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UNIVERSITY OF THE WITWATERSRAND

WITS SCHOOL OF LANGUAGE LITERATURE AND MEDIA

RESEARCH REPORT

INVESTMENT IN BROADBAND AND THE EMERGING MARKET STRUCTURE IN SOUTH AFRICA

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A research report submitted to the Wits School of Language Literature And Media, in partial fulfilment of the requirements for the degree of Master of Arts in the field of ICT Policy and Regulation.

Johannesburg, October 2014

DECLARATION

I declare that the report is my own unaided work. It is submitted in partial fulfilment of the requirements of the degree of Master of Arts in the field of Information and Communications Technology 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.

…….

Milingoni Lloyd Fulufhelo Nedohe

31 October 2013

ACKNOWLEDGEMENTS

I would like to acknowledge the guiding chides of my Supervisor Ms Luci Abrahams. Your patience and firm hand made me dig deeper each time I thought I had scaled the highest peaks. I will remember your voice and laughter for a long time. Lunch still stands.

I would be remiss if I do not acknowledge the Guardian Angels, my leading ladies and support through a life less ordinary. Dr Snowy Khoza, and Ms Regina Farisani. Many thanks for the countless prayers and support at all times. You are blessings.

To my kids, it may not have been perfect, yet in your small ways you make each day an experience worth a life.

ABSTRACT

This research study investigates the investments that have been made in broadband infrastructure in South Africa, with special focus on the impact on the broadband market made by ECA 2005 and subsequently the Altech judgement of 2008 (which unblocked infrastructure investment bottlenecks by ruling that Value Added Network Services (VANS) licensees were entitled to ECNS licences to build their own build infrastructure).

The Altech judgment was a defining development of the South African telecoms sector, as it sounded the death knell to the dependence by VANS and other firms on wholesale infrastructure from the incumbent Telkom. The judgement, based on provisions of the ECA, was followed by heightened investment as firms, both MNOs and VANS, stepped up investment in self-provisioning infrastructure, thereby creating a period of intense facilities-based competition. The post-ECA and Altech judgement period coincided with the significant global market shift of fixed-to-mobile substitution, thereby dictating that the market structure that emerged in South Africa would be tilted towards the growth of mobile telephony, the latter becoming the foundation of mobile broadband through the emergence of next generation technologies of the smartphones and 3G and LTE.

Through application of interpretive methods and qualitative analysis of published data and interviews with sector experts, research observations confirm that firms have lapped up the self-provision benefits of the post-2005 licencing regime and developed significant supply-side vertical capacities that have led to infrastructure duplications and competing network externalities. The resultant market structure appeared inefficient, with a high degree of concentration and equally high barriers to entry. This research used the investment calculus by Bauer (2010) as the applied method of analysis in order to develop a systematic analysis of investment decisions and firm behaviour. Due to significant capital outlays and expectations of return on investment (ROI) by firms competing in the broadband market, it follows that they have entrenched a rigid, costly wholesale interconnection market that has been immensely profitable for the firms, but has not passed benefits to new entrants and consumers. Whilst supply-side firms have refined capital investment strategies through application of real options, the subsequent market structure has been made less competitive due to inefficient regulatory interventions by ICASA, and the slow implementation of recommendations of SA Connect, the national broadband policy, leading to market inefficiencies and a widening digital divide.

DEDICATION

This research is dedicated to the memory of my grandparents, Ms Matilda Mukatoni Nedohe and Mr Marcus Tovhowani Nedohe, and my parents Ms Lillian Mbulawa Nedohe and Mr Edward Matodzi Nedohe.

Your voices remain an indelible inspiration.

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LIST OF ABBREVIATIONS

ADSL	Asymmetric digital subscriber line A
ATC	American Tower Company
BBM	Blackberry messenger
BEE	Black Economic Empowerment
CAGR	Compund annual growth
CAPEX	Capital expenditures
Contralesa	Congress of traditional leaders of South Africa
CoT	City of Tshwane
CSIR	Council for Scientific and Industrial Research
DAS	Distributed antenna systems
DBSA	Development Bank of Southern Africa
DFA	Dark Fibre Africa
DFIs	Development finance institutions
DoC	Department of Communications
ECA	Electronic Communications Act 36 of 2005
ECNS	Electronic communication network services
ECS	Electronic communcation services
ENPV	Expanded net present value
FMC	Fixed-mobile convergence
FTTH	Fibre-to-the-home
FTTX	Fibre-to-the-exchange
GSM	Global System for Mobile Communications
GSMA	Groupe Speciale Mobile Association
HD	High definition
HHI	Herfindahl-Hirschman Index
HSPA	High Speed Packet Access
ICASA	Independent Communications Authority of South Africa
ICT	Information communication technologies
IDC	Industrial Development Corporation
IDP	Integrated Development Plan
ISAD	Information and Society and Development Plan
ISPs	Internet Service Providers
ITU	International Telecommunication Union

JSE	Johannesburg Stock Exchange
LAN	Local area network
LLU	Local loop unbundling
LTE	Long term evolution
MNO	Mobile network operator
MTN	Mobile Telecommunications Network
MTRs	Mobile termination rates
NBAC	National Broadband Advisory Council
NDP	National Development Plan
NLDs	National long distance services
NPV	Net Present Value
OECD	Organisation for Economic Cooperation and Development
OPEX	Operational expenses
OTT	Over-the-top services
PAJA	Promotion of Administrative Justice Act 3
PGDS	Provincial Growth and Development Strategy
PIC	Public Investment Corporation
PNC	Presidential National Commission
POPI	Protection of Personal Information Act, 2013
PPP	Public-private-partnership
PSP	Private sector participation
QoS	Quality of service
RAN	Radio access networks
REMGRO	Rembrandt Group
ROI	Return on investment
SANReN	South African National Research Network
SARB	South African Reserve Bank
SENPV	Social expanded net present value
SME	Small and medium enterprises
SMP	Significant market power
SNO	Second Network Operator
SSA	Sub-Saharan Africa
UASSA	Universal Service and Access Agency of South Africa
USO	Universal service obligations

VANS	Value added network services
VOIP	Voice over internet protocol
WACS	West African Cable Systems
WAN	Wide area networks
WTO	World Trade Organisation
ZAR	South African Rand

CHAPTER 1: THE BROADBAND INVESTMENT CONTEXT IN SOUTH AFRICA

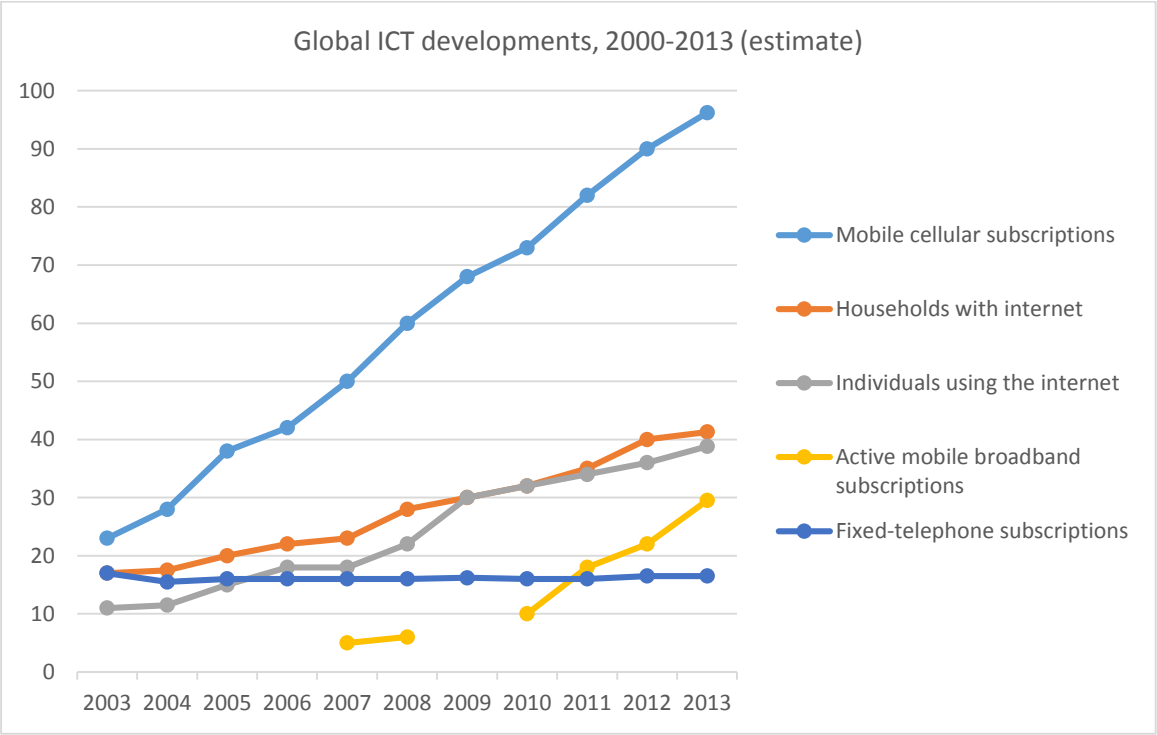
This chapter provides an overview of investment in South Africa's telecoms sector, with specific interest in broadband. It sketches the context of self-provision as a direct result of the Altech ruling.

1.1. Africa catches fever from the global rise of mobile telephony

Investment in South Africa's ICT sector has reflected global trends, where large capital outlays over the last decade have been made towards infrastructure that would support the mobile telephone explosion and rising demand for data. Firms have made huge investments into mobile networks and related technologies to ensure they each possess tools of competitive necessity in the growing market place for broadband.

While global growth in mobile-cellular penetration is flattening, reaching 96 per cent by end 2013, mobile broadband continues to grow strongly, on average by around 40 per cent annually between 2010 and 2013 (ITU, 2013), thereby confirming the rise of broadband as the new area of investment focus and major commercial competition in all elements of the broadband value chain.

Figure 1: Global ICT developments (2000-2013)

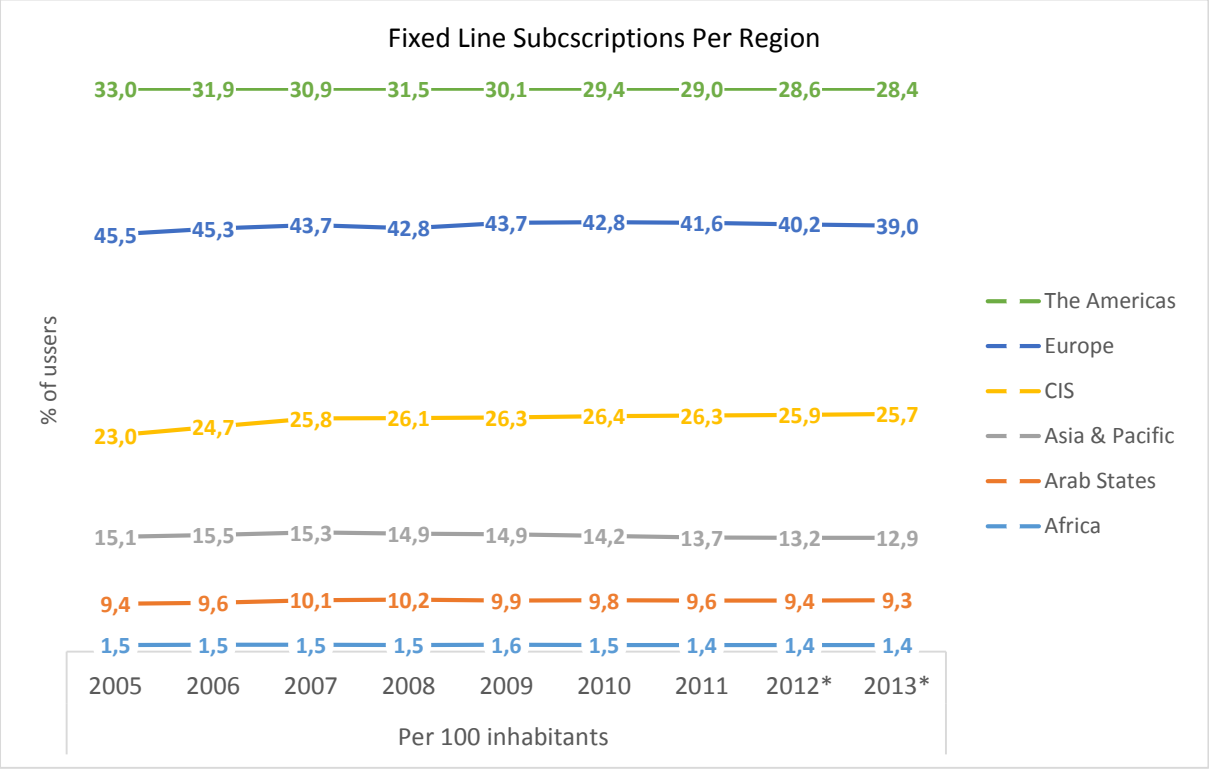


Source: ITU (2013)

Fig. 1 shows the rise in households with Internet and individuals using the Internet positively linked with the phenomenal rise to saturation levels of mobile global telephony; in contrast to the stagnated

use of fixed telephony. Africa has caught up with fixed-to-mobile substitution; with the trend in the past few years showing a consistently flat growth of the PSTN. The Organisation for Economic Co-operation and Development (OECD) and the Americas alongside Asia appeared to have found the balance, while Africa's growth of fixed line telephony having little upsurge over a period that saw massive spikes in mobile.

Figure 2: Africa's decaying use of fixed telephony



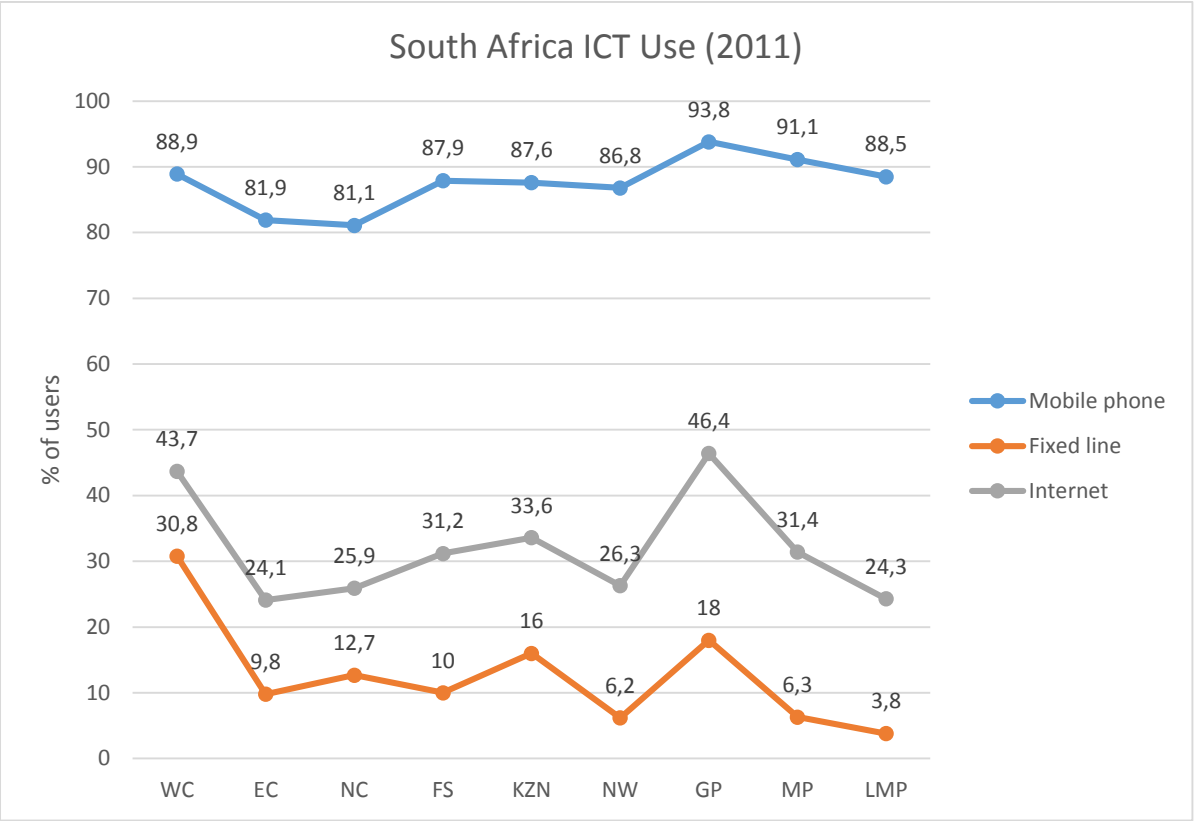
Source: ITU Indicators 2013/*estimate

The explosion of mobile telephony has made Sub-Saharan Africa (SSA) "the fastest-growing region in the world for mobile phone users in the past five years, with mobile subscribers having increased 18% a year for the past five years to total 253 million as of June 2013" (Wall Street Journal, 2013). Africa is in the midst of a technological revolution, and nothing illustrates that fact than the proliferation of mobile phones; with more Africans (having) access to mobile phones than to clean drinking water" (Hutton, 2011). Fixed lines continued to decline in the period 2005-2013, supplanted by mobile telephony; though internet use shows low figures of access and use.

The mobile telecommunications explosion has also been evident in the make-up of the use of ICT services in South Africa, where the use of mobile services has reached near saturation levels. Fig. 3 shows that whilst mobile telephony has grown significantly in South Africa, along with global patterns, to almost full coverage of the population, the levels of Internet use is not even half the number of cellular phone use across the provinces of the country. Internet use is invariably high amongst the

provinces with most densely populated cities like the Western Cape, Gauteng Province and Kwazulu-Natal, whilst Limpopo and rural provinces of Eastern Cape and Mpumalanga appear to lag behind in general use of ICTs.

