is implemented partly or as a whole depending on conditions of a particular school and their budget. At the time of writing, a number of schools around the country had implemented this innovative solution, but it must be mentioned that the majority of these schools are private, and are heavily depended on the fees that are not always affordable to the ordinary South African parent.

[17] An interview of ITSI CEO Dr Jacobus Liebenberg by Craig Wilson of TechCentral on the 13 November 2012, Available on http://www.techcentral.co.za/

[18] m-Learn Educational Suite. Available: http://www.itschools.co.za/

Figure 19: Modules contained in the M-Learn Educational Suite



Source: iTSi.co.za

This model of m-learning is not a mere replacement of textbooks with digital content, but replacement of these books with a content that enables teachers and students to add notes, video clips or comments to these prescribed e-textbooks. Teachers can add slides, videos, images, and other content to course material, which is then pushed to pupils' tablets. According to Dr Liebenberg, the problem with many e-learning solutions is the requirement for Internet access that is unaffordable, but the ITSI solution addresses both the issue of content and access. This means that a learner does not need to always have access to Internet in order to learn, but they can enhance their e-text by adding more content whenever they get Internet access.

The following picture shows learners in a private school with their educational gadgets that they carry to school. It is indicated that these school learners no longer need to carry heavy textbooks as the mobile tablet contains all these textbooks in a digitised format with an ability to add more content like notes or comments to enhance their learning capabilities.

Figure 140: Goodbye heavy school bags! Hello MobiPad with digital CAPS aligned e-textbooks!



Source: TechCentral

Involved schools distribute content to pupils over Wi-Fi and ITSi employees or its partners install a server and Wi-Fi if the school as no infrastructure, or they install the necessary software where a school has an existing infrastructure in place. This server ensures that content is kept updated and also ensures that this content is backed up at ITSi's head office on a weekly or monthly basis, depending on a school's contract with the company. Backing this content ensures that it is restored quickly and allows learners to get back on their feet should they lose their tablets through theft or damage.

Figure 151: The MobiPad - an interactive digital teaching tool



Source: iTSi.co.za

The involved school pays an amount of about R35 per learner for this business continuity service and there are no further loaded costs for training,

maintenance, or support. According to Liebenberg, schools that have a large numbers of pupils are eligible for discounts and negotiate to pay lower rates. The school is also responsible for payment of broadband services that allow the school to back up their server and allows learners to connect to Internet services.

Parents of learners are responsible for the purchase of the tablet, recommended by ITSi. This is usually an Android 4.0 or higher devices with 1Giga byte of random access memory (RAM). The cost to load a single textbook is R82 - which is cheaper than a printed version.

A profile for a legible learner is created to allow them access to the content and allow them to add notes, and to also enable them to download additional content in the form of updates. The profile also enables content restores if the tablet is inaccessible due to damage or theft.

Product offerings include: M☺BIRead® – a reading and comprehension toolkit , M☺BITeach® – a content publishing tool by schools and educators, M☺BIScience® - Physics and Chemistry for High schools, ☺BIMultiplication® - a fun game to test learners' knowledge of multiplication tables, and M☺BIParent® - a parental learning and monitoring tool.

4.5. Case Study D: E-health in Peebles Valley

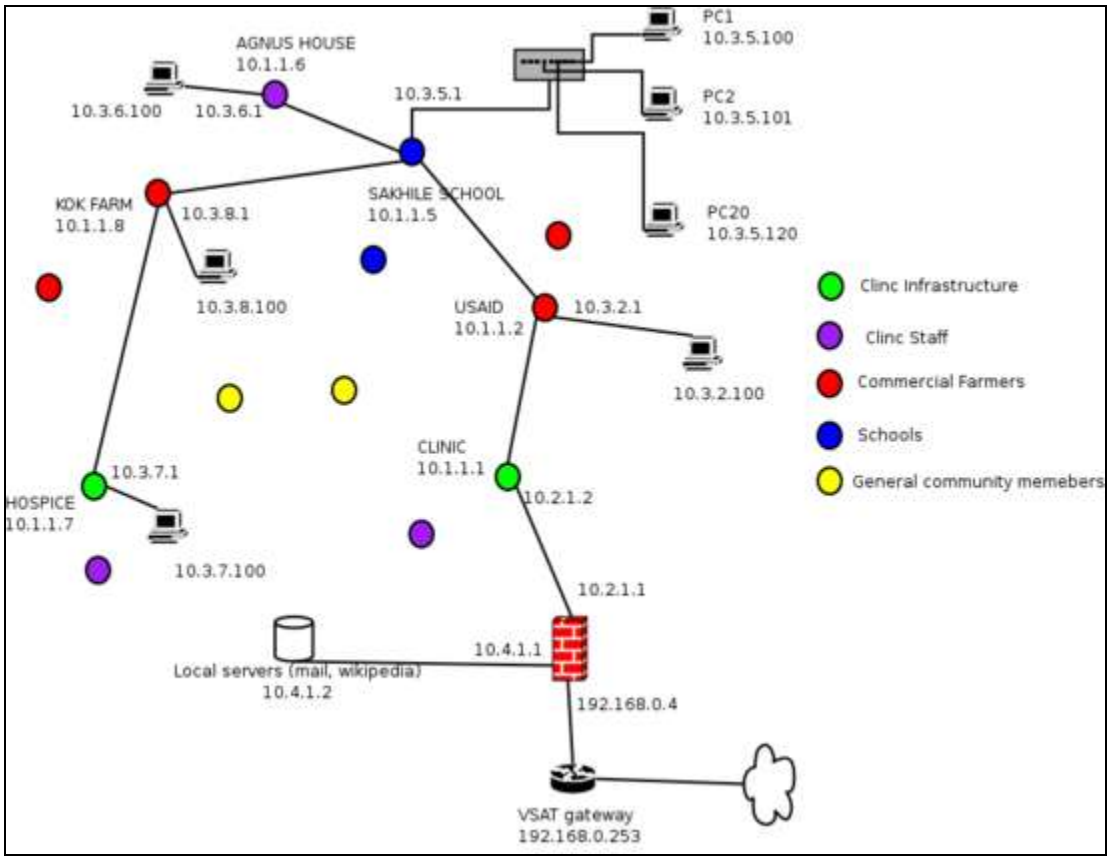
The e-health project in Peebles Valley is derived from a FMFI project named Mpumalanga Mesh project[19] that was implemented around 2006 and commissioned in 2007, and most data was gathered from the website of this research body including the project brochure[20]. A couple of telephonic interviews were conducted with four persons that were involved in the implementation and these were:

[19] The Mpumalanga Mesh Project was conducted by First Mile First Inch (FMFI) research group mainly based in CSIR. Link: http://www.fmfi.org.za/wiki/index.php/Mpumalanga_Mesh:Project_Overview

[20] Wireless Mesh Project Brochure:http://www.fmfi.org.za/wiki/images/9/9d/FMFI_Mesh_PLC_FI_Brochure_Final.pdf

- David Johnson – a CSIR researcher who published and presented a paper on this project at an ICT4D conference in India;
- Dwayne Bailey, a researcher at Translate.org – whose projects are aimed at adaptation of ICT for human languages;
- Reverend Henry Munnings and Doctor Margie Hardman – husband and wife who run the NGO that operate the ACTS clinic.

Figure 22: The Mesh Network in Peebles Valley in Mpumalanga.



Source: fmfi.org.za

The FMFI is a research body whose projects target community development needs, and the above project was aimed at the improvement of communication between doctors, health workers and nurses at the ACTS clinic at Peebles Valley; provision of Internet access to local schools and local

farmers in Mpumalanga province of South Africa through usage of the Wireless Mesh network.

According to David Johnson, the wireless project's vision was to empower people in the area of Pebbles Valley economically and bridge social and cultural and social barriers in health, education, business and agriculture through the use of low cost wireless connectivity. The mission was to connect people to the Internet and to local information, resources at clinics, schools and farms using wireless mesh network, and implementation of sustainable business models that will ensure continuity in the supply, installation and support of the wireless mesh networking technology in specified areas.