Figure 3: South Africa's mobile explosion



Source: Stats SA (2011)

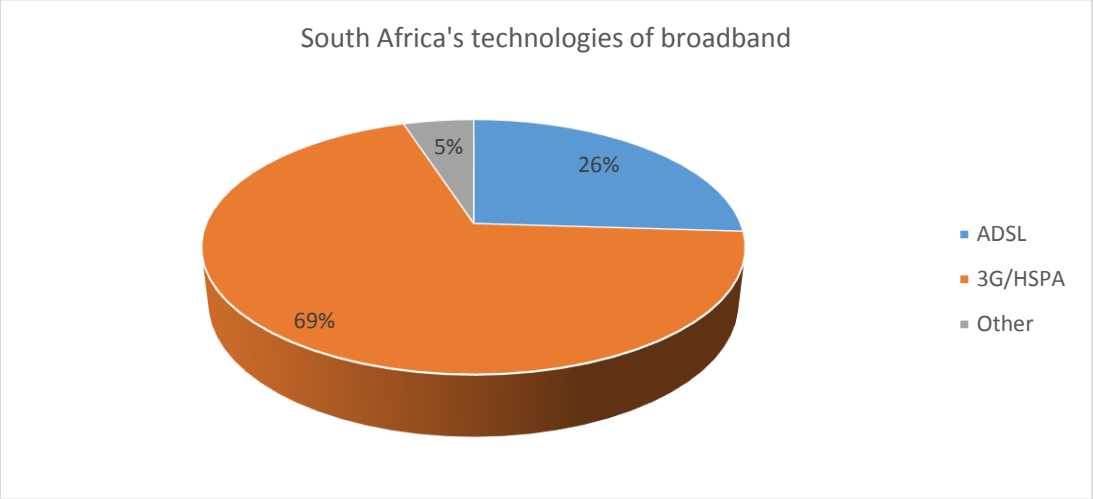
Though boasting some of the highest penetration levels of mobile telephony, Limpopo, the Eastern Cape and Mpumalanga have negligible access to Internet. These patterns could be attributed to the levels of investment that have occurred in Gauteng, Western Cape and to some extent KZN, where mobile penetration shows remarkable percentages of diffusion.

The rise in mobile telephony has been accompanied by a rise in mobile data consumption, with "the number of broadband subscriptions growing from 3, 6-million at the end of 2010, to 8, 2-million by the end of 2012, representing a 128% growth" (Word Wide Worx, 2012); with the growth attributed to reduced data costs, accelerated investments for network rollouts and the increasing consumer use of smartphones.

According to the DoC (2012) the use of these technologies was set to increase between 2011-2016, with ADSL gaining CAGR of 7%, 3G/HSPA 17 % and other technologies scaling 8% CAGR. In South Africa,

broadband is provided through many technologies including , fibre (FTTx), 3G/HSPA and other access technologies like WiMax, Wi-Fi, CDMA2000EV-DO and satellite (DoC, 2012).

Figure 4: South Africa's use of broadband technologies



Source: DoC (2012)

The increase in the deployment of 3G, 4G and LTE- enabled mobile networks has led to a rise in the combined penetration of mobile broadband-compatible devices, including handsets, with mobile broadband subscriptions growing as a proportion of total Internet users (Internet Society, 2014).

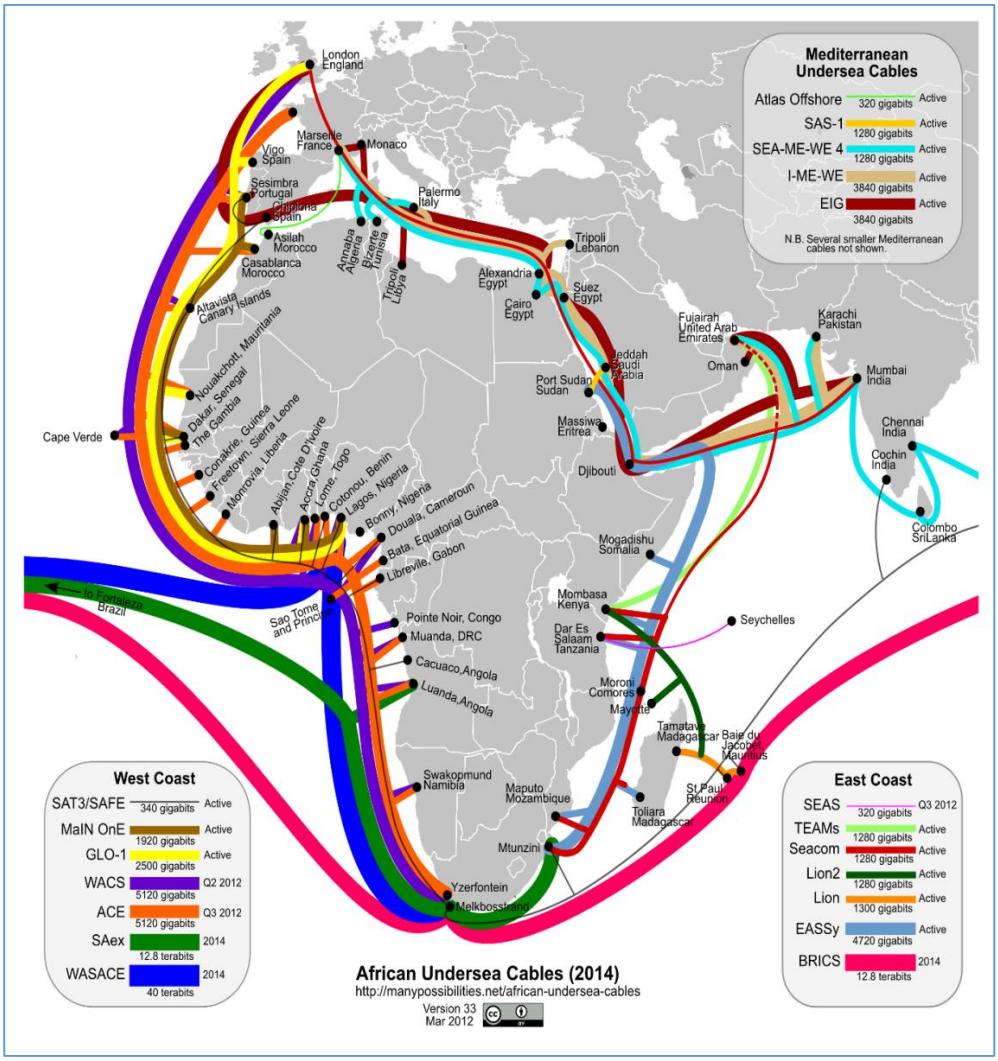
1.2. Investment in networks post-ECA 2005 liberalisation

Investment in broadband infrastructure spurred up after liberalisation of the sector and subsequent to the licence regime of the Electronic Communications Act 36 of 2005 (ECA), specifically the Electronic Communications Network Service (ECNS) - which allowed the holder to roll-out and operate a physical network (radio equipment or fibre networks). MNOs immediately increased their capital expenditures for self-provision to reduce their reliance on Telkom infrastructure. Due to the protracted delays by the regulator in implementing the licence conversions that would allow all firms with ECNS to invest, VANS launched court challenges against the state, with the Altech judgment providing the clearest interpretation of the ECA 2005.

Buoyed by the ECA 2005 and the Altech court decision, value-added network service(VANS) and MNOs made multibillion rand investments in backhaul facilities like international undersea cables, terrestrial and access infrastructure like fibre optic cables and radio access, thereby improving operational and competitive efficiencies that would see firms developing vertical capacities. Vertical integration is the organization of successive production processes within a single firm (Riordan, 1990), thus vertical integration brings upstream and downstream assets and production under unified ownership and control (Riordan, 2005).

Fig. 5 shows the landing of many undersea cables on the coast of South Africa, which occurred after the ECA 2005 and the 2008 Altech judgement released pent-up investment by both mobile and fixed operators , as they sought to roll out their own telecoms networks instead of being forced to buy wholesale access from the incumbent operators) (Anderson, 2008).

Figure 5: Broadband undersea cables on the African continent



Source: (Song, 2013)

The judgement provided firms with an opportunity to gain scale through investments in their own the Telecommunication Act of 1996, in terms of which (RSA, 1996) :

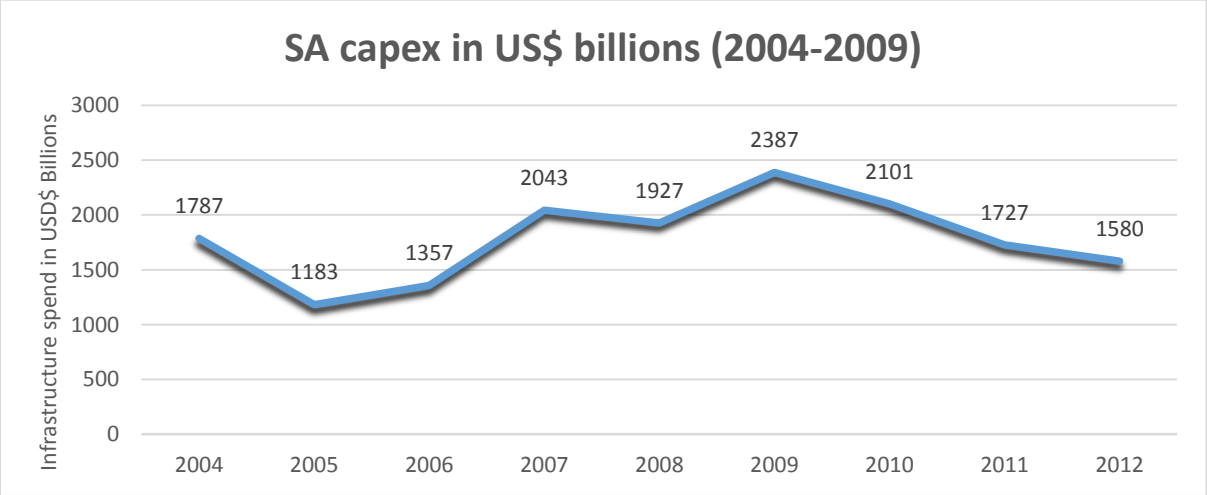
> 40. (1) (a) Telkom shall be deemed to be the holder of a licence to provide, subject to subsection (3), the value-added network services provided by it immediately before the date of commencement of this Act: Provided that as at the date of commencement of this Act Telkom shall be deemed to have applied to the Minister for a licence in terms of this Act in respect of each such service, and the Minister shall, after the provisions of section 36(6), (7), (8) and (9) have been complied with, in relation to the terms and conditions of the licence, grant the application and issue such licence to Telkom with a period of validity of 25 years from the date of commencement of this Act.

In terms of the judgement:

> ***10.5*** It is declared that the Applicant was entitled to self-provide its own telecommunications facilities with effect from 1 February 2005.
>
> ***10.6***. It is declared that clause 1.1(b) of the value added network services licence issued to the Applicant by the Second Respondent on 18 August 2005 to the extent that it purports to deprive the Applicant of its entitlement to self-provide telecommunications facilities is of no force and effect.

Self-provisioning is described as "the procurement of any telecommunication facilities by the licensee from any supplier of telecommunications facilities and to use them under and in accordance with this licence to provide the telecommunication service" (Ellipsis Regulatory Solutions, 2011). The simple consequence of this ruling was that every VANS licence holder now had the right to build their own network, and Vans operators now have their legal foot in the door after a central regulatory barrier crumbled like the Berlin wall (Esselaar, 2008).

Figure 6: SA Telecoms CAPEX 2004-2009



Source: ITU (2013)

Fig. 6 illustrates increased investor sentiment after 2005 and 2008 respectively. The largest outlays in the period just after Altech (2008-2009) could be attributed to Vodacom's purchase of Gateway Communications, a pan-African satellite communications operator for $700 million, which will be discussed in Chapter 4.

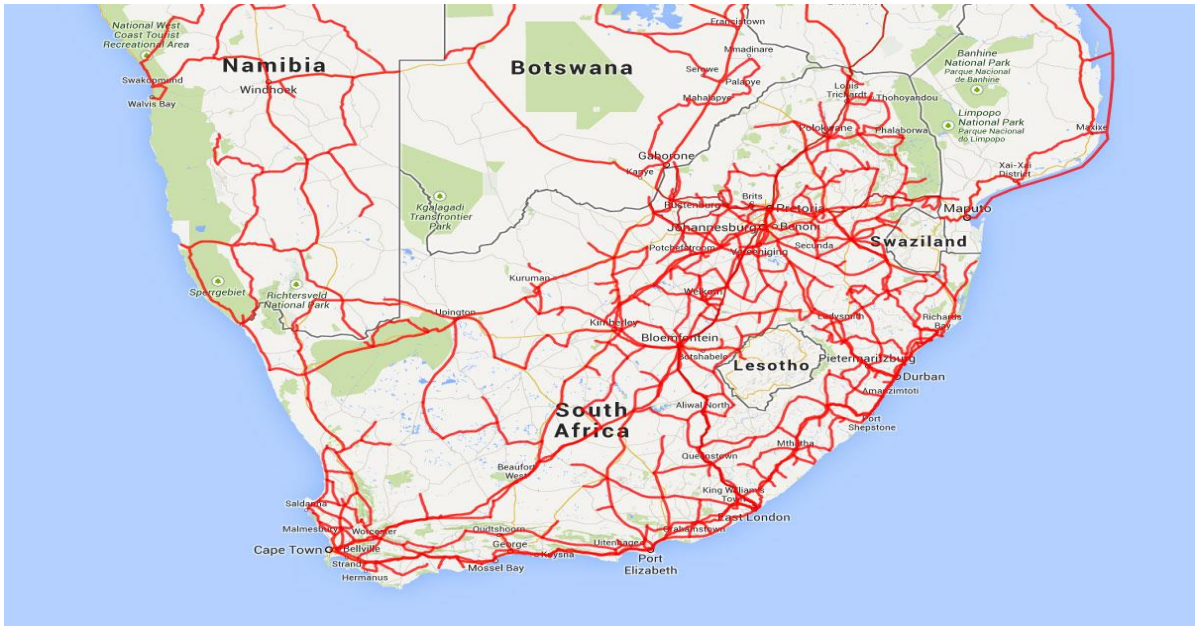
1.3. The broadband market structure and historical legacies

1.3.1. Telkom's dominance of the wholesale market as a context for SA market structure

The wholesale market structure of telecommunications in South Africa is derived to a large extent on the historical significant market power that Telkom had as a state-owned monopoly for both voice and data, and specifically Telkom's domination of the wholesale market serving independent service providers. Telkom also had tight control of access to international data bandwidth and relatively high

prices were charged to VANS providers for access to this bandwidth, despite the intention of the policy and law to include regulation of these wholesale prices (Gillwald, 2005, p. 478).

Figure 7: South Africa's fibre networks



Source: Mybroadband (2014)

Telkom has the largest national fibre network, offering connectivity to most areas in the country. Other national fibre players include Neotel, Broadband Infraco, Fibreco, DFA, SANReN, Vodacom and MTN (MyBroadband, 2014). The wholesale market is thus less efficient, as it is " structured around a vertically integrated national operator from whom rival firms are required to acquire their non-competitive facilities in order to operate and with whom other networks have to interconnect in order to access historically larger number of subscribers on the incumbent's network" (Gillwald, 2003). This created a monopoly and high entry barriers and a market structure that was far from being cost-effective.

> Telkom's VANS market dominance and its ability to undermine the profitability of the other players in this segment—through denying them access to international bandwidth and over- charging for the bandwidth they do provide—have been the source of several of the complaints that have tied up ICASA, the Competition Commission and the courts (Gillwald, 2005, p. 478).

The observations above imply that the wholesale market structure was less efficient and was open to massive dominance and anti-competitive tendencies by the incumbent or those with market power. Market power occurs when an industry participant can unilaterally set and maintain prices and other commercial terms (ITU, 2009, p. 5).

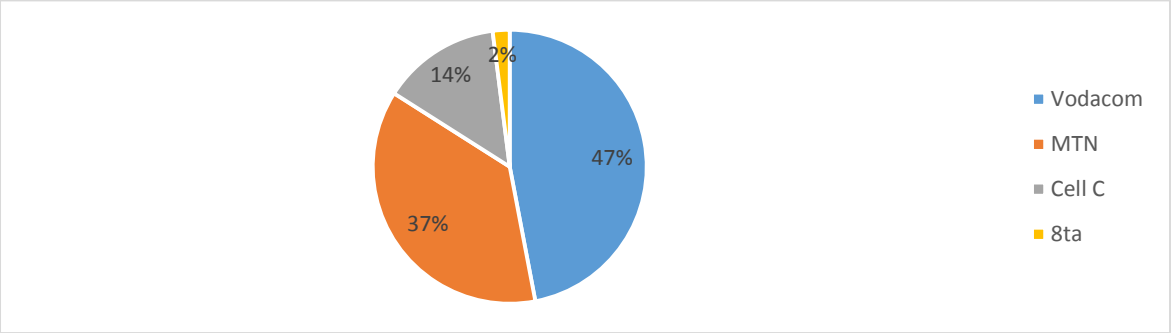
1.3.2. Defining the broadband market structure

According to ICASA "the objective of market definition is to identify those entities which constitute actual or potential competitors which are capable of constraining any other entity's behaviour and effectively preventing them from conducting themselves independently of their competitors and their customers" (ICASA, 2007). ICASA therefore believes that the market has a high propensity of becoming uncompetitive; specifically with all firms embracing and utilising their new found freedom to invest in their own respective infrastructure capacities.

Despite ECA provisions of open access and infrastructure sharing; most firms have network infrastructure that is not available on open access and new entrants face high barriers in their quest to compete. According to Esselaar (2008) "barriers to entry include the substantial costs of building a network were estimated at between R300-million to R1-billion depending on the size of the network". The mobile industry in South Africa is a good example, where " high initial costs in the mobile industry often mean that firms only become profitable after 6-8 years" (Theron & Boshoff, 2010, p. 2).

In the case of South Africa, the "telecoms market continues to reflect a market with a number of vertically integrated operators with two very strong incumbent mobile operators and a fixed line incumbent operator" (DoC, 2013). The significant capital expenditures by MTN and Vodacom make them dominate the market in the country, commanding a share of 37% and 47% respectively; with the smaller and late entrants Cell C at 14% and Telkom's 8ta at just 2% (Deloitte, 2013). According to the Department of Communications (2013) "the level of fair competition which is expected to contribute to stimulating further reduction in prices is slow and radical policy and regulatory interventions are needed".

Figure 8: The MNOs market share



Source: Deloitte (2013)

By using the Herfindahl-Hirschman Index (HHI), the market structure of MNOs in Fig 8 showed an HHI of 3778. A value of 1000 to 1800 indicates moderate concentration, while a value higher than 1800 is regarded as a concentrated industry (Mohr & Fourie, 2004, p. 277). According to Mohr et al (2004,

p.274), economists use concentration measures to quantify the extent to which a market is dominated by a small number of large firms. The HHI and its significance in understanding the emerging market structure in South Africa will be explained further in Chapter 2.

1.4. Consumer markets and access do not reflect the massive investments

South Africa's National Development Plan has " referenced high pricing as a major economic stumbling block to economic growth, innovation and job creation" (DoC, 2013), and uneven, high broadband prices as creating bottlenecks to the diffusion of internet amongst the majority of the population. Whilst the use of smartphones has increased adoption of mobile broadband, revenues of firms are predominantly supported by the middle to high income groups who are able to pay high costs of data and devices, whilst a high percentage of the population have been " excluded from the Knowledge economy due to the high cost of the ICT services/prices" (DoC, 2013).

In launching South Africa's National Broadband Policy, the Minister of Communications Yunus Carim noted that:

> "…..the slow deployment of fixed broadband service (ADSL) and its relatively high cost has meant that over the last five years mobile broadband rapidly became the primary source of broadband access rather than providing a complementary service as it has done in mature economies." (RSA, 2013)

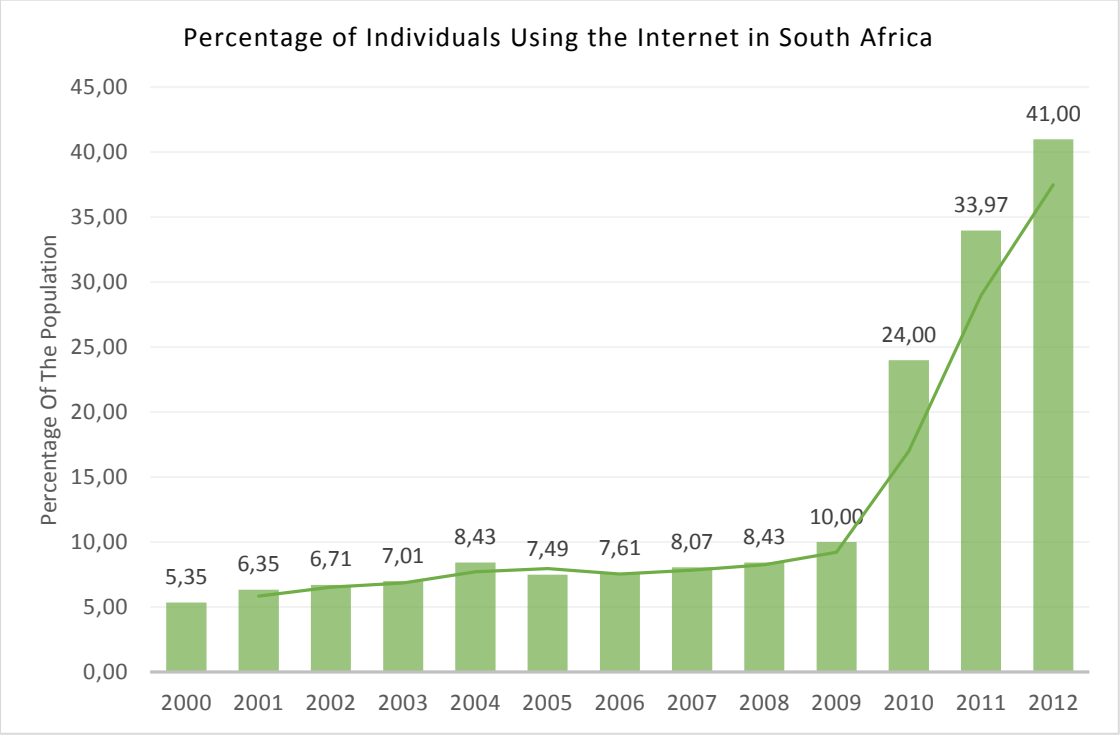
Table 1 : A sample of firms shows high broadband prices

Service Provider	Device	Peak Data GB	Off-Peak Data GB	Price	Minimum price per GB	Peak price per GB
Neotel	Neotel MiFi	100	0	R 2 299	R 23	R 23
8ta	No device	60	60	R 1 800	R 15	R 30
Cell C	No device	50	150	R 1 799	R 9	R 36
Neotel	Neotel MiFi	36	0	R 1 699	R 47	R 47
Cell C	No device	24	0	R 1 299	R 54	R 54
Vodacom	No device	24	0	R 1 499	R 62	R 62

Source: (MyBroadband, 2012)

South Africa has the significant market ambivalence of high levels of investment in the telecoms market, and dismal use of internet in the country, with penetration levels still at starkly low levels, though there is some increase in diffusion post the ECA 2005 and notably in the period after the Altech judgement of 2008.

Figure 9: Exponential increase of Internet usage in SA



Source: ITU (2012)

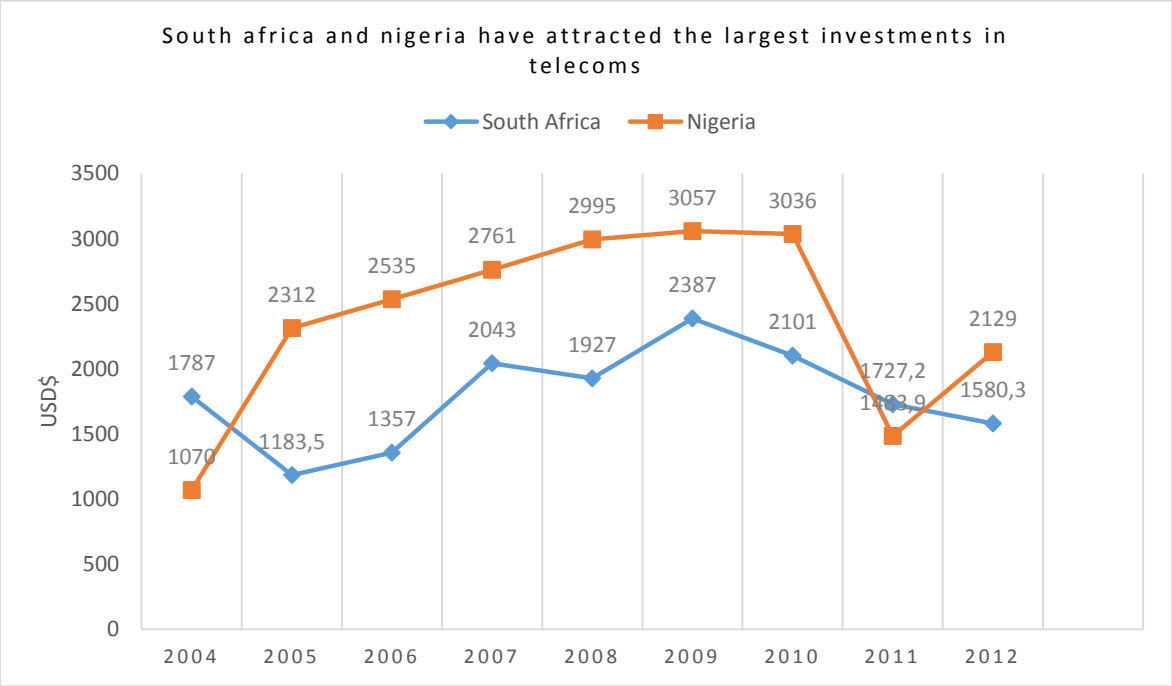
Policy makers and regulators have noted the less competitive market structure of broadband in South Africa, and have called for interventions that seek to correct the skewed imbalances of big networks and little diffusion, which could also present risk to the economic viability of the sector and the broader economy of the country. According to Noam (Noam, 2006, p. 279) ,network industries have become volatile; attributed to "very high fixed costs, very low marginal costs, inelastic demand, lags in supply, network externalities and technological uncertainties, all which encourage firms to gain economies of scale on the supply and demand side", leading to a "pattern of boom, overcapacity, price war, bust and shakeout".

1.5. Policies and regulatory influences on the market structure

1.5.1. Policies shape the market structure

In Africa, Nigeria and South Africa are the two largest markets and they account for circa 36% of the total cumulative telecoms investment , in line with relative population size and spending power of regions where " the regulatory environment has proposed competitive behaviour in the telecoms industry and benefited most from investment" (Futter, 2011, p. 26).

Figure 10: Competition drives investment spend for SA and Nigeria

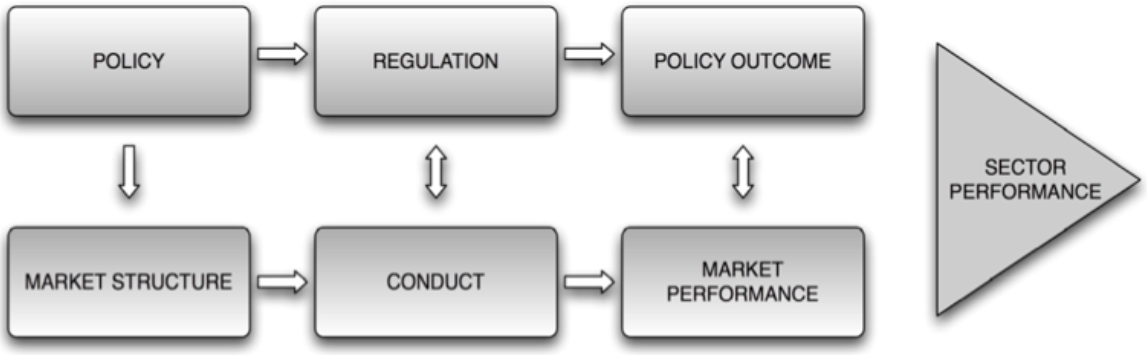


Source: The World Bank (2014)

In South Africa, the development of policies for the ICT sector was bedevilled by various factors that appeared to have had the opposite effect to the expected policy outcomes. Whilst policy appears to have nurtured the growth and adoption of mobile voice telephony, the use of internet, both fixed and mobile has remained lamentable. The 2011 Census results show that 64.8% of households do not have access to the Internet, and that the bulk of those with access rely on cell phones (Mawson, 2013).

With almost two-thirds of the population excluded from the internet and the benefits of converged services, it is an enormous opportunity cost to economic growth and can be attributed to the failed attempts at developing meaningful broadband polices and regulation with clear guidelines on both public (government) and private investment in infrastructure. Policies determine the market structure; and regulation- the competitive environment; both with the intended purpose to develop the market and sector competitiveness.

Figure 11: Policy and regulation linkages



Source: (Gillwald, 2009)

The prevailing market structure in South Africa therefore reflects two items that are key to this study: (1) the *inefficient market structure* for broadband that has emerged from (2) *inefficient policy and regulation.* If the market fails to meet the universal service objective on its own or there is reason to believe it will, the government intervenes through regulation or funding (Wellenius, 2000, p. 2)

In South Africa some of the policies that had an influence on the market structure include: The White Paper on Telecommunications Policy (1996), The Telecommunications Act, ECA (2005), The ISAD Plan 2006, The Draft Broadband Plan 2010 and SA Connect: SA's National Broadband Plan 2013.

1.5.2. The Telecommunications Act 103 of 1994

The stated objectives of the Telecommunications Act of 1994 were to develop "regulation of telecommunication activities other than broadcasting, and for the control of the radio frequency spectrum; and for that purpose to establish an independent South African Telecommunications Regulatory Authority and a Universal Service Agency" (RSA, 1996).

These objectives were going to be enforced by various provisions , including 42(a), which stated that "a private telecommunication network shall not be provided by means of telecommunication facilities other than facilities made available by Telkom or any other person providing a public switched telecommunication network" (RSA, 1996).

Some of the purposes essential for this study, were, according to the Act, to:

- promote the universal and affordable provision of telecommunication services
- make progress towards the universal provision of telecommunication services;
- encourage investment and innovation in the telecommunications industry;
- encourage the development of a competitive and effective telecommunications manufacturing and supply sector;
- Ensure fair competition within the telecommunications industry.

1.5.3. The Telecommunications Act 103 of 1996 and the White Paper on Telecommunications Policy

The White Paper on Telecommunications Policy was presented as an attempt at social redress by the country's first post-apartheid Minister of Posts, Telecommunications and Broadcasting Pallo Jordan with the help of eminent professionals from both within RSA and the international community, and after consultation with various stakeholders.

Table 2: White Paper on Telecommunications

Strategic Pillar	Policy Recommendation
Social redress	▪ Targets the deprived masses in the rural and urban areas (social goals), ▪ delivering "a high level services capable of meeting the needs of a growing South African economy" ▪ private sector investment encouraged
Network Connectivity	▪ High-quality network providing value-add services and access to the international information highway; link its economy into the global system.
Investment/ownership	▪ Ruling party alliances in favour of state ownership
Market structure	▪ Accelerated sector development, exclusivity for Telkom
Open access	▪ integrated high-quality network providing value-add services and access to the international information highway is required to support internationally competitive industries

Source: Adapted from the White Paper on Telecommunications (RSA, 1996)

As if portentous of the future, the Minister acknowledged that "changes in technology, trade liberalisation and globalisation were moving so rapidly it was becoming difficult to predict their implications on policy" (RSA, 1996).

1.5.4. The Electronic Communications Act 36 of 2005 (the ECA)

The ECA is " convergence legislation which attempts to take into account the blurring between broadcasting and telecommunications, and can be characterised as pro-competitive legislation in stark contrast to the preceding Telecommunications Act which was protectionist and sought to protect the incumbent fixed line provider from the effects of competition" (Ellipsis Regulatory Solutions, 2011).

The ECA 's service licencing framework regulates infrastructure rights (in the actual digging), spectrum allocations, universal service and access, also regulates competition, an item that will be essential in understanding the role of the regulator in creating space for investment. There are two chief

categories of service licences that we will focus on, as this resulted in the development of a new market structure. Ellipsis (2012) describes:

The Electronic Communications Network Service (ECNS) - which allows the holder to roll-out and operate a physical network (radio equipment/ and or fibre). Telkom and all mobile operators have the ECNS and have invested in fibre and other types of strategic infrastructure for competitiveness.

The Electronic Communication Services (ECS) - which allows for a holder to interconnect in order to provide certain services to its customers, or even invest in its own infrastructure.

In South Africa Telkom and mobile operators have both the ECNS and the ECS licenses; noting that they are both wholesale network operators and are also retailers that deal directly with the public. Several other Acts of Parliament have direct or indirect impact on the sector:

Some of the applicable laws are:

- *ICASA General License Fee Regulation of 2009*; which requires operators to make annual license fees of 1.5% of their annual gross profit.
- Operators pay a fee of 0.2% of their gross annual turnover to the Government's Universal Service and Access Fund (USAF), intended to fund the rolling out of infrastructure to the country's rural areas, mostly regarded as unprofitable by the operators.
- *ICASA Act of 2000* best known as the ICASA Act, which sets outs the parameters and powers of regulation used by ICASA .
- *The Film and Publications Act 65 of 1996*, which regulates ISP's and content deemed to be sexually offensive like child sex abuse content and pornography.
- *The Broad-Based Black Economic Empowerment Act (53/2003(BBBEE)* and its subsequent Amendments, which is meant to provide opportunities for native (South African historically disadvantaged individuals, primarily Black) and also create platforms for ownership in all sectors of the economy.
- *The Competition Act 89 of 1998 (the Competition Act),* which overlooks "investigation, control and evaluation of restrictive practices, abuse of dominant position, and mergers" (RSA, 1998).
- *The Electronic Communications and Transactions Act 25 of 2005*, regulating intermediaries like financial institutions and information conduits.

1.5.5. The Information Society and Development (ISAD) Plan of 2006

With support of the Presidential National Commission on Information Society and Development (PNC on ISAD) the Department of Communications developed a Medium Term Strategy Map in 2001 which identified the development and implementation of a Broadband strategy as a priority.

Table 3: Policy proposals of the ISAD Plan

Objective	Policy Recommendation
Strategic Goal 1	Enable the maximisation of investment in and through the ICT sector, prioritising in ICT broadband infrastructure.
Strategic Goal 2	Ensure that ICT infrastructure and services are available, reliable and affordable
Strategic Goal 5	Enhance the role of, and ensure proper oversight over ICT State owned entities as the delivery arms of Government ICT policies.
Policy and Regulatory Framework	Ensure a predictable, investor friendly, progressive and enabling policy and regulatory environment and strengthening the capacity of the regulator.
ICT infrastructure	Provide ubiquitous access to ICT infrastructure and services at affordable prices thus enabling participation in the economy and society

Source: Adapted from Department of Communications (2006)

1.5.6. The National Broadband Policy 2010

By 2010 the Department of Communications under Minister Siphiwe Nyanda had become exasperated with the free-for-all, uncoordinated patterns of investment. In an effort to stem the emerging duplication of infrastructure and network roll-outs by Government structures without the appropriate funding models and matched competencies, the Department ushered the National Broadband Policy of 2010. The policy proposed:

- "to create a uniform, integrated, homogeneous and coordinated Government approach on the roll-out of Broadband in South Africa, thus ensuring both optimal utilisation of resources and coordinated roll- out of infrastructure" (RSA, 2010).
- to "expand networks into these marginal areas as contemplated under Chapter 14 of the Electronic Communications Act. 36 of 2005.
- to regulate the high prices of broadband, stating that it has become evident in the South African market that the provision of Broadband services in certain areas is prohibitively costly.