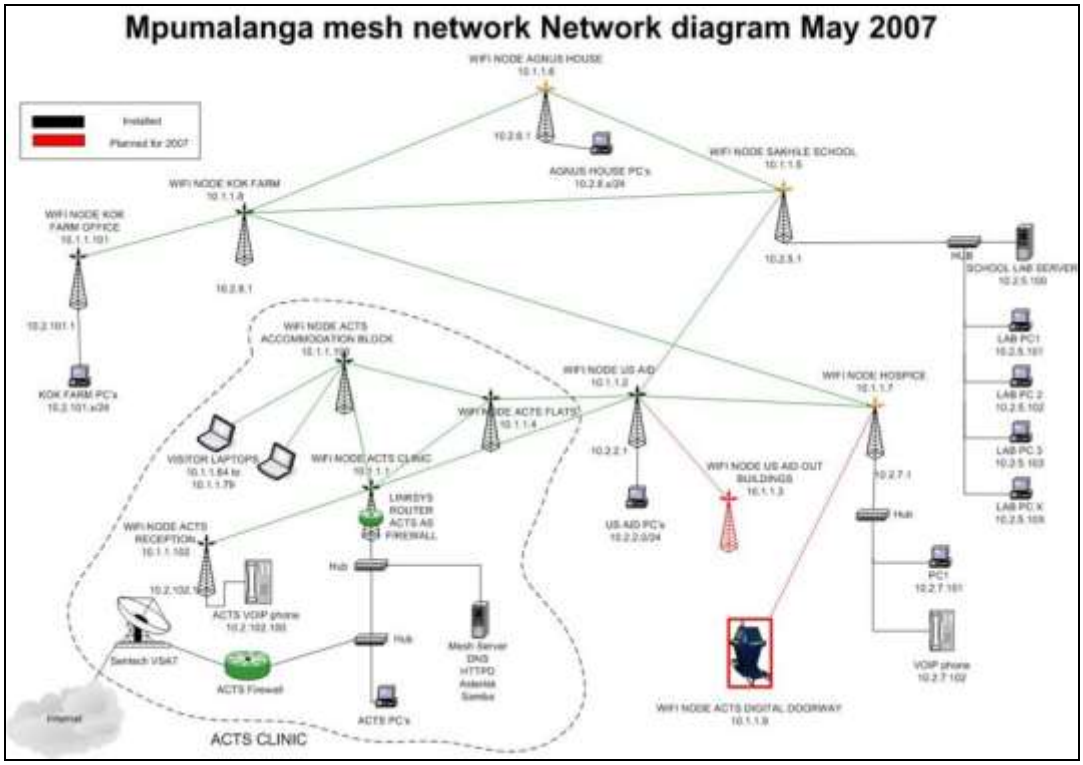
The mobile mesh network connection was between five entities as follows: a nut farm owned by Kobus Kok, the USAID farm, Sakhile high school, ACTS Clinic and its two accommodation blocks, Agnes Mdluli's House with the "Cantennae", and Legogotye hospice. This network is depicted in figure 20, with figure 21 also including the backup connections.

All the connections in the mesh network points were dependent on a Telkom VSAT connection located at the ACTS Clinic for Internet connectivity, which was switched off every night to control bandwidth utilisation. The costs of running this VSAT were shared between the two farms and ACTS clinic.

The ACTS clinic used the VSAT to connect to Wits University's medical faculty for their research on HIV/AIDS (Health Information Network) and also to collect HIV information and statistics from field workers which was loaded on their Decision Support System called TherapyEdge HIV.

The whole project was signed off and maintenance and support was handed over to Compuright, an IT services company run by Ray Smith, located in White River, Mpumalanga. Ray had his business model that would ensure continuation of services to the under-serviced at affordable prices.

Figure 163: Peebles Valley Mesh Network Layout



Source: fmfi.org.za

The project was dependent on the CSIR research license and whoever needed to take over needed to apply for a new operator's license.

The policy and regulatory issues in this project, similar to other case studies in this research, revolve around Wi-Fi licensing conditions in South Africa that exempt a network operator from licensing on the free spectrum of 2.4-2.5 GHz if they comply with the following conditions (FMFI, 2006):

1) the network must be implemented on a single site in the same premises, e.g. a business complex or school;
2) network signals must traverse short distances with an allowed maximum radiated power of 100 MilliWatts (0.0001KiloWatts);
3) only usage of approved certain type equipment is allowed;

4) no interference to users of other ISM equipment or other frequency bands may be caused;
5) network must be confined to computer systems of the same user or entity.

The FMFI (2006) clearly indicates that community networks cross single property boundaries, and that power needs to be boosted in order to make signals travel longer distances, thus exceeding the single site implementation and the 100 MilliWatts maximum power requirements, that a central licensing exemptions.

Figure 174: Aerial view of the Mesh Network in Peebles Valley



Source: fmfi.org.za

FMFI research also mentions the lack of clarity to the type of license that can be used in a community WiFi network operator – class license for services, for infrastructure or for both – and indicates that although licenses no longer need to be signed by the Communications Minister, the ease and speed of

the regulator to grant them is a matter of concern as the regulator faces challenges like under-staffing and low budgets (FMFI, 2006).

Figure 185: The Telkom VSAT dish at ACTS Clinic



Source: fmfi.org.za

4.6. Research Data Summary

4.6.1. E-learning at Ekurhuleni East FET College

The Deputy Principal of the college Dr Johan Groenewald, who was the project manager during implementation, was interviewed. He stated that a Motorola Canopy point-to-point wireless series is the technology utilised to connect five EEC College campuses located in KwaThema (HQ), Springs, Benoni, Daveyton and Brakpan together.

This wireless network operates in the free unlicensed frequency spectrum and consists of point-to-point links that enable the five campuses to transfer bandwidth-intensive information like voice and video at high speed and low

latency, allowing a lecturer in one classroom to teach and interact with students at other EEC campuses that are between four to twenty kilometres away from each other. This network is reliable and has faster data rates and manages to maintain almost 100% uptime in and around the EEC network.

All the analogue Telkom telephones in the five campuses were replaced with cheap Voice over Internet Protocol (VoIP) phones that allow all the campuses to communicate with each other free of charge. External calls from other campuses are routed through a service provider link located at the main campus at KwaThema – meaning one telephone number for all campuses, allowing the college to spend allocated budget on other necessary activities like facilities. There is also an IP-based data and video communication between computers and computer peripherals on different campuses, including interactive smart boarding, video conferencing, and video surveillance for monitoring of security.

The Deputy Principal of EEC agreed that the policy environment during the implementation assisted in the delivery of project within the expected time because of support the college received from the Department of Communications. The fact that the deployed broadband network operated on unlicensed spectrum meant little interaction between the college and ICASA. Freeing up the spectrum released by the conversion of television from analogue to digital television can also assist in the reduction of noise levels, but it would help if government fast-tracked the process of freeing up spectrum.

4.6.2. BB4All for LED in Kwaggafontein, Moutse and Verona

A total of nine people were interviewed and amongst this group four were found on the various sites where the project was implemented. The VOs agreed that the vision of the BB4Al project had not been achieved. They pointed to a huge demand for Internet connectivity from businesses and

individuals wanting Wi-Fi services at their premises, a service they could not provide although their offices were Wi-Fi hotspots.

Self-sustainability was a problem as the VOs felt that they were living from hand-to-mouth since they were mainly depended on the CSIR monthly stipends of R1500 for servicing allocated schools. VO's wished to provide other on-demand broadband services to change that situation. Related to that was the constant extension of the project completion time. This meant postponement of commercialization process of their services meaning losing on possible profits.

A physical science teacher of one of the BB4All schools indicated that they planned to publish a school magazine and establish an Internet radio station for the school and surrounding communities. He also indicated that the free broadband service provided by the project was essential for the day-to-day running of the school, and that this had opened up many opportunities for school learners, including being linked to the *Siyavula* learning channel, taking part in online practical work, and downloading student notes.

Incidence resolution times were a challenge because of distances that had to be travelled by VO's to reach affected schools, although turn-around times were improved as a result of reduced travelling times by teachers and the circuit manager to and from the circuit offices. Pass rates for grade twelve Mathematics learners had improved after the introduction of the BB4All project, and communities were benefiting as some schools were providing Internet access, printing and faxing services to local community members during weekends free of charge for improving their resumes and doing online job searches.

There were policy-oriented challenges like lack of access to high points to erect towers that delayed the project and prolonged timelines. ICASA licensing policies to enable VOs to operate as service providers and

restrictions on the traffic allowed on the SANReN[21] network operated by CSIR were other policy-related challenges.

4.6.3. M-Learning Solution by ITSI in Pretoria

On-site data collection in this mini-case study was difficult although it is based locally around Pretoria, as the researcher had access to the CEO and owner of IT School of Innovation (ITSi), Dr Jacobus Liebenberg. His company is busy with implementation of this m-learning initiative in schools nationally. The solution embraces mobile tablet technology in combination with mobile broadband to deliver an 'interactive, multimedia' anywhere teaching and learning solution for teachers and students, and which consists of a tablet computers running Google's Android operating system and uses MobiReader which is a locally developed application that distributes and displays content published by Via Afrika.

This m-learning model is a replacement of text books with an electronic content that enables teachers and students to add learning material like slides, notes, video clips, images, or comments to these prescribed e-textbooks, which is then pushed to pupils' tablets with little or no requirement for unaffordable Internet access. The learner does not need to always have access to Internet in order to learn, but they can enhance their e-text by adding more content whenever Internet access becomes available.

Content is distributed to pupils over Wi-Fi and ITSi employees or its partners install a server and Wi-Fi if the school has no infrastructure, or they install the necessary software where a school has an existing infrastructure in place. The server is for ensuring content back up and updates to minimise risks should tablets be lost and all this at a cost of R35 per learner with discounts applicable to schools with a large numbers of pupils. The school has the responsibility of paying for broadband services for Internet connectivity.

[21] SANReN - South African National Research Network, a new National Research and Education Network in South Africa. Available: http://www.sanren.ac.za/

Parents of learners are responsible for the purchase of an ITSi recommended Android tablet and the cost for a single textbook is R82.

Product offerings include: M☺BIRead® – a reading and comprehension toolkit , M☺BITeach® – a content publishing tool by schools and educators, M☺BIScience® - Physics and Chemistry for High schools, ☺BIMultiplication® - a fun game to test learners' knowledge of multiplication tables, and M☺BIParent® - a parental learning and monitoring tool.

According to Dr Jacobus Liebenberg, the solution has become so important to solve the current crisis in education in SA and yet the DoE has not shown any indications of interest to take part in the project.

4.6.4. E-health in Peebles Valley

Most data about the Mpumalanga Mesh e-health project[22] was gathered from FMFI's website, and a couple of telephonic interviews were conducted with four persons that were involved during its implementation that was around 2006 and commissioned in 2007. The mission and vision of this project was to connect people in the area of Pebbles valley to the Internet and to local content, resources at clinics, schools and farms using wireless mesh network and to empower people economically and bridge social and cultural barriers in health, education, business and agriculture through the use of low cost wireless connectivity (FMFI, 2006).

The aim of the FMFI project was the improvement of communication between doctors, health workers and clinic sisters in the ACTS clinic at Peebles Valley, and at the provision of Internet access to local schools and local farmers in Mpumalanga through usage of Wireless Mesh network. The mobile mesh network connection was between a nut farm owned by Kobus Kok, the USAID farm, Sakhile high school, ACTS Clinic and its two accommodation

[22] The Mpumalanga Mesh Project was conducted by First Mile First Inch (FMFI) research group mainly based in CSIR. Link: http://www.fmfi.org.za/wiki/index.php/Mpumalanga_Mesh:Project_Overview

blocks, a house with the “Cantennae”, and Legogotye hospice. All these network points in the mesh were dependent on a Telkom VSAT connection located at the ACTS Clinic for Internet connectivity, and the costs of running this VSAT were shared between the two farms and ACTS clinic (FMFI, 2006).

The project was dependent on the CSIR research license and whoever needed to take over needed to apply for a new operator’s license. Compuright, an IT services company run by Ray Smith, located in White River, Mpumalanga was handed the maintenance and support responsibility on project sign-off.

According to FMFI (2006), the policy and regulatory issues in this project were around Wi-Fi licensing conditions in South Africa that exempted a network operator from possessing a license on the free spectrum of 2.4-2.5 GHz if they complied with the minimum distance and maximum power conditions. These could not be met because community networks crossed single property boundaries, and because power needed to be boosted for signals travel longer distances. There was also lack of clarity to the type of license that could be used for a community Wi-Fi network operator. The ease and speed of the regulator to grant licenses was another concern as the regulator faced challenges like under-staffing and low budgets.

Chapter 5. Case Studies Reveal Under-investment in Broadband Infrastructure and Broadband-enabled Services

5.1. Introduction

This chapter will deal with analysis of the data presented in the findings chapter and present the findings that will help in making conclusions and recommendations in Chapter six. The research will use a bottom-up approach by using findings from the case studies indicated above to analyse issues that might contradict or that might not be reflected in current policies and come up with policy lessons and implications emerging from experiences learnt in the project implementations.

These policy issues might be challenges and stumbling blocks towards the successful implementation of projects in underserviced areas and thus will need to be brought up for possible interventions by stakeholders involved in policy formulation. In light of the above, the research analysis will attempt to answer the following questions and sub-questions:

How can broadband policy be amended to support the introduction of appropriate infrastructure for under-serviced communities to participate in the information society?

a) How is broadband being utilised to fast-track service delivery in e-health, e-education, and local economic development for under-serviced communities?
b) In which ways do the broadband solutions implemented in the selected study areas benefit the communities?
c) Are these solutions cost effective, sustainable, scalable, and replicable to other communities?

d) How do current policies on broadband support or inhibit the establishment of information society in underserved communities?
e) What are the strengths and weaknesses of current policies and regulations on broadband with respect to the value for e-education, e-health, and local economic development?

This chapter will begin by looking at the effects of broadband on service delivery in education, in health, and in under-serviced communities where the project initiatives were implemented in relation to the solicited data. This will be followed up by addressing the benefits of broadband to these communities located in under-serviced areas.

The chapter will also look at the cost-effectiveness and sustainability of the broadband solutions implemented in the case study areas and follow this with analysing how the solutions can be scaled up and replicated to other areas facing similar challenges experienced in under-serviced locations.

The chapter will look at how broadband and Information society policies are relevant to service delivery and for local economic development, and for converting under-served communities into knowledge societies. This will be followed by addressing the relationships that exist between information society, broadband policies, and under-serviced areas.

The chapter will be concluded by addressing gaps in current broadband policy and regulations that have an effect on the initiatives aimed at addressing service delivery and bridging the digital divide in under-serviced communities.

5.2. Utilisation of Broadband for Service Delivery in Under-serviced Communities

This section looks at whether the data confirms that broadband has been exploited successfully to deliver services in education, and health, and whether it has resulted in local economic development in the under-serviced areas where the mini-case studies have been conducted.

According to data portrayed in the last chapter, in all the case studies, broadband was utilised effectively to enhance service delivery in education and health in under-serviced communities because pass rates improved in schools that were in the Meraka broadband networks – although such pass rate improvements cannot be attributed solely to the deployment of broadband. Students in satellite campuses of the Ekurhuleni East College were able to interact with lecturers located at head offices through live video conferences and through free VOIP and benefit from these scarce resources without having to travel

Pass rates improved for learners doing Mathematics in schools that were in the BB4All project in the Meraka network. The same can be said for learners utilising mobile tablets with electronic text books in terms of pass rates in addition to the advantage of weight and flexibility of the tablet. The fact that learners could interact with their teachers almost in real-time, and the fact that they could update their e-textbooks with material gathered during classes and that gathered from the internet, made these gadgets invaluable to learners.

In the case of service delivery in health, the ACTS clinic in Peebles Valley utilised mobile broadband effectively by interacting with field workers to collect clinical data of AIDS patient and to interact with the Wits University's medical research unit to collect interrogate the pharmacological and clinical information knowledge base and make sound decisions about their patients.

The ACTS clinic also utilised broadband for their decision support system named TherapyEdge HIV that was used to collate data from all the above-mentioned resources and from headquarters located abroad and make sound decisions about how to deal with individual cases for betterment of HIV/AIDS treatment and to control its spread.

5.3. Benefits of Broadband to Under-serviced Communities

The communities living in studied under-serviced areas benefited in deployment of broadband in many ways. In the E-learning at Ekurhuleni East FET College, students benefited as they were able to receive bandwidth-intensive information like voice and video at high speeds and low latency in real time. This enabled delivery of lecture material between the college head office located at KwaThema and satellite campuses located in Springs, Benoni, Daveyton, and Brakpan.

A lecturer in one classroom at the head offices was able to teach and interact with students at the EEC satellite campuses that were between four and twenty-four kilometres away from each other, without any drops in data packets. The network was said to be reliable with faster data transfer rates and able to maintain an uptime of almost hundred percent.

The college also benefited in terms of cost after replacing all the expensive analogue Telkom telephones in all their campuses with cheap voice over Internet protocol (VoIP) phones to enable all the campuses to communicate with one another free of charge. This was a value add because communication between lectures and students between the campuses suddenly became common, thus enabling students to ask any questions without the fear of exorbitant bills from the incumbent telecommunications company.

Cost reductions were also achieved by routing all external calls from other campuses through a single service provider link located at the head offices at KwaThema. The college also makes use of interactive smart boarding that enables teachers and learners located in satellite campuses to see a presentation diagram from head office and to take part video conferencing. The college was also able to improve security and reduce associated security costs by utilising an IP video surveillance system to monitor all its satellite campuses in real time.