1.5.7. SA Connect: South Africa's Broadband Policy

After much deliberations, public hearings and parliamentary and stakeholder input, the Department of Communications released the broadband policy, aptly named SA Connect. Whilst there are various facets of the Broadband Policy 2013, the following are poignant for this discussion (RSA, 2013).

Table 4: Policy recommendations of SA Connect and some interpretations

Strategic Pillar	Policy Recommendation
Social Redress	▪ Government shall play a critical role in the deployment of broadband backbone networks especially in rural and underserviced areas, which are regarded as not being commercially viable by operators
Investment	▪ Wholesale backbone network deployment by the public and private sector players. Policy to develop incentives to encourage investment in underserviced and rural areas
Access Regulation	▪ Wholesale networks onopen access and non-discriminatory principles to allow innovation and competition by service providers
ICASA	▪ Wholesale regulations to support service-based competition, final retail prices of broadband products and services charged to the consumers to be regulated.
Telkom	▪ Telkom will provide the bulk of the core backbone infrastructure. Telkom will be supported by other state-owned companies and the private sector.

Source: Adapted from the Broadband Policy (RSA, 2013)

The policy was passed under Minister Yunus Carim, a robust leader of the Department whose short spell was heralded by the sector as proactive and efficient in resolving long-standing issues of policy and sector viability.

Leadership issues had previously undermined the development of policies, with the Department of Communications having had the most active revolving door at political level.

Table 5: South Africa's Ministers of Communication

Minister	*From*	*to*	*President*
Piet Welgemoed *	1991	1994	FW de Klerk
Pallo Jordan #	1994	1996	Nelson Mandela
Jay Naidoo *	1996	1999	Nelson Mandela
Ivy Matsepe-Casaburri	1999	2009	Thabo Mbeki
Siphiwe Nyanda	2009	2010	Jacob Zuma
Roy Padayachee	2010	2011	Jacob Zuma
Dina Pule	2011	2012	Jacob Zuma
Yunus Carim	2013	2014	Jacob Zuma
Dr Siyabonga Cwele +	2014	-	Jacob Zuma

Source: Adapted from Sutherland (2014) *Posts, Telecommunications and Broadcasting # Posts and Telecommunications + Telecommunications and Postal Services

1.6. Regulatory bottlenecks to supply-side investment

1.6.1. Wholesale regulation and firms' ROI

The ECA regulates the industry through Chapter 7 (Obligation to connect) and Chapter 8 (Facilities leasing), whilst Chapter 10 (Competition Matters) is implemented aligned to the Competition Commission; thereby enhancing the ECA's vigilance and close regulation of the wholesale aspect of the networks' value chain.

Chapter 1 (ss 1-2) of The ECA Act ((RSA, 2009) describes “wholesale “as

> The sale, lease or otherwise making available an electronic communications network service or an electronic communications service by an electronic communications network service licensee or an electronic communications service licensee, to another licensee or person providing a service pursuant to a licence exemption

One of the biggest challenges when regulating wholesale services is setting prices at a level high enough to encourage those operators capable of investing in their own infrastructure to do so, while keeping them low enough to be attractive and economically feasible to those operators who need them (Roetter, 2014). Prices charged at both wholesale and retail are reflective of ROI expectations, and ISPs have been quick to point out the restrictive wholesale pricing that limited market competition.

In recent rulings after complaints from ISPs, the Commission found that:

> Telkom had contravened the Competition Act by engaging in a margin squeeze of its ISP competitors, through charging an excessive price to customers for some services; refusing to give a competitor access to an essential facility when it is economical feasible to do so; engaging in exclusionary acts and selling services by forcing the buyer to accept a condition unrelated to the contract. (Bowman Gilfillan, 2014).

1.6.2. Local loop unbundling

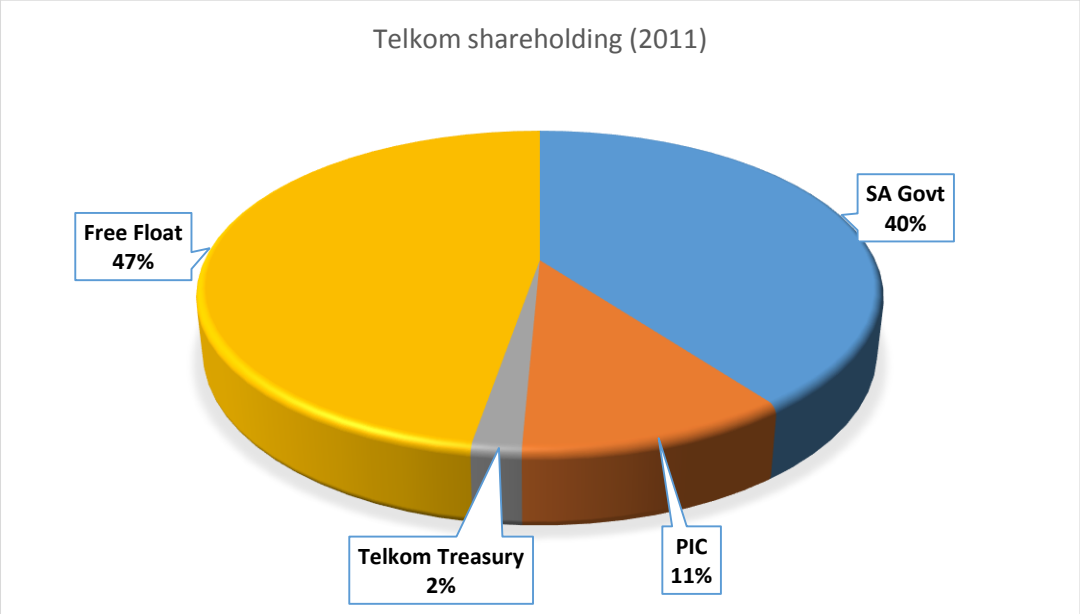
Local Loop Unbundling is the process whereby a licensee is obliged to provide access to the local loop at a wholesale price so that other licensees may access end-users (ICASA, 2014), and refers to “all physical media, including electrical, optical and radio frequency, used as the electronic communications facilities for the connection of an end-user or end-site to an access network aggregation point on the electronic communications network” (ICASA, 2013).

ICASA has sought to provide regulatory intervention and infrastructure competition due to the vast network that has made Telkom the monopoly, and the need to effect the guidelines of Section 2 of the ECA, which have a bearing on LLU, notably the following items (Ellipis, 2014):

> b) promote and facilitate the development of interoperable and interconnected electronic networks; the provision of the service contemplated in the Act and to create a technologically neutral licensing framework;
>
> (f) promote competition within the ICT sector;
>
> (g) promote an environment of open, fair and non-discriminatory access to broadcasting services, electronic communication networks and to electronic communications services;
>
> (m) ensure the provision of a variety of quality electronic communications services at reasonable prices; and
>
> (n) promote the interests of consumers with regard to the price, quality and the variety of electronic communications services.”

Resolution of LLU has proved a conundrum for the Department of Communications and ICASA, and various dates for completion of policy recommendations have not been met. The delays have been exacerbated by the political revolving door at ministerial level, and the fact that the Department remains the largest shareholder, on behalf of the state, of Telkom.

Figure 12: Telkom's shareholders



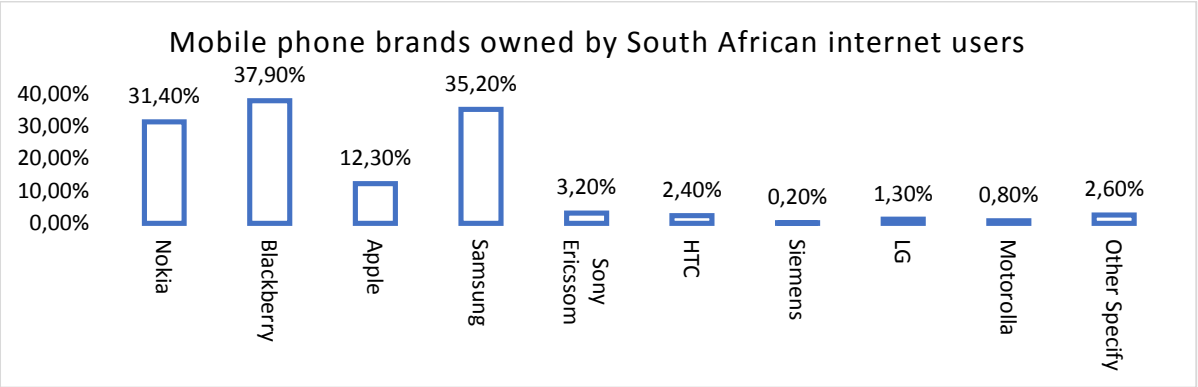
Source: DoC (2011)

Fig. 12 shows that the RSA Government remains the largest single shareholder of Telkom, with both the Department of Communications and the state's pensions fund asset manager (The Public Investment Corporation) representing its interest. The rest is listed in traded in the markets, whilst a 2% shareholding remains within the company itself in its Treasury. Telkom has slammed plans for LLU, with CEO Sipho Maseko urging the industry to invest in their own network, saying that "Telkom's shareholders shouldn't be prejudiced unfairly by subsidising competitors that don't want to invest in their own infrastructure" (McLeod, 2013).

1.6.3. Spectrum for the new wave of mobile technologies

Investment in the rollout of new technology like 3G, 4G or LTE has become an area of competition for the operators; with MNOs competing on the quality and strength of their networks; meaning that spectrum will continue to be a scarce resource that will make those with ample spectrum targets of mergers and acquisition. Whilst debate rages on efficient allocation strategies for the scare but valuable " best spectrums for LTE are of 800MHz, 2.6GHz and 3.5GHz" (Steyn, 2013), firms have ramped up investment in innovative technology to match the expected demand for mobile broadband driven by smartphones, shown in Fig.13.

Figure 13: South Africa's uptake of smart phones by brand



Source: Mybroadband (2014)

ICASA still has to publish final guidelines on the allocation of spectrum, with the Department of Communications choosing to adopt a " holistic approach to broadband spectrum, considering all frequency bands suitable for broadband, rather than limiting focus to the 700/800 MHz or 2.6 GHz bands, to ensure that spectrum is used to extend broadband coverage and capacity" (DoC, 2014).

1.7. Summary of the research problem

This research will look at the conduct and investment trends of private sector and public sector firms, and their respective contribution to the emerging market structure for wholesale broadband services. The report will review the ECA 2005 and its stipulations for infrastructure investment by firms, and how the Altech judgment's interpretations of the Act regarding self-provision unlocked administrative blockages , thereby creating a platform for large supply-side infrastructure investment by both ISPs and MNOs and leading into the development of a strong facilities-based competition.

The promulgation of the ECA on 19 July 2006The ECA, and thereafter the emergence of further investment by ISPs after the Altech judgement, ushered a period of increased investment, as both public and private sector firms had an opportunity to replicate infrastructure capabilities of not only the fixed incumbent Telkom, but also those of other market participants.

Whilst these new investment trends were welcomed for reducing Telkom's domination and for unblocking infrastructure bottlenecks that were created by the legacies of the Telecommunication Act and unfettered Ministerial determinations that hampered sector growth, the new wave of ECNS self-provision investment trends dictated that firms with larger access to capital would be first to markets through larger deployment of investment resources in order to gain market leadership . Not only would they develop larger on-net gains through being leaders in the market; they could also invest in larger wholesale capacities that could distort the market as new entrants would be unable to match the sunk investments of the larger firms (SMPS). Whilst the ECA had laid down infrastructure sharing

and wholesale access regulations, the disruptions caused by new investment by both ISPs and MNOs in self-provision could undermine the Act's provisions of infrastructure sharing and limit the development of a competitive market structure. Larger firms with better access to the capital markets and shareholders willing to provide investment capital could dominate the supply-side, or even grow vertical capacities that could render market competition inefficient. Large investments require return on investment, and as such firms with better infrastructure could pass these requirement to both wholesale and retail parts of the value chain, which leads to high barriers to entry for new firms and high consumer prices.

By using Bauer's calculus (2010), the evolution of the market structure in South Africa would be investigated by this report; with special focus on the relationship between regulation and investment and how these elements interplay in the creation of a competitive market structure that ensures the mutual inclusiveness of firms viability (appropriability), and also achieves the goals of universal access (demand and innovation). This research would therefore seek to investigate how the post-ECA 2005, and the period after the Altech judgment, have influenced investment trends and shaped the emerging broadband market structure in South Africa.

CHAPTER 2: LITERATURE REVIEW ON INVESTMENT IN BROADBAND INFRASTRUCTURE AND MARKET STRUCTURES

2.1. Introduction

This chapter aimed at establishing global and theoretical perspectives on infrastructure investment and the variables that impact investment. Broadband infrastructure has evolved and technologies of convergence have resulted in a dynamic mix of infrastructure, and subsequently made policies and regulation appear to lag behind. The chapter starts by defining broadband infrastructure and its relevance to the economy as a public good.

A conceptual framework is proposed that will be used to collect and analyse data. The framework will look at the supply-side of infrastructure investment, focusing on the investment by both private and public investors in broadband, and their expected return on investment. It will further provide a theoretical overview of demand factors that influence investment, and also review theoretical perspectives on market structure development.

In order to derive a better overview of the variables at play in the investment of broadband, this chapter reviews and proposes the use of Bauer's (2010) calculus, specifically to gain critical insight into the broadband value chain, theoretical relationships of factors considered in the investment decision. The chapter concludes by looking at the key macro-factors of policy and regulation and how they impact the investment decision.

2.2. Defining broadband Infrastructure

Broadband refers to channels channel carrying multiple formats (voice, video, text, data), and technologies that provide speeds of at least 256 kbit/s (upstream and downstream capacity combined) technically, this would include: Wireline–ADSL, Mobile (3G HSDPA), Fixed Wireless (WiMax) technology (Genesis, Unspecified). A great number of access technologies are capable of providing broadband communications. These technologies have been adopted in South Africa according to investment patterns in the country, and their benefits are not enjoyed evenly due to the high barriers to both investment and adoption.

The economic returns to telecommunications infrastructure investment are much greater than the returns just on the telecommunication investment itself; telecommunications infrastructure investment and the derived services provide significant benefits; their presence allows productive units to produce better (Roller & Waverman, 1996, p. 2)

Another view defines "infrastructure as the capital stock that provides public goods and services and its presence is a determinant to assess the quality of life and growth in the economy" (Yoshino & Nakahigashi, 2000, p. 2). This view advances the public good component of infrastructure, and the roles of both the state and the private sector (capital) in investing in infrastructure development, in delivering social objectives (public goods) and economic growth, a view that is also affirmed by Bernal (2013, p.4) that the "provision of high-speed broadband is critical to communities in regional and rural areas as it serves to expand economic capacity and can stimulate commerce". Given that a country cannot participate in the digital economy without a robust IT infrastructure such as an advanced broadband network, it becomes less a question of if governments invest in these projects but rather a question of when (Andes & Castro, 2009). Studies by Bauer (2009) support the view by Atkinson (2007, p.151) that "broadband opens the door for government policies to spur broadband deployment and adoption" as "broadband has become a 'motherhood and apple pie' issue" (Atkinson, 2007, p. 176).

A definition that is more aligned to ICT is that of Bhattacharyya (2009, p. 2), which identified between "hard "and "soft infrastructure"':

Table 6: The distinction between hard and soft infrastructure

'hard infrastructure'	Physical structures or facilities that support the society and economy, such as transport, energy, telecommunications and, basic utilities like water supply.
'soft infrastructure	refers to non-tangibles supporting the development and operation of hard infrastructure, such as policy, regulatory, and institutional frameworks

Source: Adapted from Bhattacharyya (2009)

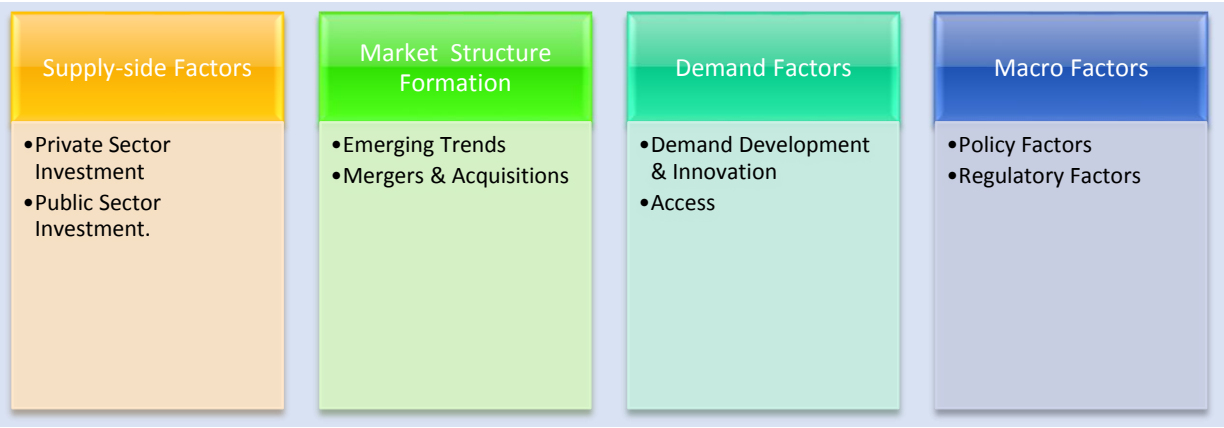
The definition by Bhattacharyya (2009) shows that there is a basis for "soft infrastructure", in this instance policy makers, to develop policy and regulatory frameworks that guide the development of "hard" infrastructure that is public goods and with specific, tangible benefits for society. A national broadband policy provides the policy that gives oversight to investment in both the supply- and demand-side of broadband infrastructure by both private and public investors. At the same time, governments need to find a balance of developing policies that encourage private sector investment and still deliver on the social welfare. The delicate balance means that government policies appear wary of not "giving away the crown jewels" (Wallsten, 2001, p. 5) while at same time committing to "regulatory rules so that they are perceived as credible by investors" (Kirkpatrick, Parker, & Zhang, 2006, p. 145)There is considerable reason to believe that there are significant externalities from (high speed) broadband, and that if left to themselves, market forces alone will lead to less investment in broadband than is societally optimal (Atkinson, 2007, p. 145).