5.4. Cost-effectiveness and Sustainability of BB Solutions in Under-serviced Areas

In this section we discuss issues of cost and sustainability of broadband in the four case studies. We attempt to show through analysis, what site data reveals and make our conclusions on this basis.

The wireless network implemented at Ekurhuleni East College can be said to be cost-effective in that the school saved on implementation costs as they only paid far less than a million rands to link up all the five campuses in comparison with costs of other solutions.

Savings were also experienced after replacing the expensive, low-capacity and unreliable Telkom leased lines with voice over internet protocol (VOIP) phones in all the campuses to enable free calls between the campuses. The savings for the college were stated as being in the region of R500K per annum on integrated services costs.

Other indirect cost savings were on the usage of the IP-based data and video communication between computers and computer peripherals on different campuses, including interactive smart boarding, videoconferencing, and video surveillance for monitoring of security.

With such cost savings it is clear that the model is sustainable as the college was able to use the funds saved, on other issues of importance, and this includes the fact that the college has an intention of building a community centre in the school premises. The centre will have a Clinic, Gym, Crèche, Conference rooms, Gaming Centre, an SMME Development Centre, an Internet Café, and a Coffee Shop. Such a project will be self-sustainable as the services provided the college will render will have to be at a price.

The BB4All project has not shown any cost effectiveness as it is still running at project mode under CSIR auspices. The license being utilised belongs to SANReN and the funds are budgeted for by the Department of Science through the CSIR.

It is also difficult to address the issues of sustainability at this stage but data proves that there is huge demand for broadband services from small and medium businesses around the areas visited by the researcher meaning that these businesses will operate at a profit as soon as operating conditions are made possible. These conditions include village operators getting operating licenses enabling them to provide services to the public. The situation is a complex as it involves a number of variables and means making contact with the regulator.

Lisa Thornton Incorporated, a consultant company that was hired to conduct a study and come up with recommendations produced two scenarios for CSIR as follows (CSIR, 2010):

- VO's to apply for a class license for providing Electronic Communication Network Services (ECNS) and Electronic Communication Services (ECS);
- Buying an unutilised national license from an existing license holder in accordance to the regulator's guidance.

The decision that CSIR took was not clear at the time of conducting this research, but what was clear was determination from the CSIR project office to end the project as they were at a commercialisation stage characterised by selection of a company that would buy in and run the project as a business. According to the project progress report, two companies had already been shortlisted (CSIR, 2012).

The researcher assumes that due diligence was followed before the selection of a company was done, and another assumption is that companies that placed their bids were presented with all the information, meaning that they saw value and placed their bids and thus it can be deduced that the project is cost effective and sustainable.

The m-learning case study in Pretoria is different from the rest since a private company is implementing the successful business model evidenced by the increasing number of private schools that are buying into this concept and ITSI's dependence on the model for its survival.

Schools that have implemented this solution are mainly private and do not have budget limitations as public schools. Cost-effectiveness and sustainability can be looked at from the point of view of the end-user, who is a student.

Although the researcher did not have a chance to speak to many students due to constraints indicated in the m-learning section of the last chapter, one can deduce that value is derived from the fact that learners do not have to carry heavy textbooks, but have to just carry a tablet with all the textbooks in electronic format. The second deduction is that the material that the tablet contains is interactive and allows the learner to add notes and attach videos on their e-textbooks, making them more dynamic and thus linking a lot of information downloaded from the internet to their e-textbooks.

There is also the advantage for the teacher and learner to interact in real time whereby the teacher is able to monitor progress of each student in a given assignment and the learner is able to get feedback in real-time. On sustainability, again because of the nature of this case study, we look at how the students and their parents can sustain this model. The model is sustainable considering issues of affordability as the schools that have embraced the project are private schools. A completely different picture would emerge if we were to look at how this would fare in a public school.

One can briefly attempt to describe a scenario for implementing such a system in public school. Firstly the government through the department of basic education would have to subsidize the schools that elect to implement the m-learning solution. The most cheapest and a little descent android tablet can cost roughly about two thousand rands, and adding the cost of the software and maintenance plus internet cost can be steep for such schools and yet these are the very schools that are in dire need of such technology.

On top of these costs one would have to add insurance that can mean adding up a big chunk to the costs since most of our public schools are located in areas where crime is high. Then we look at the issue of affordability where most parents barely afford the little fees charged by these public schools. The question of cost-effectiveness and sustainability is very tricky in this scenario and is a subject of another research study.

It is very clear that this m-learning technology is important for all learners and if the country is realistic at the objective of closing the digital divide, and of creating an information society, then these issues should be prioritised by policy decision makers, and private businesses alike to help in resolving the challenges South Africa faces in education.

Sustainability and cost effectiveness of the e-health project in Peebles Valley depends on two variables: demand for broadband services in surrounding

areas, and a working business model from the business owner who took over the running of the project on completion or on commercialisation.

As indicated in the previous chapter, the most crucial entity in this mesh network is the ACTS clinic since it is the centre and very vital for survival of this network. Also mentioned in the last chapter is that the clinic sees broadband connectivity as very crucial for its day-to-day operations, hence the preparedness to foot the Telkom bill of about R3000 per month for the VSAT (FMFI, 2006).

This model was not very sustainable in the long run and it is for this reason that the clinic decided to work on its own community mesh network in White river, a town that is twenty kilometres away. The advantage of this will be the ability to share the costs of the low ADSL that will be used for connect a base station in White river.

On the commercialisation of the mesh network project, a local private company called Compuright was selected and the director of the company laid down plans to install another mesh network in White river and link this to the network in Peebles Valley. The White river mesh network would utilise ADSL and this would provide internet access that would be sold to the ACTS clinic and the surrounding farmers and schools at a reasonable prices.

The owner also indicated that the people would be able to receive first few bundles free of charge and then would be charged depending on usage when the free bundles are depleted. This model can work somehow, but there is a danger of schools not paying up and thus things going back to basics with schools not utilising these important services, unless the department of basic education intervenes by subsidizing schools.

This model would not affect ACTS clinic and farmers who are also in this mesh network because they are used to paying more expensive prices for

VSAT and 3G internet connections, but it would have negative effects to private individuals and cash-strangled schools. Government needs to look at interventions in the form of policies that would prevent such a project from following the rest of past projects considered to be failures.

5.5. Scalability and Replicability of Broadband Project to Other Areas

Out of the four mini-case studies, the most versatile and flexible when it comes to scalability and replicability is the m-learning case study as it does not involve huge infrastructure investments. This is because a school needs to have only a single server to enable backups of content to ITSi head offices in addition to a wireless access point or “hotspot” that learners can use to connect their Android tablets from time to time to access the internet.

It would be easy to implement this system to other provinces but, the only restrictions are more cost-related if it is to be implemented in schools located in rural areas with little or no budgets to utilise. This is where the government is strongly needed to play a role to ensure that benefits experienced by affluent schools are also experienced in poor schools that need them the most since the majority of these schools experience poor pass rates.

At the time of gathering data, the CEO of IT School of Innovation had indicated that talks between his company and two municipalities were at an advanced stage where the municipalities were aiming at implementing the solution at certain schools as a pilot project. There is hope for underserviced schools in these provinces because they would be at the forefront of mobile learning implementation and they could be used as case studies by other government departments.

The Motorola canopy series implemented at Ekurhuleni East College is another good candidate for scalability. The college has aims of expanding this project by building a community centre that will provide services like internet cafe, Conference rooms, Gaming Centre, and an SMME Development Centre. These are matters that can be achieved only if the implemented network solution is scalable enough to allow this envisaged expansion. There was also talk of including other schools in the network for the benefits of children located around EEC.

The project can be a trend setter that could be replicated to other learning institutions located in under-serviced communities. People around institutions located in underserved areas could use this example and implement their own solutions for the betterment of local conditions. Implementing the solution at Walter Sisulu University in Butterworth - an area where even police stations do not have internet connectivity, let alone schools around, could bring many benefits to these communities in line with goals of creating information societies.

5.6. Relevance of SA's Broadband and Information Society Policies for Service Delivery and LED

Although this research mentions the two policies in the South African context, in reality these policies never been implemented (Melody *et al.*, 2004). This is in contrast to the following facts:

- the country is a signatory to conventions that seek to foster the establishment of these policies;
- the rhetoric from previous South African presidents and government officials alluding to the importance of these policies; and

- the amount of research that has been produced by academic institutions and private companies around the two policies.

The broadband policy is still a concept under discussion within the department of communications since the proposed 'National Broadband Policy for South Africa' was just released by the then minister of communications, Pule as a government gazette number 36332 for public comment recently in the middle of April 2013. The previous version of the draft policy named 'Broadband Policy for South Africa' was released for comments by the past minster of communications, retired General Nyanda in July 2010. The results of these public comments were never published.

This research can argue that this backlog in establishing these important policies has resulted in the current state of affairs that hinders usage of broadband for service delivery in education and health in the country especially within communities located in far flung areas. These communities continue to be disadvantaged and under-serviced, despite government's promises of a better future for all South African citizens.

The collected data proves the irrelevancy of information society and broadband policies because of their non-existence, although formulation of the latter is at an advanced stage since it has been released for public comments. We can only hope that policy formulation process will be expedited within the remaining twelve months before the 2014 elections to prevent what seems to have occurred to the previous broadband policy draft documents released for comments in July 2010 because of a change in government structure.

Van Audenhove (2003) identifies four distinct periods in South Africa's policy formulation process: transition, transformation, implementation, and evaluation periods. It is unclear and difficult to locate the period where the broadband policy can be at because it has been in formulation for more than

three years because of political changes that have taken place that have had a tendency to affect policy formulation projects in the country.

It is advisable for government to ensure continuity of previous projects within departments regardless of changes in its structures by creating some form of independence between ministries and their respective departments and by ensuring that there is minimal or no interference by ministers on ongoing projects run by their departments.

5.7. Link between Information Society and Broadband Policies and Under-serviced Areas

This section looks at data on information society and broadband policies and the relevance of the two policies in ensuring that much needed services are taken to under-serviced areas to ensure the development of an information society and thus minimise the digital donga in the country.

At its 2011-2014 Strategic Plan document the department of communications identified six key pillars of their turnaround strategy, and three of these are the following:

- building of an integrated national broadband plan;
- building of a people centred inclusive information society and knowledge –based economy; and
- implementation of major projects like ICTs and rural development, and e-skills institute (DoC, 2011).
    - The e-skills institute is an entity that originates from CSIR's Meraka institute established with the purpose of enhancing ICT skills in South Africa through training. This entity was later absorbed by the department of Communications and its responsibilities were expanded to include: increasing access to as well as usage of ICT;

> increasing national e-skills consciousness; increasing service delivery through increased ICT skills; and to facilitate the building of an Inclusive Information Society (DoC, 2010).

The implementation of the three pillars signifies seriousness on the part of this department about broadband policy and plan to achieve the envisaged inclusive information society. Broadband is identified by the department of communications as another flagship programme and the key intervention for its achievement is identified as the national broadband strategy development and national broadband implementation plan (DoC, 2011).

Although the above may be true, data gathered on site during the research of the mini case studies proves otherwise as people are still facing the same problems caused by digital exclusion and the advantages brought about by broadband implementation have not been realised. The strategy plan document was developed in 2011 and it is about to reach its sell-by date which is 2014 and yet there is very little evidence that proves that the strategy has been successful.

According to the data gathered at the e-education and e-health mini-case studies, the link between a national broadband policy and strategy, and the creation of an information society is well-established, but, the implementation of this broadband policy is not where it should be. The lack of government intervention in pricing and lack of government support in project implementations, are common factors in all the mini-case studies proving the lack of broadband policy implementation. The Mpumalanga mesh project relies heavily on CSIR and its commercialisation does not seem to include government since preference for project takeover was private business.

A similar observation is made with the m-education in Pretoria. The CEO of ITSi indicated during the interview that as much as his solution to education was very important – proven by its uptake by private schools – government

had shown very little interest to participate in the initiative. Intervention by government would be important for replication of such initiatives to very needy schools in under-serviced communities. The same can be said about the e-education project implementation at Ekurhuleni East College since the institution is dependent on its budget for ensuring sustainability of this project.

Failure to see the relationship that exist between broadband policy and strategy, and the development of an information society is what hinders progress in achieving this objective, and this relationship is the cornerstone for ensuring that conditions for communities located in under-serviced areas are improved and for ensuring that local economic development takes place. It is crucial for government to develop the broadband policy and implementation strategy quickly so that it can be implemented immediately. It is also crucial to develop the information society policy and implementation strategy so that the two talk to each other in order to reap the benefits of economic growth and prosperity for populations located in under-served areas.

5.8. Broadband Policy and Regulatory Gaps Affecting Service Delivery

South Africa's broadband policy does not exist in its totality because it is still in draft form. The department of communications released the latest draft for public comments in the Government Gazette number 36332 in April 2013. It must be noted however that the first draft of the policy was released for public comments in the Government Gazette number 33377 in July 2010. What happened thereafter this process is unclear, but one can make assumptions that this process was derailed by the many changes that took place in government between 2010 and 2013 resulting in the repackaging of this policy in government gazette 36332.

It is important to note some differences between the two policy drafts when addressing radio frequency spectrum for broadband. The first policy draft only mentioned this crucial element of mobile broadband in a single line that goes on as follows:

> This policy recognises that radio frequency spectrum is a scarce national resource and that the allocation shall be guided by the developmental objectives in the public interest. (DoC 2010, pg. 16)

The second draft in government gazette number 36332 recognises the importance of radio frequency spectrum and goes much further than its predecessor by dedicating at least four paragraphs for radio frequency spectrum for broadband. The draft notes the promotion of broadband services and goes on as follows:

> ...to promote the availability of broadband services in rural and underserviced areas, allocation and assignment of radio frequency spectrum bands....will be prioritised;....sufficient allocation and appropriate licensing of radio frequency spectrum in order to promote universal access...and stimulate the economy will be prioritised. (DoC 2013, pg. 14)

The problem as indicated before is that this policy was in draft and there was no indication of where it was at the time of writing this research, but evidence on the ground is that frequency spectrum allocation has not taken place yet. ICASA is very silent about this aspect despite all the noise from public and private organisations to expedite the process.

This broadband spectrum is very crucial for the successful operation of mobile broadband networks in rural and underserviced areas, as pointed out in the data section. Delaying spectrum allocation and licensing is similar to delaying the much needed progress in economic development of underserviced communities and thus delaying the creation of the envisaged

information society. This has a negative effect on the economy of the whole country and needs urgent intervention from the executive powers.

It should also be noted that radio spectrum allocation is dependent on the public broadcaster's analogue to digital television migration project which will free up spectrum. The causes of these delays in this project are unclear, but there are indications that the set-top boxes that needed to enable usage of old TV sets after the switch to digital TV, have not yet been manufactured because of cost constraints.

The current policy draft addresses the weaknesses in identified in the first draft relating to development of broadband, broadband infrastructure development for access purposes and encouragement of content development for consumption of broadband services. Addressing the three broadband aspects is in line with established international broadband standards as depicted in InfoDev's broadband strategies (InfoDev, 2011) and will ensure success in broadband implementation in South Africa, but the delays in generating this policy and mapping it to strategies is the main problem that exacerbates the challenge of digital divide in the country.

Data on the Ekurhuleni East College case study indicates that future plans that the college has, which are the deployment of mesh network to avail broadband services to local communities, are on hold, and are delaying the process of transformation of local communities into digital societies.

A similar situation exists with the BB4All project in Mpumalanga in that the Village Operators are unable to provide broadband services to local communities that are demanding these serves because of licensing constraints. South Africa's legal and regulatory environment is not yet ready for this although steps were taken by CSIR to address the issue by approaching Lisa Thornton Incorporated to conduct a study and come up with

recommendations on how to license the VO's. The recommendations were as follows:

- Village Operators needed to apply for class licenses that would enable provision of electronic communication network services (ECNS) and electronic communications services (ECS);
- Buying a national license from existing license holders who were not utilising them in accordance with the regulations.

It appears that CSIR has not yet made a choice on the above-mentioned recommendations as the VO's are still complaining about their inability to operate as true broadband service providers and the delays in the project that affect sustainability and affecting their moral, as indicated in the data presented in the previous chapter. These delays can be attributed to the failure by government to free radio spectrum and allocate this freed radio spectrum to service providers like Village Operators.

5.9. Summary of Analysis and Interpretation of Findings

The data presented in the previous chapter above proves why South Africa is dropping in international and regional rankings and failing to reach the WSIS objectives and requirements of establishing an information society and a knowledge economy. In terms of the PNC on ISAD's ten point plan and the CMM (Capability and Maturity Model) the country can be found at level one or two, described to be a stage of formation of processes and structures, and the phase is characterised by disorganisation (Presidential National Commission, 2006). The ten point plan from PNC on ISAD addresses the development of an information society in South Africa, and this section will utilise this model in an attempt to summarise the analysis chapter.