Technology can play an ambiguous role in the pursuit of goals of pluralism, decentralisation and democratic development, and could efficiently deprive communities of their autonomy and limit pluralism (Girard, 2005, p. 88), specifically when markets become less efficient and investors of wholesale networks require to recover returns on their investment and do not pass the benefits of reduced interconnection terms to the demand. This scenario plays itself in South Africa, where investors have not passed the benefits of economies of scale and created a bottleneck through locking up reduced interconnection and infrastructure sharing benefits amongst the firms, resulting in lamentable rates of technology diffusions. This low level of broadband penetration represents a major barrier for access to online services by small businesses and consumers (Goldstuck, 2012, p. 3).

2.3. Conceptual framework to guide data collection and analysis

The conceptual framework (Fig.14) will be used as a guide to developing an understanding the relationship between investment in broadband post the ECA 2005 and the unlocking of the administrative blockages emanating from the watershed Altech judgement; and the policy and regulatory provisions guiding broadband investment in South Africa. With telecom liberalisation, services have become separable from facilities, and regulators have had to develop mechanisms for examining wholesale and retail services, and this unbundling of services from facilities has spawned VANS and the internet, making e-economy possible (Melody, 2005, p. 27). This unbundling of network inputs allows the researcher an overview of the various elements or concepts that make up the ecosystem of broadband, and as such also provide a basis for understanding the relationships for better analysis.

Figure 14: The Conceptual framework



Source: Adopted from Reilly and Brown (2006)

Concepts are derived from data, and they represent an analyst's impressionistic understanding of what is being described in the experiences, spoken words, actions, interactions and issues expressed by participants (Corbin & Strauss, 1996), and they show the efforts of the researcher in "obtaining

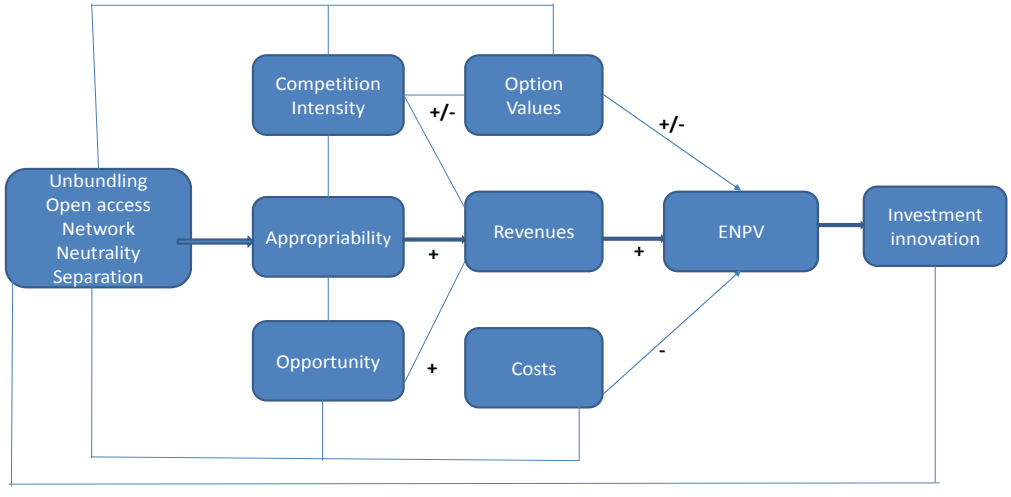
culturally specific information about the values, opinions, behaviours, and social contexts of particular populations" (Family Health International, 2013, p. 1).

2.4. Supply-side dynamics

2.4.1. Private sector investment and the rate of return (ROI)

An investment is the "current commitment of dollars for a period of time in order to derive future payments that will compensate the investor for (1) the time the funds are committed, (2)the expected rate of inflation and (3) the uncertainty of future payments/investment risk" (Reilly & Brown, 2006, p. 6). It follows that investment in broadband infrastructure is deployed to achieve objectives of shareholder ROI and compensate for their "deferred consumption". The economic approach to infrastructure investment involves computing all the benefits and cost of projects and then their rate of return, if the effective real rate of return exceeds the going real interest rate the investment is worthwhile (Gramlich, 1994, p. 1183). Private sector Investors require regulatory certainty for them to be able to invest in any market, and treat their capital outlays as risk capital. This is evidenced by the fact that all regulated telecom operators and potential investors include 'regulatory risk' as a key factor in determining their investment strategies (Mahan & Melody, 2005, p. 7). Bauer's calculus (2010) at Fig.15 shows investors' caveats in their deployment of investment capital over the investment period, and gives a theoretical overview of how regulatory bottlenecks like ICASA's delayed licence conversions could shape the market structure.

Figure 15: Bauer's investment calculus



Source: Bauer (2010)

Risks are uncertainties resulting in adverse variations of profitability and losses (Bessis, 2005). For investors, risks are further classified in two categories: investment opportunities with certain

outcomes and investment opportunities with uncertain outcomes (Correia, Flynn, Uliana, & Wormald, 2000). Overall project risk is influenced by industry conditions, including the competitive landscape, knowledge about consumer demand, and the stability of government policy (Bauer, 2010, p. 8).

These permutations of outcomes or scenarios in a project are expressed in the formula below of Expected Net Present Value,

$$ENPV = \sum_{i=1}^{N} NPV_i \times P_i$$

Where N is number of possible NPV outcomes, NPV_i is the net present value of the i^{th} outcome and P_i is the chance that the i^{th} outcome will occur. By including scenarios in the valuation analysis, the uncertainty of the real world is being captured (Technomyblog, 2014).

Regulation and public policy measures affect investment and innovation decisions because they modify one or more factors in the investment calculus (Bauer, 2010, p. 67). In order to develop clearer insights, Bauer's calculus (2010) is aligned to the conceptual framework. The approach allows a more systematic assessment of the ways in which regulatory and other public policy instruments affected the investment and innovation incentives of regulated and unregulated players in the ICT ecosystem (Bauer, 2010).

The alignment is discussed in Chapter 5 (.5.2), where Table 27 gives typical examples of how elements in the conceptual framework are reflected in the calculus as a framework of analysis. The table provided clarity of alignment; specifically with relationships between regulations (risk variables) vs. supply-side investment trends noted in Chapter 4.

2.4.2. Public sector investment in broadband infrastructure

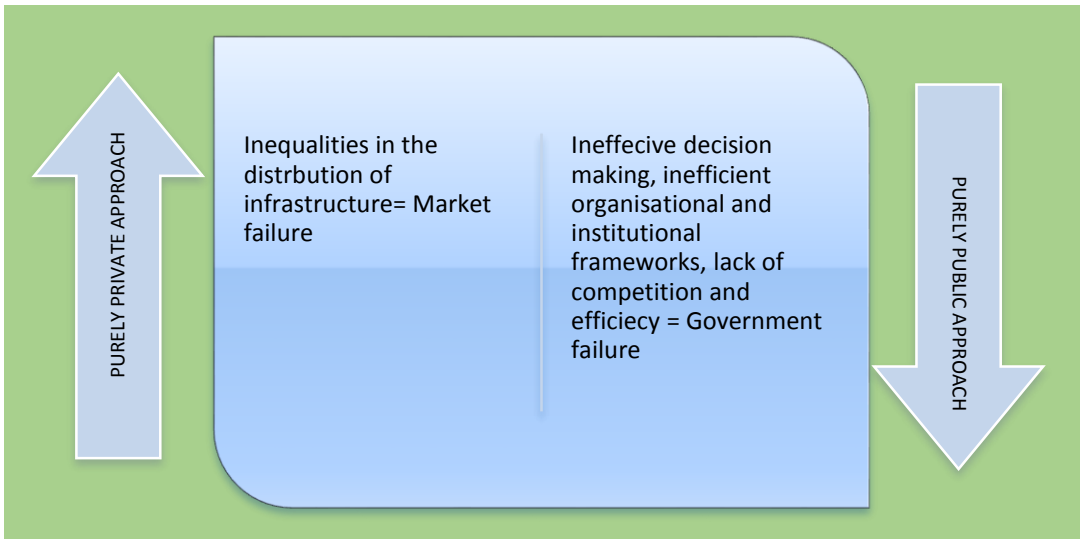
Fiscal constraints and the inability to cater to demands for infrastructure ,coupled with demands for privatisation of infrastructure services has made governments to rethink and embrace Private Sector Participation (Annamalai, Mahalingam, & Deep, 2012), a development that was also necessitated by "the exceptionally poor performance of state-owned telecom firms which generated pressure for reforms" (Wallsten, 2001, p. 3), though most governments were hostile to the idea due to "a combination of the need to balance conflicting objectives, political constraints and bad advice" (Wallsten, 2001, p. 5). The World Bank cited examples of state-owned entities in Turkey's coal mining company, the Philippine's National Power Corporation, Tanzania's Morogoro shoe factory and Bangladesh's state sugar milling company as providing "a wealth of anecdotal evidence that state-owned companies could have a negative impact on the economy" (World Bank, 1995, p. 12).

According to the World Bank, the "more extensive government ownership in an economy, the greater the likelihood that bureaucrats , facing perverse incentives and contradictory demands, are running businesses in which private entrepreneurs, facing clear-cut incentives for profit maximisation in competitive markets, would be more efficient" (World Bank, 1995, p. 15). The need to balance the demands of reform with building institutional efficiencies and sustainability pressurises government to explore strategic partnerships with the private sector. Private sector participation can bring additional capital but also end-user benefits from a more competitive environment in the form of lower costs, as well as the use of the private sector's technological and managerial competences in the public interest (Inderst & Della Croce, 2013). But government cannot expect unwavering private investment to continue during a recession; investment by government through tax incentives and grants can help spur private sector investment in broadband (Andes & Castro, 2009, p. 5), an observation that places the task of developing a conducive policy and regulatory regime at the doorstep of the government.

Telecommunications investment is also regarded as lumpy, thereby creating the need for regular review of possibilities of stimulus provisions and other forms of state intervention. The term "lumpy" refers to the situation where there could be large investments one year and relatively little additional investment for the remainder of a decade (Reynolds, 2009, p. 12). The lumpiness could therefore undermine ICT sector development and stated goals of universal access; whereas a long period of underinvestment limits economic efficiencies and also has negative socio-economic consequences. These permutations create the basis for policy and regulatory intervention.

PPPs are understood to be characterised by low equity in the project vehicle and a reliance on direct revenues to cover operating and capital costs and service debt from financiers (Grimsey & Lewis, 2002, p. 107), while some " new versions of privatization potentially jeopardize public purposes by pressing for market-style competition, by sidestepping norms that apply to public programs, and by eradicating the public identity of social efforts to meet human needs" (Minow, 2003, p. 1230). This shows that though a necessity, partnerships between public entities and the private sector are difficult to implement, specifically as the objectives of public equity are more normative than ROI targets of private equity investors and shareholders.

Figure 16: Private and public sector investment contest



Source: Adapted from Kwak, Chih, Ibbs (2009)

Firms in both the private and the public sector have a dim view of each other's objectives and capacities in infrastructure investment.

2.5. Market structure formation

2.5.1. Theory of the market structure

A market is any contact or communication between potential buyers and potential sellers of a good or service (Mohr & Fourie, 2004, p. 33), and according to Mohr et. al (2004, p.277) "market conduct refers to the efforts of suppliers to market their products, to gain a competitive advantage or to limit competition amongst themselves". This means that in any market, specifically in network industry, there are efforts by firms to act with a profit maximising incentive and seek to dominate each other. Studies by Economides (2006, p.486) show that "the natural equilibrium in network industries is winner takes most" and in that market, "economic models imply a high valuation of the dominant firm compared to other firms in the same network industry".

Studies by Wallsten (2001, p.5), World Bank (1995, p.15), and Mohr et al (2005, p.36) confirm that "it is almost inconceivable that a complicated economic system can function smoothly without some agency to coordinate the millions of decisions taken by the various participants in market system", which implies the need for regulation and ensuring a competitive market structure for participating firms. In South Africa's case "the need to reform long-standing habits of central ownership and control in order to improve efficiency presents issues that are also found in transition economies" (OECD, 2003, p. 10).

2.5.2. Understanding market concentration

South Africa is characterised by high market concentration, and "some of the high concentration is the legacy of the history of monopoly concessions, and some of it is due to scale factors" (OECD, 2003, p. 10). This was also the case in the historical development of the telecommunications sector in South Africa, where infrastructure and management capacities were concentrated in the monopoly.

According to Gillwald (2005),

> …..the first phase of reform in South Africa was predicated on the effective retail regulation and access regulation of monopoly operator, who was not only dominant in the market for historical reasons but was further bolstered by the capital, management skills and technology injected through the strategic partner.

With the abolition of public monopolies and the liberalisation of service operations, the number of firms operating would increase and the ensuing competition would lead to greater productivity, thereby widening consumer choice and lowering prices (Heritier, 2001).The need for regulation that allows competition is based on the need to create a market structure that allows equitable opportunity to compete by new entrants and developing demand side checks and balances that protect consumers and promote technology diffusion.

Market concentration is measured easily using the Herfindahl-Hirschman index(HHI) in order to derive clear understanding of market concentration and thus its competitiveness. HHI is a statistical measure of concentration used by the Department of Justice and the Federal Trade Commission in the analysis of the competitive effects of mergers (Rhoades, 1983, p. 188). According to Rhoades (1983) HHI can be used to measure concentration in a variety of contexts, including the concentration of income (or wealth) and also market concentration.

The formula for HHI:

$$H = \sum_{i=1}^{N} s_i^2$$

where s_i is the market share of firm *i* in the market, and *N* is the number of firms. Thus, in a market with two firms that each have 50 percent market share, the Herfindahl index equals $0.50^2+0.50^2 = ½$ (wikipedia, 2014). The HHI reaches a maximum value of 10,000 when a monopoly exists in which one firm has 100 percent of the market, and takes on a very small value, theoretically approaching zero, in a purely competitive market (Rhoades, 1983, p. 189).

South Africa's market concentration has historically been a " sad story of declining penetration, now approaching 8% from the wrong side, with Telkom also the sole provider of access to ADSL cloud and no LLU" (Potgieter, 2010, p. 14)

Table 7: The HHI for fixed-line markets in South Africa (1984-2008)

	1984	1998	1992	1996	2000	2004	2008
C4	100%	100%	100%	100%	100%	100%	100%
HH	10 000	10 000	10 000	10 000	10 000	10 000	10 000

Source: Potgieter (2010)

Table 8: The HHI for mobile markets (1998-2008)

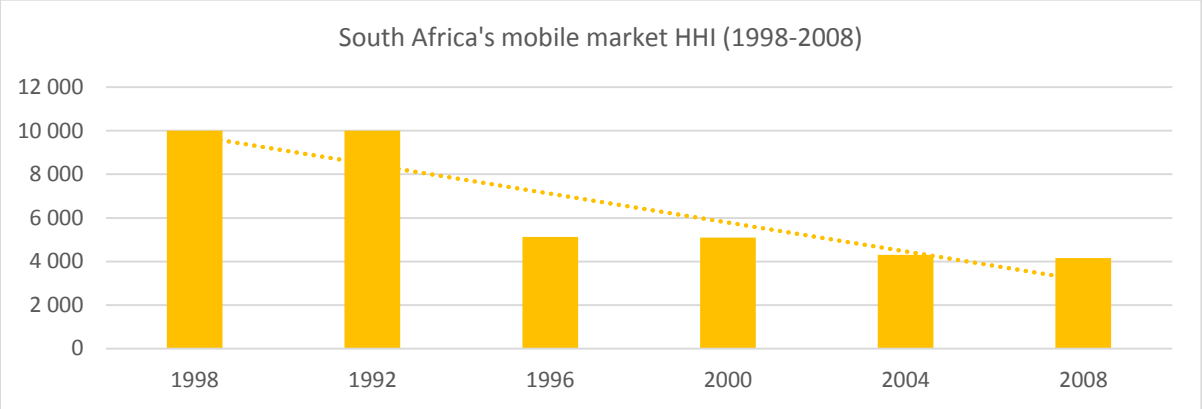
	1988	1992	1996	2000	2004	2008
Vodacom	0,0%	0,0%	58,0%	56,9%	50,8%	63,7%
MTN	0,0%	0,0%	42,0%	43.1%	40,5%	33,4%
Cell C	0,0%	0,0%	0,0%	0,0%	8,7%	12,4%
Virgin Mobile	0,0%	0,0%	0,0%	0,0%	0,0%	0,5%
Telkom	100%	100%	0,0%	0,0%	0,0%	0,0%
C4	100,0%	100,0%	100,0%	100,0%	100,0%	100,0%
HHI	10 000	10 000	5129	5094	4297	4152

Source: Potgieter (2010)

The HHI for telecommunications in South Africa showed a market structure for fixed that was not competitive, whereas the market structure for mobile markets shows improved competitiveness but also signs of possible market dominance and less efficiency; thus necessitating intervention through asymmetric regulation.

The ECA and the Competition Act provide an economic regulation mandate to the competition authorities and ICASA in a number of areas, including interconnection and facilities leasing, spectrum management and universal service and access and competition and price regulation (Hawthorne, Bonakele, Cull, & Lewis, 2014), and according to Hawthorne et.al (2014), interconnection regulations address the anticompetitive permutations of network effects, whilst “facilities leasing regulations are designed to ensure that new entrants are able to gain access to facilities in order to climb the “ladder of investment”.

Figure 17: South Africa's historical HHI for the mobile market



Source: Adapted from Potgieter (2010)

The improved trend of the HHI starts when South Africa's mobile licences were issued in the years post the political transition. Potgieter (2010, p. 12) observed that the HHI for mobile was "very dynamic, compared to fixed-line, though high interconnection were used historically to stymie competition".

2.5.3. Wholesale telecoms market

The ECA 2005, specifically with the removal of administrative blockages through the interpretations given by the judge in the Altech case, was a game changer in the wholesale market in telecommunications in South Africa. The judgement provided the basis for ECNS holders, large or small, to invest in wholesale infrastructure in direct competition with Telkom. Wholesale Services refer to the various upstream inputs that operators either self- provide and/or provide to other operators as inputs (ICASA, 2013). Competition has been viewed as the main tool to develop effective access and foster innovation, investment in communication markets (OECD, 2008, p. 19), and according to the OECD, "network unbundling policies, including collocation, were employed to stimulate competition in the PSTN by providing entrants with wholesale access to infrastructure that was difficult economically to replicate". The intention in OECD states was based on the view that "facilities-based competition is the most effective form of competition and the goal of regulatory reform and liberalisation in the sector". The HHI (Fig 17) provides a perspective on the lack of competitiveness in the South African telecommunications sector, thereby necessitating the development of appropriate economic regulatory provisions that " tune" the imbalances. Economic regulation has been established as a last resort for those markets where it is clear that competitive outcomes cannot be achieved by market forces (Economides, 2005, p. 50).

The view by Economides (2005, p.50) that "the main reason proposed for regulating telecommunications has been that a desirable competitive outcome could not be achieved by market forces" supports the observation by Hawthorne et al(2014, p.4) that interconnection "ensures that large incumbent licensees, such as Telkom SOC Limited (Telkom), Vodacom (Pty) Ltd (Vodacom) and MTN (Pty) Ltd (MTN) are not able to benefit from network effects, although these can be generated in other ways".

The "other ways" raised by Hawthorne et al (2014) are the reasons firms invest in infrastructure as they seek scale and scope. Business firms do not make investments for altruistic reasons but rather make investments in order to earn a return on the invested capital (Crandal & Aron, 2008, p. 19) , and "for any company to make any investment, it must determine, and convince the capital market, that the investment is reasonably likely to produce a positive return in net present value (NPV) terms sufficient to compensate for the risk incurred" (Crandal & Aron, 2008, p. 19).

Market definition is an essential first step in a competition investigation, not only for the purposes of calculating market shares, but more importantly because it involves an analysis of substitutability (Boshoff, 2013, p. 4). Boshoff (2013) argues that a properly defined market is necessary for the calculation of market shares, which are used as proxies for market power.

In 2013 ICASA issued a public tender for a broadband value chain analysis, "in terms of a section 4B inquiry process on the Electronic Communications Network & Services Value Chain Analysis of the South African Electronic Communications Industry under the Independent Communications Authority of South Africa, Act 13 of 2000 (The ICASA ACT)" (ICASA, 2013). The ECA empowers ICASA to regulate facilities leasing, interconnection and competition (Chapters 8, 9, and 10) and through Section 2 of the ECA, the Objects of the ECA. According to ICASA (2007, p.6)

> the objective of market definition is to identify those entities which constitute actual or potential competitors which are capable of constraining any other entity's behaviour and effectively preventing them from conducting themselves independently of their competitors and their customers. The identification of such relevant markets then serves to delineate the boundaries within which any effective and meaningful analysis pertaining to the competitive dynamics of the relevant markets may be ascertained.

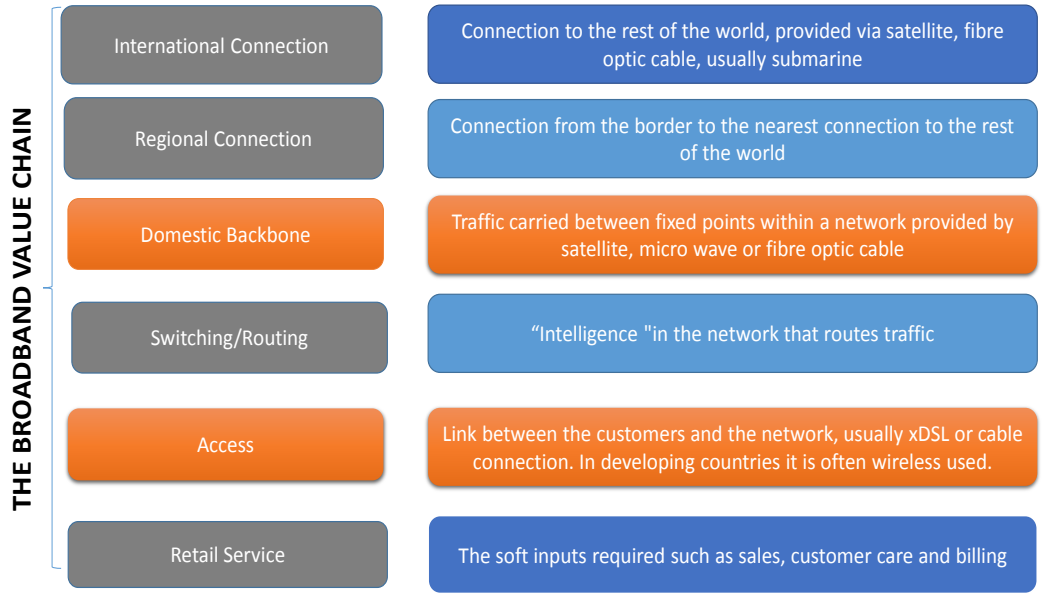
ICASA's market definition model adopts the hypothetical monopolist test, which entails the "evaluation of the likely competitive consequences emanating from a hypothetical profit-maximising entity imposing a "small but significant non-transitory" increase in price test ("SSNIP test") ICASA (2007, p.8). The SSNIP test entails identifying the narrowest possible market, and considers whether or not it would be profitable for a hypothetical profit maximising entity to impose a small but significant, non-transitory increase in its price.

In order to ensure that the market is competitive the ECA's provisions of regulation for competition are read along with the provisions of the "Competition Act No.89 of 1998, which replaced the old Act of 1979" (Competition Commission, 1998), the Objectives of which, amongst others is to

- "to provide South Africans with fair, competitive prices and product choice"
- "to increase opportunities for South African business to compete internationally"
- "to make sure that small and medium-sized businesses have a fair and equitable chance of operating in the local economy"

From the perspective of policy makers, access charges could help a number of tasks, such as encourage the right amount of downstream entry and upstream bypass, encourage efficient network investment and network utilisation, while being manageable (Volgesang, 2003, p. 4).

Figure 18: The Broadband Value Chain



Source: Williams (2009)

Investors in self-provisioning infrastructure in South Africa choose specific capacities of the broadband value chain to invest with the intention to improve operational efficiencies (both supply-side and demand side) and maximise on the returns (revenues).This was done for strategic reasons, essentially in an attempt to gain market share in the process of the rapid expansion of the Internet (Economides, 2005, p. 68),thus building vertically integrated business capacities. Vertical integration means the extent to which companies in a particular market own other companies that are their suppliers, or customers, or both (Competition Commission, 1998).Telecommunication is an infrastructure industry, where the network is an essential input and plays a decisive role in the market (Cambini & Jiang, 2009),

This research focused on the domestic backbone and access networks as the major rungs where investors have raised significant barriers to market entry in South Africa and as such gained network vertical externalities that could undermine market competitiveness provisions of the Competition Act, specifically the prohibited practises of vertical and horizontal integration (Competition Commission, 1998). Vertical integration occurs when a firm does something for itself that it could otherwise procure on the market (Hovenkamp, 2010, p. 863) .

2.6. Demand-side Dynamics

2.6.1. Demand Development and Innovation

Broadband networks support the delivery of a wide range of 'over-the-top' (OTT) services (such as on-demand video services, cloud computing or interactive gaming), and provide the conduit between the suppliers of such services and their customers (ITU, 2013). It is the forecast of demand for these services that determines the levels of investment. Investment in NGN is meant to cater for new technological developments that have gained in scale, and as such increase revenues through ARPU or network externalities. The existence of network externalities carries and essential message about the perception of value during a start-up, value increases with size and larger pool of subscribers means more possible connections (Allen, 1988, p. 258). According to Allen (1988, p.261) "the shift from novelty to necessity elevates an attempt a network innovation to the status of essential commodity sought after by the full pol of communicators", a stage by which the network's service has been accepted as "orthodox through consensus formation".

In the broadband market; the task of demand development resides with the national government through its ability to both invest in supply and demand, and equally mitigate for possible market failure and inherent risks. For innovations to diffuse, demand has to be responsive to changes in functionality or design and demanders must be able and willing to buy and use (Elder, 2013, p. 12). By incentivising consumption and investment, ICT innovations complement Keynesian countercyclical policies (Fransman, 2010).

According to Elder (2013) ,demand side innovation policy is:

..... public action to induce innovation and/or speed up the diffusion of innovation through increasing the demand for innovation (i.e. the willingness and ability to buy and use an innovation), defining new functional requirements for products and services and/or improving user involvement in innovation production (user-driven)".

According to the World Bank, "demand-side strategies focus on expanding the market through programs designed to encourage broadband Internet access and adoption, and demand facilitation strategies incorporated in top-down national plans, can originate from grassroots efforts, or involve the public and private sectors as well as civil society" (Kelly & Rossotto, 2012, p. 248). This puts the

responsibilities of development of national (Broadband) policies, demand cultivation and implementations thereof, at the feet of formations of the state, and perhaps even in front of the political parties' policy think tanks and alliances, and the community of stakeholders that seek to influence policy and regulatory development. Where the state fails to utilise these opportunities to grow the demand, private sector investors create an opportunity to grow positive innovations that increase uptake of broadband services at commercial rates that provide adequate, or even more, ROI.

By incentivising consumption and investment, ICT innovations complement Keynesian countercyclical policies (Fransman, 2010), and specific focus of this study would also be on the various policy responses that have been made in order to stimulate demand, whilst also looking at the innovative initiatives by both public and private sector operators to stimulate demand of their services.

In the highly interconnected and interdependent ICT ecosystem, innovation takes place at different nodes of the value network and can be operationalized and measured at different layers of the system (Bauer & Shim, 2012, p. 3). Investing in telecommunications infrastructure does itself lead to growth because its products - cable, switches, etc. - lead to increases in the demand for the goods and services used in their production (Roller & Waverman, 1996, p. 2).

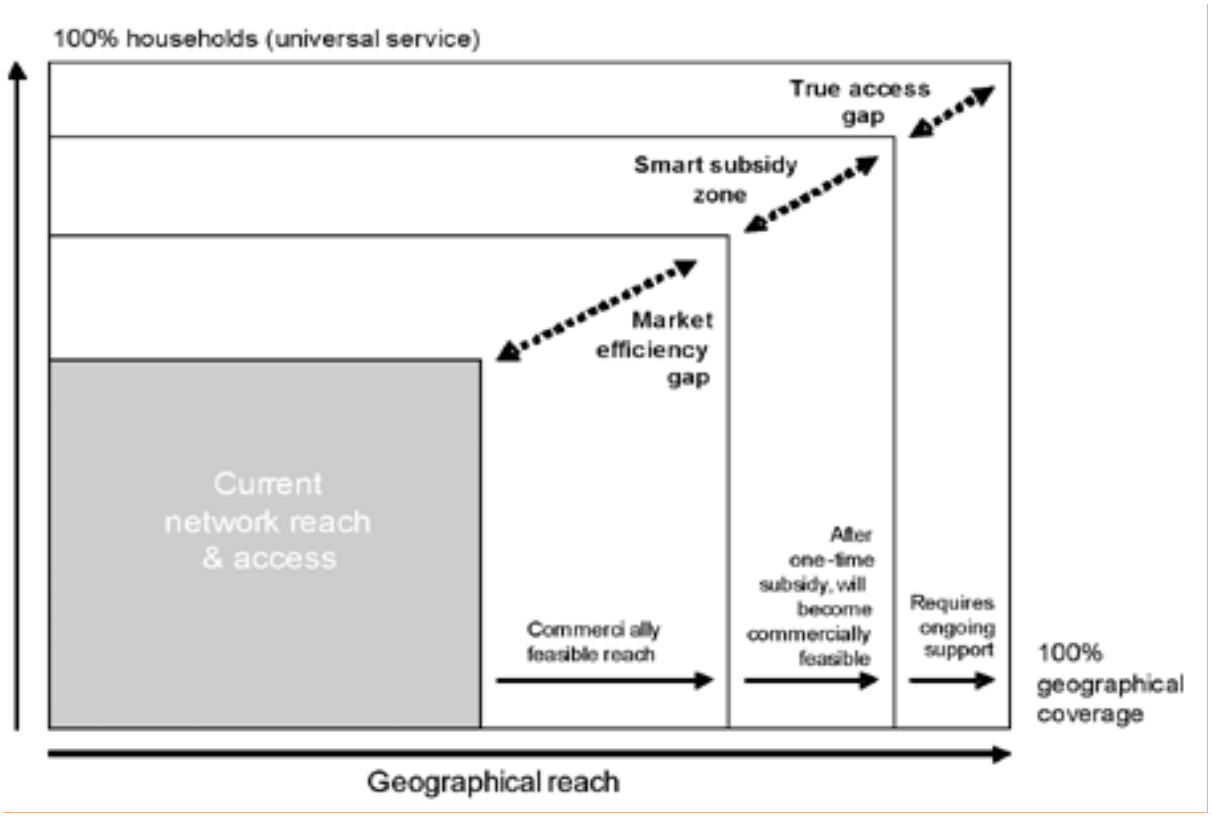
2.6.2. Universal access and the impact on investment

In order to understand the interventions required to further the diffusion of broadband technologies towards targets of universal access, policy and regulation takes into account the market efficiency gap and the access gap.

Digital citizenship refers to the ability of citizens to participate in society online, and forms part of the creation of economic opportunity and political participation in the information age (Mossberger, 2008), and the diffusion if the broadband internet infrastructure is shaping the nature of traditional ICT sectors such as information, entertainment, communication and media as well as other sectors of society (Picot & Wernick, 2007, p. 660). This research aims to also establish and analyse the possible skewed patterns of access and use of broadband and how these could perpetuate the exclusion that poor people have had to suffer over long periods.

The transformative nature of broadband is a tool that can be harnessed to re-integrate those that have been marginalised by spatial legacies of apartheid and were subsequently severed from equal economic opportunities. The basic idea behind pervasive computing is relatively simple: As computing elements continue to proliferate in the environment, consumers will benefit if those computing elements can communicate with one another and with the outside world (Crandall & Jackson, 2001, p. 13).

Figure 19: The market efficiency gap and the true access gap



Source: Dymond & Oestman (2003)

According to the World Bank , " the market efficiency gap refers to the difference between the level of service penetration that can be reached under current plans and conditions, and the level one would expect under optimal market conditions, and the access gap exists because the market has limitations and we reach what we have termed the "affordability frontier" (Navas-Sabater, Dymond, & Juntumen, 2002, p. 8), and governments should first eliminate the market efficiency gap through sector reforms and market development before they consider the mechanisms designed to correct the true access gap (Dymond & Oestman, 2003, p. 58).For purposes of this reach, only current network reach and access and the market efficiency gap will be major points of focus.

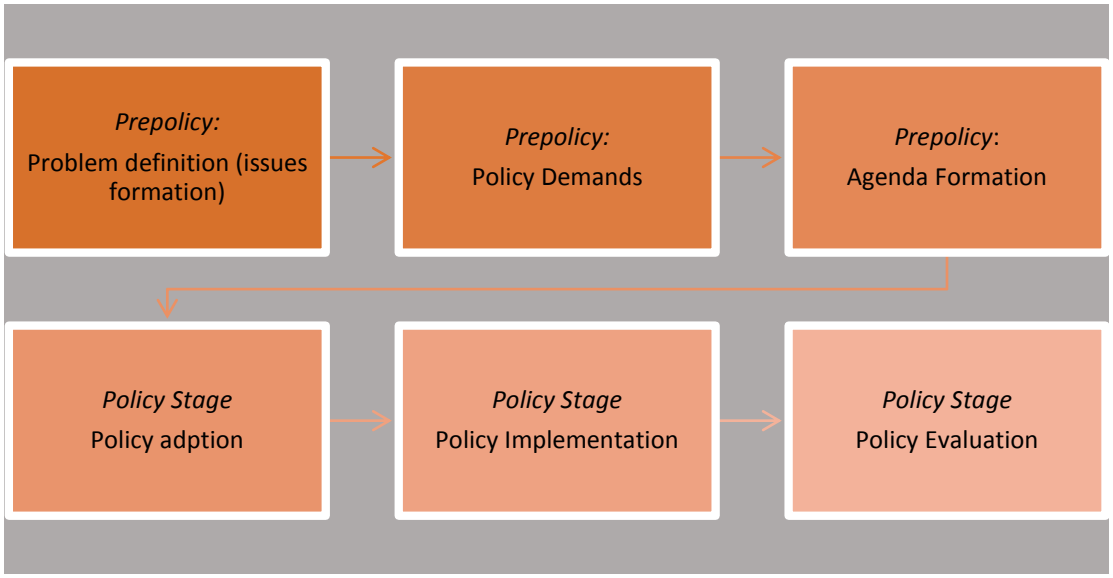
2.7. Macro-factors (government policy)

2.7.1. Government policy formulation

The development of a public policy begins with public recognition that a problem exists, and before a policy issue is defined or adopted, a problem of public concern must be perceived (Cochran, Meyer, Carr, & Cayer, 2009, p. 8). In a society with historical, structural and wide economic disparities like South Africa, it becomes fundamental to develop policies with the intention to even out the legacies of inequality that have been institutionalised since the days of apartheid. Investment in broadband infrastructure should also seek to create the benefits of access and prices that will enhance

connectivity, because “Fast, affordable nationwide broadband service is a public good of the highest priority” (Honing, 2012). Fig 20 shows the stages of policy development.