The current policy and regulatory environment does not promote projects aimed at delivering services to underserviced communities through the

utilisation of mobile broadband. In all the four case studies, policy has failed to encourage progress in utilisation of broadband in the areas of education, health, and local economic development. The ICT infrastructure in the environments varied, and depended on the location of the studied subjects. The projects located around CBD's showed signs of maturity of ICT infrastructure. The ITSi project was implemented in private schools with no budget constraints as most of them were found to have existing wireless broadband and computers that were used during implementation. The EEC project did not have signs of struggle in ICT infrastructure, but the BB4All and Mpumalanga mesh projects had constraints in this aspect because of location. The same can be said in terms of access to information and ICT infrastructure;

The fourth point addresses security, confidence, and e-awareness. In all the four mini-case studies, only two can be said to be compliant on this point and these are the EEC and ITSi projects. This is because the projects are private in nature and a private company was engaged in implementation. Security and confidence was an important requirement and a service level agreement to ensure project success, since the projects involved large sums of money paid. The other two projects – BB4All and Mpumalanga Mesh for e-health – were found to be lacking in this aspect, mainly because of location. People in these areas might be e-aware but the lack of knowledge and exposure to cybersecurity maybe because of the surrounding physical environment perceived as more secure than urban environments where the other two projects are based. People are relaxed and tend to forget that the cyber-environment is very much wide and unsecure. This is a subject for further research or extension of current research.

The next point – science, innovation, research and development, relates more to the entities that implemented the projects than to the subjects of the projects, although innovation was observed on the BB4All and Mpumalanga

Mesh for e-health projects. A teacher in one of the BB4All project schools developed a website for communication and interaction purposes between the school and the circuit office. The same teacher initiated and taught a new subject called computer technology at the school. His long-term objectives were to develop an internet radio service for the schools and surrounding neighbours. Innovation in the e-health was seen with the “Cantenna”, where a can was used as an antenna and this attracted attention from local and international media and research teams.

On the human capital development which is the sixth point in the PNC on ISAD plan, we can say that all the four mini-case studies had strong symptoms of this aspect. The subjects involved benefited and developed as results of the projects. The ability to search the internet for jobs and to research topics for schools or college, the ability to network with friends elsewhere and communication between the ACTS clinic and its field workers are some of the benefits of the four broadband projects to the communities.

The seventh point addresses funding and, out of the four broadband projects, only two were operated utilising funds either from donor organisations (e-health) or from government departments (BB4All). Private funds were used to finance the other two projects. The contradiction is that projects where funding was used lacked in addressing other requirements as they depended on funders who had to check the importance of increasing funds against the requirements that were possibly viewed as unimportant.

The eighth point addresses measuring the development of information society and ICT impact in South Africa and this is a subject of another research although one can argue that the four projects had some impact on the information society.

The ninth point discusses coordination and integration amongst stakeholders involved in the projects. This element is evident in most government projects

characterised by lack of coordination between government departments and the private sector. This lack of coordination was pointed out by Dr Liebenberg, the CEO of ITSi when he interjected that the m-learning project could be very helpful in addressing challenges experienced in education but the department of education was not coming to the table to negotiate. The BB4All project did not suffer this as there are well-established lines of communication between CSIR and government and between CSIR and the private sector, and also because this institute follows well proven and established methodologies that help in ensuring coordination and integration.

The tenth element of the PNC on ISAD's ten point plan addresses the digital inclusion of the special group (Presidential National Commission, 2006) and looks at how women, children, and the handicapped are addressed when implementing ICT projects. This research is not going to address this point as it is a subject for another research.

In summary, although the four mini-case studies address almost all the elements of the ten point plan, they fall short of addressing all of them and this can be used to conclude that their contribution towards the creation of an information society in South Africa is very little, due to many reasons like lack of or delays in implementation of broadband policies and regulations, lack of knowledge, lack of coordination, budgetary constraints and other reasons that will be addressed in the conclusion and recommendations chapter below. The chapter will also look at whether under-serviced societies are transformed into information societies and whether they can influence changes in the broadband and information society policies in the areas of education, health, and local economic development. Conclusions will be made by recommending South Africa's broadband policy objectives, benefits, key priority areas, and roles between government and the private sector.

Chapter 6. Conclusions and Recommendations: A Comprehensive, Structured "Broadband for All" Strategy

In this chapter we discuss the status of the digital divide and how far the concept of creating an information society through service delivery in health, education, and local economic development has gone in particular in under-serviced areas. We also attempt to look at the status of broadband implementation in underserviced areas in order to understand if the objectives have been achieved. The area of study has some limitations in that most researchers have been looking at the digital divide that exists between the urban and rural population of South Africa and the focus of the research has not been on broadband, and this creates limits in the mount of available literature on this subject.

The research also looks at presented data to see if there are lessons learnt from the case studies and attempts to identify any policy gaps that could have hindered these projects. This is followed by an attempt to lay down an action plan aimed at closing these gaps. The recommendations look at how broadband policy and strategy can be implemented better and this is followed by a suggestion of a common definition and implementation of information society strategy. Fast-tracking of critical broadband projects and creation of partnerships between involved entities is also addressed.

This is followed by a suggestion to replicate successful projects to other needy areas utilising a suggested entity within DOC that needs to be set up and be responsible for this function. The chapter concludes and suggest future research that can be undertaken to help close the digital divide in under-served communities and thus in the creation of an information society and a knowledge economy for these areas and for South Africa.

6.1. Digital Divide and Information Society Status in South Africa

It is important to attempt to show the current status of the digital divide in the country despite the projects that have been implemented to close it, and also discuss whether the objective of creating an information society has been achieved.

Reliance on mesh network technology that is expensive to setup and requires technical skills that are difficult to get does not seem to be the proper solution. Since the price of mobile broadband continues to drop, using easy to implement wireless solutions, like 3G seems to be the better option. The mobile broadband data specials introduced by companies like Telkom mobile could be utilised. In the case of the Mesh project in Mpumalanga, there is a dilemma of selling the equipment and the project material to a service provider, who is going to want to recover the costs from the customers through higher prices and thus prolonging the struggle for creation of an information society in under-serviced societies.

The provision of free broadband for schools as it is the case currently in the BB4All project in Mpumalanga will eventually stop and schools will have to pay up for internet access. This will have negative effects on the digital divide and on the objective of creating an information society unless the government intervenes by way of subsidising these schools or by looking at alternative and innovative ways of providing the service to schools free of charge.

Other interventions could include introduction of regulations and policies that will make internet connection compulsory to all schools and support this by encouraging business communities located around under-served communities to invest in wireless networks for tax reliefs.

6.2. Status of Broadband Implementation in South Africa

Broadband implementation is improving more especially in urban areas. It is the rural areas that such implementations have fallen behind because big telecommunications companies do not to see value in investing in these areas. The most common practise is what is termed “box dropping” where refurbished computers are dropped at public places like schools or community spaces without any forethought. Tele-centres are in abundance in most under-serviced areas but these entities do very little to stop the widening digital divide gap.

The BB4All project in Mpumalanga is a good example of a non-box dropping practice although it has signs of falling into the same trap that caught other projects aimed at bridging the digital divide since the whole project is to be handed over to a private company as mentioned above, in a process called project commercialisation.

The e-health project at Mpumalanga has suffered the same fate but fortunately the ACTS clinic is a sound business that is able to share its resources to surrounding communities. The clinic had plans of installing their own wireless mesh network to be able to continue providing free internet services to connected schools and communities.

The point-to-point wireless network project in Ekurhuleni East College is also in the process of expansion where a hall would be built with an internet kiosk aimed at providing internet services to surrounding communities. As part of this expansion, the EEC has plans of connecting more schools to its wireless network so that the schools can also benefit as those that are already in the network.

The ITSi's m-learning innovation is also going to be deployed in KwaZulu Natal and the Eastern Cape as there were upcoming negotiations between the company and the two provincial governments.

6.3. Lessons Learnt from Case Studies

The BB4All project runs the risk of failure as it has reached a stage of commercialisation. It is a fact that all projects must start and finish at some point and the project sponsors do not have funds to continue supporting them forever. The problem comes when the indicated finish times have been reached and the project has not been completed because the product becomes an unfinished one. Data suggests that this is the same fate that the BB4All project will suffer.

According to the gathered data, there are important milestones that have not been reached in this project. The village operators are still operating as common kiosks that provide Internet access to communities, not as wireless internet service providers selling data to surrounding communities because they do not have operating licenses as suggested on the recommendations from Lisa Thornton Incorporated.