Figure 20: The stages policy development



Source: Cochran, Meyer & Cayer (2009)

Because of the nature of the broadband industry, there are significant trade-offs between more competition and the goals of efficiency, innovation, lower prices, and higher speeds and broader deployment (Atkinson, 2008, p. 2), and as such “policy should work to remove unnecessary regulatory obstacles to deployment, and not tilt the playing field to promote any particular technology” (Atkinson, 2008, p. 15)

Price and connectivity for a developing country are the foundation, whilst speeds and performance are also critical but can be addressed through standardisations and regulatory provisions in order to eliminate possibilities of further perpetuating or creating new levels of inequality, or at worst case, inefficient markets and competition dynamics that reflect the uneven investment levels.

Samuelson (1954) distinguished between:

Private consumption: goods which can be parcelled out among different individuals. Kelly and Rossotto (2012, p. 206) provided a scenario where there is a monopoly or dominant control of international routes; and “backbone networks are owned by a few operators or consortiums: restricted ownership can be a barrier for non-affiliated ISPs that need international connectivity”. This is tantamount to the “private consumption” of broadband as accessibility to the backbone networks is “consumed by a club of the few”.

Collective consumption goods: goods which all enjoy in common in the sense that each individual's consumption leads no subtraction from other individual's consumption. Collective consumption designates broadband a public good; and is the basis for government's policy interventions in order to maximise universal access. The Internet is a key driver of global connectivity and opportunity, but different bandwidth speeds, limited access, and contrasting levels of openness can mean that the Internet exacerbates rather than offsets inequality (Oxford Martin Commission, 2013, p. 22).

Holcombe (1997, p. 21) slates government's intentions to enter production of the public good as creating market inefficiencies; and he concludes by stating that

- The theory of public goods is considered a tool for the government to justify the legitimacy of its activities and make it less costly to get citizens to comply with its wishes
- Production of public goods should not be dependent on the contribution of the consumers, as the latter is "excess burden of taxation".
- Production should be left in the hands of the private sector which is profit driven.

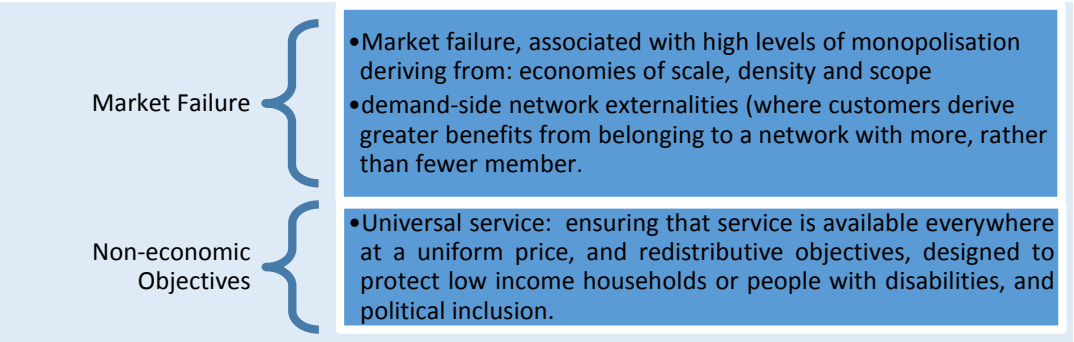
This research focuses on the role of the state as custodians of policy in South Africa. The mandate of the Department of Communications (DoC) is "to create a vibrant ICT sector that ensures that all South Africans have access to robust, reliable, affordable and secure ICT services in order to advance socio-economic development goals and support the Africa agenda and contribute to building a better world" (DoC, 2014)

2.7.2. Policy and regulatory frameworks and their role in influencing investment

According to Kelly and Rossotto (2012, p. 2) " broadband's role as a transformative technology is similar to the impact that electricity has had on growth, and innovation over the last two centuries, with the potential to redefine how economies function". Broadband is a massive enabler of the economy and has been acknowledged as a pillar in the National Development Plan in South Arica, and will be "an enabling platform for economic enterprise, active citizenship, social engagement and innovation" (RSA, 2013).

There is widespread agreement that infrastructure-based competition provides the most sustainable and effective level of competition in the communications market (OECD, 2008); which invariably develops a market where there is potential for market power and potential for predatory behaviour. The bottom line is that if policymakers want to maximize not only societal welfare but also consumer welfare, they must balance the push for more competition with the need to create an efficient broadband industry structure (Atkinson, 2008, p. 2).

Table 9: Reasons for regulatory interventions



Source: ITU (2009)

Regulation should be seen to grow competition amongst the private sector whilst balancing with policy measures that incentivise the private sector to enter into markets that are deemed not profitable. Much more important are the effects of regulation on wholesale markets, including regulatory measures that affect the horizontal structure of markets and newer forms that shape the vertical structure of market (Bauer, 2009, p. 13).The proper level of government investment in broadband is the portion of the network which is not cost-effective for the private sector to cover (Andes & Castro, 2009, p. 5).Table 10 provides a simplified framework for policy and regulatory interventions where there are possible market failures and the need for investment incentivisation.

Table 10: Public policy instruments affecting investment incentives

Intervention point	Regulation	Public policy
Competitive intensity	Licencing conditions, Unbundling, open access Network neutrality	Antitrust enforcement
Opportunity	Line of business restrictions	General business climate
Appropriability	Profit regulation,Retail price regulation Non-discrimination requirements	Patent and copyright provisions Antitrust provisions
Cost	Quality of service requirements,Unbundling, open access Network neutrality	Tax policy (investments tax credits, depreciation, carry-over of losses) Subsidies
Discount rate	Stability of regulation	General business climate
Option Values	Unbundling, open access,Network neutrality	General business climate Patent and copyright provisions Antitrust provisions Taxes and subsidies

Source: Bauer (2009)

Regulatory capacity to execute mandates and regulate the industry effectively has an impact on sector investment and innovation, and thus its development. With the move towards convergence of both infrastructure and service networks "there is no economic or policy reasons to differentiate among services on the fixed network and less reason to distinguish between fixed and mobile where there is already a high level of substitutability as mobile moves increasingly into data" (Teljeur, Gillwald, Steyn, & Storer, 2003, p. 28).

2.8. Summary of the conceptual framework

The conceptual framework discussed in Fig.14 provides a basis from which it becomes easier to develop an overview of the interdependencies and relationships between the various facets of this research. The framework creates a structured method of understanding how supply-side investment in fixed and wireless broadband infrastructure in South Africa by both private and public sector players could impact the emerging market structure; whilst on the other hand the framework builds a helicopter perspective of how other factors like government policy (e.g. National broadband policy) and regulatory intervention (for instance through market definition and tariffs) could affect demand and innovation. The framework is also able to provide a holistic perspective of factors that are major contributors to evolution of the market structure, and as such provide clarities on possible bottlenecks to the goals of technology diffusion and universal access.

CHAPTER 3: RESEARCH METHODOLOGY AND DESIGN

3.1. Introduction

Chapter 3 looks into the applied research methods utilised in the study, and links these to the theoretical aspects of investment and the various policy and regulatory theoretical dimensions that impact supply-side investment, demand and innovation. The chapter presents both the problem and purpose statements, and the research questions. Chapter 3 also provides clarity on data gathering, validation, coding and analysis, and concludes by providing a chapter layout of this report.

3.2. Problem Statement

The problem identified in this research was how broadband infrastructure investment trends by firms post the ECA 2005 and the epochal Altech judgment, which allowed VANS to join the larger networks in the race for self-provision; have shaped the emerging market structure of wholesale and consumer broadband , and how the prevailing policy and economic regulation impacted supply- and demand-side investment trends in South Africa. By interpreting the objects of the ECA 2005 of self-provisioning, the Altech judgement opened up the policy induced bottleneck towards wholesale broadband infrastructure investment through its enforcement of the objects of the ECA Act of 2005.

Initial investment in network infrastructure is regarded as costly and irreversible, making the investment decision of firms for self-provision of infrastructure an important imperative of competitive strategy, as high input costs demand that each firm would compete based on its facilities towards optimising return on investment through wholesale interconnection and broadband services. Firms sought to invest in infrastructure that provided both comparative and competitive advantage, and the depth of investment of individual firms therefore had an impact on both wholesale and consumer prices, and subsequently the competitiveness of the market structure. This research therefore looked at how MNOs used the ECA stipulations for self-provision to their benefit despite the outstanding licence conversions; and also review these investment trends in the wake of the Altech judgement, where VANS joined the pool of investors. These trends would be critically reviewed in order to understand the emerging market structure and how the structure impacts the realisation of universal access.

In the emerging investment paradigm, the role of the state as both an investor in broadband infrastructure and custodian of policy development has a fundamental, asymmetric impact on development of a competitive wholesale market structure. Investment in infrastructure is a sunk cost that expects to create return over the long-term, and as such requires long-term stability of the policy environment and predictable regulatory frameworks with minimum deviations or propensities for

increased business risks. It was further necessary to establish how the development of the national broadband policies affected investment patterns of the firms, and how the market structure was impacted by the regulatory regime's implementation of economic regulation.

3.3. Purpose Statement

In particular the objectives were to discover the nature and levels of competitive leverage (network externalities) and demand derived from the investment, and the prevailing policy and regulatory trends in the period 2009-2013.

In order to derive a better understanding of the complex relationships between policy and regulations and their impact on investment, this report reviewed the ECA rules for self-provisioning, and the Altech judgement's definitive interpretations on self-provisioning for VANS, and these two factors have impacted investment trends in South Africa.

The data was collected and structured according to the conceptual framework; and was analysed using Bauer's calculus (2010) in order to develop a theoretical and structured understanding of the investment paradigm in South Africa, and how the various role players in the ICT ecosystem impacted the firms' investment decisions. Bauer's calculus was applied in order to understand the investment decisions and the levels of profitability (revenues) that were attributed to these investment decisions.

The purpose would therefore be to critically review data on the firms' capital expenditures and revenues, which were an accurate reflection of the levels of investment (*deferred consumption*) that firms would have been willing to deploy in order to gain a return (*positive revenues*) on their investment. Investment is by nature a sunk cost, and therefore requires a significant level of policy, regulatory and market demand certainty for the firm to invest. Data was organised according to the conceptual framework for concise structuring of observations, emerging trends and respondents' views

This research analysed the broadband policy milestones that have affected the evolution of the ICT sector in South Africa, and developed an understanding of how policies and regulatory oversight affected investment in both fixed and wireless broadband networks (supply-side). Supply-side investment was also linked to demand-side factors of demand and innovation. This report also reviewed and analysed the levels of demand-side uptake of broadband, to gain insight into how wholesale and consumer market viability have affected both private and public sector broadband infrastructure investment trends. Investment trends in network industries shape the market structure; and this research reviewed the competitiveness of the market structure. Whilst some investment details, notably capital expenditures and revenues, were unavailable due to the fact that some firms were not listed, the research made use of public reports and other press reports in order to

understand investment decisions of firms that were both listed on the Johannesburg Stock Exchange, and those not listed. These details were distilled using the Herfindahl-Hirschman Index in order to establish the levels of sector concentration, and thus its emerging competitiveness in the period post the Altech judgement (2009-2013).

3.4. Research Questions

The primary research question was:

How have supply-side (private and public) investment trends in broadband infrastructure in South Africa affected the market structure, and how were these investment trends influenced by the policy and regulatory narrative?

In order to respond to the main question above, the following sub-questions were answered:

a) How has the ECA rules on investment and the Altech judgement influenced investment in broadband infrastructure in South Africa?
b) How large are the capital expenditures of private and public operators towards self-provisioning?
c) What role has consumer demand played in further investment in broadband?
d) Which government policy and regulatory provisions have affected these investment trends?
e) What aspects of the National Broadband Policy aim to shape investment trends?

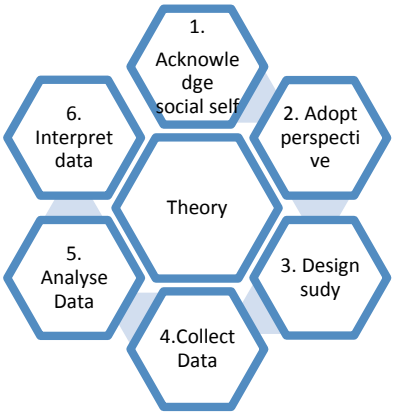
3.5. Research Methodology

3.5.1. Applying qualitative methods of research

The subject matter that this research sought to understand was empirical data in the context of theories of economic regulation. In order to develop insight into the relationship between investment in broadband and economic regulation (policies and regulatory provisions), specifically in an evolving market structure, qualitative research was the most appropriate paradigm as it is based on “empirical, descriptive data” (Marvasti, 2004). Whereas quantitative research involves the use of methodological techniques that represent the human experience in numerical categories (statistics), qualitative research provides detailed description and analysis of the quality, or the substance, of the human experience (Marvasti, 2004).Qualitative research tends to work with text rather than numbers (Rowlands, 2005).

Qualitative research may take various steps, and some of the following steps of qualitative research process will be applied in this research, though the “process is not strictly linear and could flow in several directions before reaching and end” (Neuman, 2011, p. 15).

Figure 21: Steps in the qualitative research process



Source: Neuman (2011)

The steps outlined in Fig. 21 provided structure in the method of qualitative approach, but were modified or adjusted to include other factors into the steps that could enhance the quality of the research process. Research, according to Neuman (2011, p.15) is an "ongoing process, and at the end of one study often stimulates new thinking and fresh research questions".

A detailed study of investment trends and policy development was made through interpretive approach. The intention of (using interpretive methods) is to understand the deeper structure of a phenomenon, which it is believed can then be used to inform other settings (Rowlands, 2005), and to " discover what actions mean to people who engage in them" (Neuman, 2011, p. 90) methods are often used in evaluations because they tell the program's story by capturing and communicating the participants' stories (Patton M. , 2003).

This study aimed at understanding investment patterns of firms, and the resultant market structure directly as a result of investment trends and the prevailing policy, regulatory and market demand paradigm. By applying interpretive methods, this research developed an understanding of investment decisions by the firms and specifically the factors leading to these investment decisions, e.g. new broadband technology of next generation networks, or the ability of firm investment to deliver new and bigger profits. These factors and their interrelationships were understood by applying Bauer's (2010) investment calculus, which provided a structured and methodical overview of policy and regulatory impact on firm behaviour in the market. Specifically for this report was the role of policy and regulation in influencing the patterns of investment in the critical infrastructure of broadband. Broadband is now a critical infrastructure in any modern economy, as vitally important as water,

transport or energy networks, and could be integrated with these in intelligent, distributed networks to enable the more efficient dissemination of resources (ITU, 2013).

These networks are regarded as networks for the economy and social integration, and the absence of policy to develop these is sometimes regarded as an opportunity cost, at the extreme, economic sabotage due to the significant enabling capacities of ICT for both social cohesion and economic opportunity. It is now widely accepted that Information and Communication Technologies (ICT) plays a major role in national development, and has become one of the major building blocks of a modern society (UN Habitat, 2011). In polarised societies with immense historical legacies like South Africa, the impact of ICT policies could be beneficial to society if implemented inclusively and appropriately, whilst neglecting intervention could be tantamount to abandoning both the political and economic transition agendas.

This report used this basis to develop an overview in order to understand this relationship. Government policies and regulation *(Macro dynamics*) influence market development and production (*Suppl*y) dynamics and the ultimate impact on the consumers (*Demand*). It was this conceptual framework that was applied to analyse the investment in broadband infrastructure by both public and private institutions, the market impact and how this helped achieve sustainability for the investors and the community.

3.5.2. The research also applied interpretive paradigms

According to Myers (1997), qualitative research can be undertaken using three research paradigms or underlying epistemologies, though there is no consensus on whether these can be undertaken at the same time. These are positivist, interpretive and critical.

This research applied the interpretive paradigm. Interpretive researchers start out with the assumption that access to reality (given or socially constructed) is only through social constructions such as language, consciousness and shared meanings. The flexibility in qualitative research allowed for this study to “bracket” (Husserl, 1913) data according to common concepts and allowed for the observer’s experience to look at the development of broadband policy, regulation and investment in South Africa, and also be able to investigate the intricate relationships of the various actors in the ICT sector in South Africa. The emphasis was also on the ability of the researcher to use their prior experience to be able to analyse qualitative data. It implies that the researcher should have developed concepts (conceptual framework of data collection and analysis) of their own in order to understand the subject of study. Just as painters need both techniques and vision to bring their novel images to life on canvas, analysts need techniques to help them see beyond the ordinary and to arrive at new understandings of social life (Strauss & Corbin, 1998, p. 8).Through applying interpretive methods,

each factor was looked at and understood as playing a role to achieve a certain purpose. For instance firms act to optimise revenues (ROI), while policy and regulation seek to achieve redistributive redress and competition respectively.