The village operators did not have the technical knowledge that would enable them to repair a damaged network point. They relied on technical services provided by the CSIR and this service would eventually stop when the project reached its completion date. Although there were talks of sending all the VO's for this technical course, nothing had been done about this at the time of writing.

The village operators were unemployed youth recruited from those areas where they operated their businesses. As such, they did not have private transport to use on call-outs. This means that more time is spent on travelling

to the schools experiencing connectivity problems on the wireless mesh network.

The stipend paid by CSIR was not enough to cover their costs, and it was not clear what would happen to them on commercialisation of the project.

With regards to the EEC project, there were also issues that affected schools connected to the wireless network. The DoC employee who was active in coordinating the effort for connecting the schools left the department and there was no follow up after his departure, as a result the schools were no longer connected as they did not have the skills to fix connectivity problems. The EEC also did not make any follow-up to try and resolve this issue as it did not affect them directly.

The e-health project data did not indicate any serious challenges, except for technical challenges with the farmers who were part of the network. They usually unplugged a node without realising that they were actually cutting off the schools that were depended on the node for connectivity. The CSIR technician had to run around to resolve the problem, and it was not clear who was going to take over this role.

The ITSi's m-learning solution did not experience any issues at all the schools where it was implemented as the company signed support contracts with the involved schools. One risk the schools faced was lost or stolen tablets, although this risk was mitigated since parents had to pay for insurance and since ITSi was backing up learner data, which was restored when the lost tablet was replaced.

The only challenge came up in the form of a comment from the CEO of ITSi who complained that government was reluctant to participate although there was awareness of how schools that implemented the m-learning project are transformed. The response from the department of basic education was from

the KwaZulu Natal and Eastern Cape provincial governments and no response from Gauteng itself although the whole concept started in Gauteng where the IT School of innovation is based.

6.4. Identification of Policy Gaps and Creation of Action Plan

South Africa's broadband policy does not exist as it is still in draft form with the latest draft released by the department of communications for public comments as Government Gazette number 36332 in April 2013. The first draft of the policy was released for public comments in the Government Gazette number 33377 in July 2010, and no evidence of any feedback can be shown. This draft was later repackaged in the government gazette number 36332 in April 2013.

There was no indication of the stage of this policy since it was released for public comments in April 2013, but existing data gathered on sites indicates that frequency spectrum allocation has not taken place yet. ICASA is very silent about the allocation and licensing process despite calls from public and private organisations to fast track it.

Data also indicates that the BB4All project in Mpumalanga also shows signs of stagnation as Village Operators are still unable to provide broadband services to communities that are in need of these services because of licensing constraints. South Africa's legal and regulatory environment is not yet ready for this although steps were taken by CSIR to address the issue by approaching Lisa Thornton Incorporated to conduct a study and come up with recommendations on how to license the VO's.

The recommendations were that the Village Operators needed to apply for class licenses that would enable provision of electronic communication network services (ECNS) and electronic communications services (ECS); and

the option of buying a national license from existing license holders who were not utilising them in accordance with the regulations.

Another policy gap is that there is no information society policy in South Africa despite the fact that a structure was created by the former president of South Africa, Thabo Mbeki, to focus on its creation. The policy would guide creation of this information society and would help in deriving strategies aimed at creating and monitoring progress. This policy would assist in providing guidance to the public and private sectors when implementing projects that are aimed at creation of the information society and closing the digital divide.

6.5. Recommendations

The following are six recommendations that could ensure that the goal of creating an information society in under-served areas of South Africa is achieved.

6.5.1. Creation of a broadband implementation structure within the DoC

The role of the department of communication is very broad and it is for that reason that the recommendation is the creation of a new division or structure operating at a deputy director general level whose primary responsibility would be strictly to foresee the implementation of broadband in the country. It is only at this level that commitment towards policy and strategy can be possible because the deputy director general would report to the director general and performance would be based on progress of broadband implementation projects specifically in underserviced areas.

This structure could also oversee the implementation of this envisaged information society and could be supported by an oversight committee composed of senior stakeholders from CSIR, Department of Science, ICASA,

tertiary institutions, and business community in the telecommunications space.

6.5.2. Partnerships between research institutes and government departments

At the present moment very little collaboration exists between government departments, between government and private organisations, and between government and institutions of higher learning. This results in unnecessary duplications and waste of public funds. Collaboration on broadband research between the entities mentioned above is very little or non-existent creating a scenario where "*the hand does not know what the finger is doing*" because of not sharing information.

This coordination and collaboration can be encouraged by formation of an entity (as suggested in point 6.5.1 above) that would be charged with the responsibility of ensuring that all the critical structures that share the same objectives of bridging the digital divide, are talking to each other. Combining the research capabilities of universities, CSIR, department of science, and other entities of interest could generate research data that could be critical in ensuring the achievement of the objective of creating the information society and bridging the digital divide.

Cross-subsidies and sharing of teams for implementation of broadband projects between government, the private sector, and universities could also help drive progress towards information society creation.

6.5.3. Definition and implementation of broadband and information society policies and strategies

This policy and strategy must focus on under-serviced area and must be clear on broadband implementation for development.

The policy and strategy must also address how the special groups as a priority. This group is composed of women, children, the old, and the disabled and often have very important and different requirements that are mostly ignored during implementations.

Broadband policy and strategy must also look security, an very important aspect that is taken very lightly during broadband project implementations, more especially now that South Africa is attracting attention worldwide because its involvement in international bodies like BRICS.

Literature confirms that in South Africa, there has never been a policy document and a strategy on creation of an information society, and this could possibly be the reason that there is no clarity on who is responsible and how the information society will be achieved and the tasks of executing the steps are not defined (Van Audenhove, 2003). Development of the broadband policy and strategy is very crucial in bridging the digital divide and in ensuring success in developing the much spoken about information society and in creating a knowledge economy in South Africa.

Government must take responsibility for this task and start putting clear milestones and monitoring progress through the utilisation of a structure whose responsibility is solely the creation of broadband policy and definition, implementation, monitoring and evaluation of broadband strategy.

6.5.4. Empower and re-enforce the sector regulator

ICASA is not considered to have a strong workforce that is well trained to perform its duties effectively (Southwood, 2011). Those staff members that are experienced are poached by big corporations as they get lured by offers they cannot refuse. Government is also not throwing enough budgets to enable the regulator to conduct research and increase its effectiveness.

In order to avoid staff poaching, the regulator must have good staff retention programs that are not merely based on monetary gains, but based on other important things that are difficult to find within other companies in competition for resources. These measures could include sending performing employees on vacations or encouraging them to work from home and or introducing flexi hours.

Staff members could also be encouraged through incentives for coming with innovative ideas for licensing of broadband spectrum or for coming up with innovative research that addresses spectrum issues and challenges. Such ideas could be shared amongst government departments and research institutions that are looking at broadband implementation projects aimed at closing the digital divided in the country.

6.5.5. Fast-track spectrum release and relicensing

The regulator has the obligation to fast-track the process of allocating the spectrum that is released when television is converted from analogue to digital broadcasting. Although this is dependent on the national broadcaster's speed of converting to digital signals, the regulator can put pressure on government to release spectrum for allocation and licensing.

6.5.6. Replication of successful projects to other needy areas

M-learning from ITSi: government must engage and be involved in projects that would add value and assist in closing the digital divide in under-served areas, and must take action as there crisis in education. Schools under-serviced areas have poor pass rates and the crisis will continue unless government takes bold steps and invest and spreads the m-learning initiative to other areas through the departments of Basic Education and Communication.

E-Learning in EEC: This is another flagship project that needs to be replicated in far flung places. An example would be the Walter Sisulu University in the Eastern Cape with campuses separated by bigger distances that EEC. Travelling between the main campus in East London and the smaller campuses like Butterworth is very dangerous, and having a point-to-point wireless network can be very beneficial for both lecturers and students although costs could be higher than EEC because of the bigger distances.

E-Health: This has become a very important area within government and the department is putting in place e-health initiatives throughout the country. Any successful e-health initiative that addresses people in under-serviced areas is very important and must be replicated to other affected areas to alleviate the suffering of these communities. The e-health solution implemented by the ACTS clinic should be researched and replicated to other rural areas where distance to travel to man health facilities is an important factor.

BB4All: Although this project has benefited local communities, there are some issues that would need to be resolved first before it can be replicated to other areas. Providing license for the village operators who are not licensed currently would need addressing to enable sustainability and mobility.

Technology evolution has resulted in broadband prices dropping and competition is getting tighter. Survival will be based on innovation and price. The CSIR infrastructure seems expensive and this would force a village operator to increase prices to recover costs. Building a wireless network has become as simple as buying a wireless USB dongle and buying cheap data bundles and selling these at very cheap prices since there are little infrastructure costs.

6.6. Conclusion

The purpose of the research was to investigate how broadband was implemented in under-serviced areas to provide services like e-education, e-health and for local economic development and, to investigate benefits and challenges encountered and lessons offered for replication of these broadband projects to other under-serviced areas in the country. The purpose of this research was achieved through the demonstration provided by the data gathered in the four mini-case studies which showed how e-education, e-health, and local economic development was achieved, although to a minimal extent.

The findings from the four mini-case studies indicated how the objectives of the draft broadband and information policies were not reflective of what was happening in the four areas of study, and the research came up with recommendations through the lessons and implications that emerged from experiences learnt in the project implementation sites. Some of these policy issues were challenges and stumbling blocks towards the successful implementation of projects to underserviced study areas. Possible interventions by stakeholders involved in policy formulation were also suggested.

The research attempted to identify existing gaps in the broadband policy, and proposals were made on how the encountered challenges could be addressed to ensure that people in under-serviced areas can also enjoy access to government services like e-education and e-health, and to ensure development of local economies and establishment of the information society.

The research also answered the questions and sub-questions on how broadband and information society policies and strategies could be amended to support the development of under-serviced communities so that they also

participate in local economies by showing the utilisation of broadband to fast-track service delivery in e-health, e-education and to develop economies in under-serviced communities.

All the solutions implemented in the four areas of study were shown to be cost-effective, sustainable, and scalable although they benefited local communities in different ways. The solutions were also replicable although this was in different degrees and different cost factors were to be considered for such replication to be effective.

Although it was pointed out that there was no existing broadband and information society policies in the country, current government broadband strategies support the establishment of an information society in underserved communities although there were strengths and weaknesses in current policies and regulations on broadband in terms of e-education, e-health and local economic development.

6.7. Future Research

In South Africa, broadband and information society policies and strategies do not exist although there are government structures that have the creation of these important as their basic roles. The broadband policy was released for public comment only in April 2013, and there was no evidence of feedback from the public.

Further research would therefore be required to validate the relevancy of this policy more especially after the broadband spectrum has been allocated and licensed. More research that would be beneficial to communities' located in under-serviced areas would need to be conducted to measure the growth of information society in these areas, more especially now that prices on broadband are reducing as more network operators are challenged by

Telkom’s involvement in the broadband space. As prices go down, more innovative technologies will come up leading to more research in this space.

Another important point for further research is how to ensure security of information in these community networks implemented in under-serviced areas. Most communities in these areas are not aware of Cybersecurity threats and future research needs to address this important aspect to protect vulnerable communities. The last area of research is the emergence of next generation networks (NGN) and the impact they have in under-serviced areas.

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Appendix A

Interview Requirements for CSIR Management, Employees and Village Operators (VOs) for BB4All Project Implementation

A. Scenario definition

A mesh broadband network connects the VO's to the main backbone at CSIR and enables students located in the satellite campuses to listen to and interact with specialised lecturers at the main campus in real time by usage digital video conferencing.

Staff in both campuses (main and satellite) are able to communicate cheaply to share knowledge and skills by utilizing e-mail, data transfers and Voice over Internet Protocol (VoIP).

Request for Available Documentation and Referrals

Public and private project documents, e.g. annual reports, strategy documents, IT documents, photos, website. Contact details of other project stakeholders, e.g. managers / employees / students for more information.

B. Case Study Requirements

Impact:

1. What has the impact of the mobile broadband project (BB4All Project) been on the teaching and learning culture, business and the environment?
2. What value is the mobility of technology to teachers, students and communities?
3. How does the BB4All Project improve the quality of services?
4. Some reasons for VO's to be limited and unable to provide services to government departments- (provide BB4All services to other clients either than schools)?
5. What limits them to provide wireless connectivity by making their offices "HOTSPOTS" and ensure Customer mobility? Licenses?

Community involvement and participation:

1. How have the ideas of communities (VOs), teachers, and learners been captured and implemented?
2. Did their participation enhance or destabilise project objectives of improved educational access through mobility?

Student and community readiness, training and evaluation:

1. What preparation was needed for adoption of mobile broadband?
2. What was the lead time before the village communities could utilise the project outcomes effectively (assess effectiveness of training)?
3. What is needed to replicate this project across other villages or in other provinces?

Monitoring and evaluation/outcomes mapping:

1. What is the progress of the project since implementation?
2. Were the project outcomes according to requirements and how was this verified?
3. What are the satisfaction levels of teachers, students, and management with the project?
4. Estimates of total cost and total savings for the college and its student community?
5. Comment on project benefits versus costs?
6. Any other benefits?

Policy issues:

1. In what ways has current broadband policy helped or hindered project (value to project)?
2. What policy improvements can assist in replication of similar projects?

Appendix B

Questions for Neil (Independent Consultant) and Marlien (Project Coordinator)

VISION for VO

To be "the ICT Service Provider of choice for schools, businesses, government institutions, NGO's and individual households in the areas" of operation.

1. Has the above VISION been achieved, and if not, what could be done differently to ensure its achievement?
2. Some reasons for VO's to be limited and unable to provide services to government departments- (provide BB4All services to other clients either than schools)?
3. What limits them to provide wireless connectivity by making their offices "HOTSPOTS" and ensure Customer mobility? Licenses?
4. Is the VO Internet considered affordable by customers? By schools? Compared to other ISP's (8ita)?
5. Any thoughts of increasing the VO services to include Internet Radio services to their communities?
6. How is sustainability of VO's going to be achieved on closure of BB4All project (its commercialization)?
7. Access possibilities to the BB4All IT Management System (SNOW) & to the ITSM tool for RAW data?
8. Any available Legal and regulatory support documents? (Policy Gentlemen?)
9. Has the objective of the MESH network implementation been reached fully? Is it doing what it was aimed to do?
10. What are the network effects of Point2Point/Mesh networks on the communities where the projects have been implemented [network effects

on identity & role of tokens/artefacts, AND how they influence other actors INSIDE the network]

Artefacts=P2P/Mesh wireless networks;

Actor Networks=VO's/EEC/Students/Communities

11. Would the 'formation of alliances & interactions' between actors involved in the project be considered to have become ***Strong & Stabilised?***

12. ***Has There Been Any Fluidity, Messiness*** in practices and UNPREDICTABLITY stages during the implementation of the projects?
13. How has the project progressed in its built and became sedimented and institutionalized within everyday practice of the involved actors?
14. How have the implemented projects become reference points (focal points) from government and the private sectors? (TOKEN=the tablet or MESH N/W aimed at achieving a certain objectives but changes from being viewed simplistically to being viewed as an object of desire & prestige & envy – Latour 1992)?
15. The 4 moments of translation that describe the interactions & relationships within a stable/failed actor network, that constitute the different phases of translation during which the identity of actors, the possibility of interactions and the margins of maneuver are negotiated and delimited, (Callon,1986b, and Latour, 1992). How did the 4 moments, noted below, translate themselves in the project implementations?

Problematization [to consider the concrete or existential elements of those involved as challenges (problems) that invite the people involved to transform those situations - Wiki.]

Enrolment

Interessement [interposition] (to strengthen the association between actors)

Mobilization

16. The network effects do not necessarily happen because of a specific intentionality. What events/activities that were unplanned for, that were unintentional occurred during implementation of the projects?
17. Modularity - Reducing dependencies on donors is a common aim for ICT4D initiatives. ICT4D projects should aim to establish entities that are well networked in the local context, with many loosely linked connections, but do not depend on other entities for their survival. The question needs to be asked: who are we dependent on and how will we survive if they fail?

Living Labs are systemic initiatives, which focus on creating multi-stakeholder collaboration between government, academia, business and citizens/users in different stages of the research, development and innovation (RDI) process. The concept refers to a research and development methodology where innovations such as services, products and application enhancements are created and validated in collaborative, multi-contextual empirical real-world settings (Eriksson, Niitamo & Kulkki, 2005). The focus is on empowering users to become active partners in RDI processes rather than passive recipients (Ngcobo & Herselman, 2007).

Several concepts have been reflected upon, resilience/ efficiency trade-off being one of them that is particularly important as it focuses attention on the common driving force experienced by ICT4D projects to find a unique, most cost-efficient or “sustainable” model, instead of exploring and establishing a diversity of models that would increase long term resilience.

An analysis of the factors influencing the sustainability of ICT4D projects within a resilience thinking framework would be useful in highlighting the systems dynamic aspects of ICT4D projects.