Interpretive research method assumes the observer to have a prior, established or minimum grasp of the concepts under focus, and therefore this understanding is used in order to derive meaning from data that has been selectively chosen as relevant to the subject. It is tantamount to putting emphasis on the cognitive abilities of the observer and their ability to interpret phenomena in a relative way. Creswell (2013, p. 18) takes it further by stating that in the qualitative approach to research, "the inquirer often makes knowledge claims based primarily on constructivist perspectives i.e., the multiple meanings of individual experiences meanings socially and historically constructed, with an intent of developing a theory or pattern".

Table 11 uses the structure that is used by the Family Health International (2013) to develop a framework of qualitative research; and is expanded to illustrate the chosen research methods in this report.

Table 11: Developing a foundation for qualitative research

	Qualitative Research	**Application in this research**
General Framework	▪ Seek to explore phenomena ▪ Instruments use more flexible, iterative style of eliciting and categorizing responses to questions ▪ Use semi-structured methods such as in-depth interviews, focus groups, and participant observation	▪ The research investigated the investment trends of firms and established their levels of commitment to broadband investment ▪ Interviews were conducted with sector experts, regulators and firms to gain insight into the rationale of policy decision, and investment decision.
Analytic Objectives	▪ To describe variation ▪ To describe and explain relationships ▪ To describe individual experiences ▪ To describe group norms	The research made use of the conceptual framework and Bauer's calculus to establish the dynamic relationships between investment, policy and regulation, market demand and the subsequent market structure. These were also be looked at through methods that established market concentration.
Question Format	Open-ended	This research was adjustable and not be rigid, in order to accommodate new details as it emerged from the data.
Data Format	Textual (obtained from audiotapes, videotapes, and field notes)	Interviews were conducted and captured through written/scribbled notes.

Flexibility in Study Design	▪ Participant responses affect how and which questions researchers ask next ▪ Study design is iterative, that is, data collection and research questions are adjusted according to what is learnt	The design of the questionnaire allowed for respondents in the sample to express new details that were factored into data derived from financial statements of supply-side firms. Respondents were interpretive by approach and as such provided information that was in flux as new developments in the sector occurred.

Source: Adopted from Family Health International (2013)

The interpretive method uses observable patterns that are linear or have relational outcomes of equally mutable patterns, thus creating a simplified cause-and-effect understanding of phenomena that exists and interacts socially, and hence interpretive methodology was appropriate for this study. Firms invest for return, government develops policy for citizens, the regulator is pro-competition; and the stakeholders' contesting conduct impact the evolution of the market structure and subsequently its competitiveness.

3.6. Methods of Research Design

3.6.1. Data Collection

The purpose of the research was to investigate and understand the developing market structure of broadband in South Africa, taking into account investment trends of the firms, current regulatory and policy paradigms, and market demand and innovation. By using the conceptual framework and developing an overview, the researcher was able to determine the relevant data that provides supportive or antithetical data to give substance to the research questions. Data was reviewed over the period of 2009-2013 and where relevant 2014, with inclusion of the period leading up to the ECA 2005 in order to gain contextual insight. Material that was relevant would be sampled using Patton's theory-based or operational construct sampling, which is referred to as a "formal basic research where the researcher samples incidents, slices of life, time periods, or people on the basis of their potential manifestation or representation of important theoretical constructs" (Patton, 1990, p. 177) , in order to show their evolution and inter-relations over a period of time, which Patton (1990, p.177) referred to as "social deviance or power interactions".

Policy formulation happens over a period of time, and so does the investment decision and its concomitant return on investment (ROI), and the inter-relationships of these variables were observable over a period of time. Political considerations had an impact on policy and regulatory interventions and these could be seen through certain periodic pronouncements.

Methods to collect data included, but were not limited to:

a) Review of annual financial statements of telecoms firms and state owned enterprises like Broadband Infraco
b) Review of government policy documents and applicable legislation, including South Africa's national broadband policy 2013, entitled SA Connect: Creating Opportunities, Ensuring Inclusion
c) Interviews with ICT sector leaders and experts, operators, regulators and analysts.
d) Published surveys and observations such as GSMA and ITU surveys

3.6.2. Sample

In order to derive the most appropriate responses to the research questions this research implemented purposeful sampling. Purposeful sampling is a strategy in which particular settings, events or persons are deliberately selected for the important information that they can provide that cannot be gotten as well from other sources (Maxwell, 2008). In the development of policy it is important to understand the contestations that are inherent in the build-up and the concessions or trade-offs that are part of the protocol (see Figure 20). The sample of respondents reflected the key role players in the policy and regulatory process, or sector experts with deep insight into supply-side investment strategies by firms in South Africa.

The same was applied in the sampling of firms and the investment community; the sample was constituted of leaders and decisions makers who had vast sway in the strategic direction of firms and funds allocation strategies. The logic and power of purposeful sampling lies in selecting information-rich cases for study in depth from which one can learn a great deal about issues of central importance to the purpose of the research (Patton, 1990, p. 169). South Africa's telecommunications industry has both a mix of major firms (SMPs) and other smaller firms like ISP's, and these were drawn on to shed some rich information on the research subject. These fixed and wireless supply-side firms represented a solid, rich base of information that shed light into the developing market structure, specifically with new-found investment capacities that they possessed as a result of the Altech judgement. Purposeful sampling is a strategy in which particular settings, events or persons are deliberately selected for the important information that they can provide that cannot be gotten as well from other sources (Maxwell, 2008).

The following naming convention was applied in Chapter 4.

Table 12: The naming convention in this research

Respondent	Naming Convention
Sector analyst respondents	SAR-1 and SAR-2, SAR-3, SAR-4, SAR-5
Regulator Respondents	RR-1 and RR-2
Mobile Network Operator Respondents	MNO-R1, MNO-R2
Non-Governmental Organisation Sector Respondent	SR-NGO

3.6.3. Data Validity

Data validation is an integral part of the methodology as it depends on the management of major and qualitative data, e.g. the ability of the researcher to persist with linear observations without factoring in new information throughout the research process could result in a bias that affects the validity of the outcome. Bias could also play a role in the sampling and the formulation of research questions, and the researcher should guard against a rigid approach that excludes new information.

In order to eliminate possible bias, this research accommodated as many factors as possible that were important to the subject of research, using triangulation. The method of triangulations involves "collecting information from a diverse range of individuals and settings, using a variety of methods, (which) reduces the risk of chance associations and of systematic biases and allows a better assessment of the generality of the explanations that one develops" (Maxwell, 2008, p. 236).

Patton (2002) identifies various methods of triangulation, which will be applied in the research or relationships between policy, regulation and investment:

Table 13: Patton's method of triangulation and interpretations

Triangulation Method	Application	Adaptation
Data triangulation	The use of a variety of data sources in a study, for example, interviewing people in different status positions or with different points of view	Research questions and sample size were aimed at deriving perspectives from various players in the telecommunications space, spanning investing firms, policy, regulation sector experts.
Investigator triangulation	The use of several different evaluators or social scientists	The use of telecoms analysts and investment analysts provided different perspectives of the investment space.
Methodological triangulation	The use of multiple methods to study a single problem or program (e.g., interviews, observations, questionnaires, documents).	The research questions and methods of data gathering were implemented through various channels of interaction.
Theory triangulation	The use of multiple perspectives to interpret a single set of data	There are various perspectives to this field of research and all shed rich information that was useful to the discourse.

Adapted from Patton (2002)

These methods were not exhaustive and others emerged during the research process, allowing for new information to be factored into the analysis. Iteration has been suggested as one of the methods that builds up new knowledge as new data emerges. Reflexive iteration is at the heart of visiting and revisiting the data and connecting them with emerging insights, progressively leading to refined focus and understandings (Srivastava & Hopwood, 2009, p. 77). Data and knowledge are in a perpetual flux and mutate each time, hence the need to capture with an open mind and flexibility that permits. Respondents had different perspectives of investment, for instance, and views were be reviewed and tested repetitively in order to capture the substantive items in the views. Investment in broadband spans many technologies, and respondents also suggested policy recommendations that could enhance current infrastructure investment trends. Firms look at ROI and therefore could have different investment strategies, and as such recommendations were subjected to reflexive iteration in order to be included in the recommended broadband mix.

3.6.4. Data analysis

This research based its findings on the investment profile (capital expenditures) of broadband investors and the regulatory and policy environment that influenced investment. An analysis and comparison of firm's investments and revenues over the period after the ECA 2005, and specifically after the Altech judgement (2009-2013) would inform dominant themes of the firms' investment strategies in South Africa, whilst a review of public policies and legislation that governed the industry will shed light on the policy and regulatory influences on market structure and demand development.

Participants' responses were factored in and adjusted throughout the analysis period culminating in the development of new hypothesis.

Using Bauer's (2010) calculus as a framework , the analysis focused on how the various interdependent components of the calculus relate to the conceptual framework (supply-side, market structure, demand and the interplay with policy and regulation). The pace of network investment and the investment strategies employed depended on the direct and indirect costs and benefits of alternative strategies (including their pricing components), the competitive situation, and anticipated future developments (Bauer & Wildman, 2012). The analysis would also provide a view on how the firms have invested to defend their market competitiveness or to develop new capabilities that would also deliver new revenue streams. In hypercompetitive environments, the established paradigms of sustainability of competitive advantage and stability of organizational form may have limited applicability (Rindova & Kotha, 2001, p. 1263), and as such competition for new infrastructure and product variations becomes intense. This intensity could impact on the development of the market structure, and render it uncompetitive.

This research applied coding of data according to the specific elements of Bauer's (2010) calculus. Validity was further enhanced by inductive reasoning, which allowed the researcher to go beyond the obvious, linear explanations, in order to build deeper insights and explanations of the impact of investment trends in broadband infrastructure, the impact of policy and regulation, and how these interplayed in the emerging formulation of the market structure. The development of a market structure is based on investment trends and behavior of firms (data), and as such empirical analysis of firm conduct and capital expenditures/revenues will be reviewed along with the variables within Bauer's (2010) calculus. This ability to be inclusive enhanced the application of qualitative research in this report. Intellectual goals, and the inductive open-ended strategy give qualitative research an advantage in addressing numerous practical goals (Maxwell, 2008, p. 221). Hence the need to apply qualitative research in order to understand the cause-and-effect dichotomies of the chosen conceptual framework.

3.7. Chapter Outline

Chapter 1: Investment trends in Broadband Networks in South Africa post the Altech Ruling

-The Chapter sets the context and background of investment trends in South Africa.

Chapter 2: Literature Review- Studies on Policy and Regulatory Impacts on Broadband Investments

-This Chapter examines the theoretical dimensions of broadband investment and market structures.

Chapter 3: Methodology- Qualitative Research Methods

-This Chapter describes the use of qualitative methodology in the report.

Chapter 4: Investment In Broadband: South Africa's Developing Market Structure

-This Chapter captures the data collected from annual reports of operators and interviews with sector experts.

Chapter 5: Analysis: Supply-side

Investment in Broadband Infrastructure Unblocks the Bottlenecks

-This Chapter analyses the data and perspectives of sector experts.

Chapter 6: Conclusions and Recommendations

-This Chapter provides suggestions by the writer on the policy/investment dichotomies

3.8. Interesting observations on methodology

Qualitative methodology provides a useful approach towards understanding investment trends without the need to apply the quantitative elements of rigid financial statement analysis meant for shareholders or stock brokers. Quantitative analysis would therefore focus on the firm's financial statements, as they are a numerical refection of the firm's account of its holistic financial performance over a financial year. Due to the complexity of market factors that influence investment, like policy, regulatory of technological factors, a separate qualitative report is provided, which allowed this study to investigate the interplay between these factors and the firms' applied investment decisions.

A limitation that was observed was the fact the some firms, like Cell C, do not provide public financial statements as they were not listed on the Johannesburg Stock Exchange. This places a limitation on the data regarding the entity and its capital deployment strategies, though press reports and public statements were useful in plugging this gap in the data. Bauer's calculus, which was applied as a tool of analysis, is a qualitative tool and its elements were also sufficient in developing a holistic perspective on investment decisions and the emerging market structure.

CHAPTER 4: INVESTMENT IN BROADBAND AND SOUTH AFRICA'S DEVELOPING MARKET STRUCTURE

4. Introduction to scope of investment

This chapter reviewed the self-provision investment trends post the ECA 2005, and notably after the watershed 2008 Altech judgement in order to be inclusive of investment by VANS. Focus was on investment in broadband backhaul, transmission and access networks, where firms invested in fixed and wireless high speed ICT platforms which provided vast bandwidth capacities for integrated, converged service offerings like data, multimedia, voice, IP-based services and next-generation services like video-on-demand. This step also provided critical through analysis of financial statements, with focus on capital expenditures and revenues in order to determine the levels and scope of investment that could be attributed to competition intensity.

4.1. VANS join MNOs in the investment rush

Before the ECA 2005, investment in broadband was choked by the Telecommunications Act of 1996 (TA), which had sought to direct and implement a market liberalisation regime that protected the state-owned monopoly Telkom. In terms of the TA, internet service providers (ISPs) or value added network services (VANS) could only provide their services to the market using Telkom's network, and restrictions were imposed on VANS regarding building or investing in their own network infrastructure until 2004. With the advent of the ECA 2005 and its stipulations on licensing (ECA Chapter 3, ss5-19, Chapter 4 ss-20-29, Chapter 8, ss 43-47 and its new rules on a new competition regime through Chapter 10, s67 (RSA, Electronic Communications Act 36 of 2005, 2009), restrictive conditions towards self-provsion fell aside, though not for all firms as VANS were held back subject to ICASA's implementation of licence conversions.

Table 14: The three basic findings of the Altech judgement

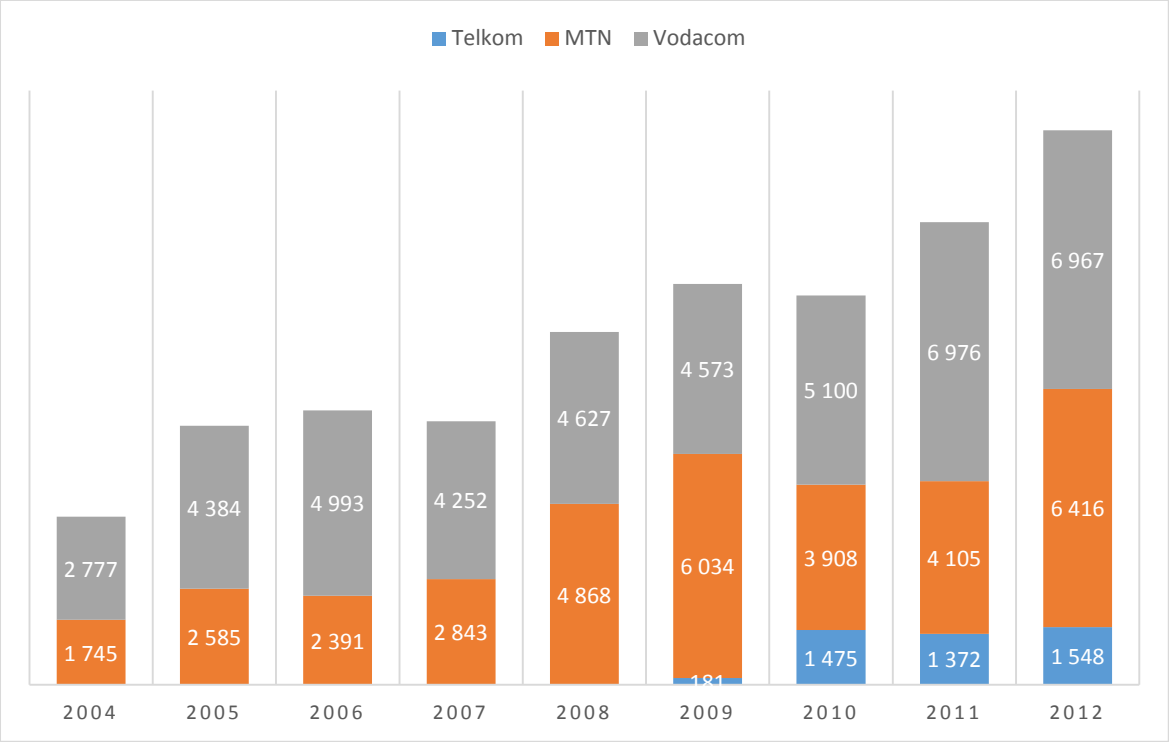
Ministerial Determination re Self Provisioning	VANS were allowed to self-provide from 1 February 2005, in accordance with the Ministerial determination made in terms of the TA.
Ministerial Policy Directions re Vans / ECNS Licence Conversions	The Ministerial policy directions (to ICASA to issue network provider licenses to only a select few of existing VANS licensees namely Vox Datapro; Internet Solutions; M-Web; Global Web Intact, and Verizon, amongst others (Altech, 2008), and regarding the conversion of VANS licences to ECNS licences is ultra vires the ECA, and therefore are set aside by the court
Licence Conversions	All VANS licensees are entitled to ECNS licensees, if they want them, in the licence conversion process. There can be no competitive process involved. ICASA is responsible for implementing the judgment, i.e., issuing the licence conversions in terms of the rulings made in the judgment

Source: Adapted from Thornton (2008)

In the press statement to hail the victory, Altech CE Craig Venter stated that (2008) the judgement was " an ndisputed victory not only for Altech but for the whole of the South African telecommunications industry and we are proud to have been pioneers in breaking competitive ground in what has been a long closed playing field".

Self-provisioning is described as made of three distinct pillars (Vodacom, 2013): installing fibre or microwave transmission infrastructure at base stations; rolling out metro core fibre which also passes near the premises of a number of corporate customers; and connecting networks across the country through the National Long Distance fibre project, which was built in partnership with other operators

Figure 22: MNO investment on the up post the ECA and Altech judgement



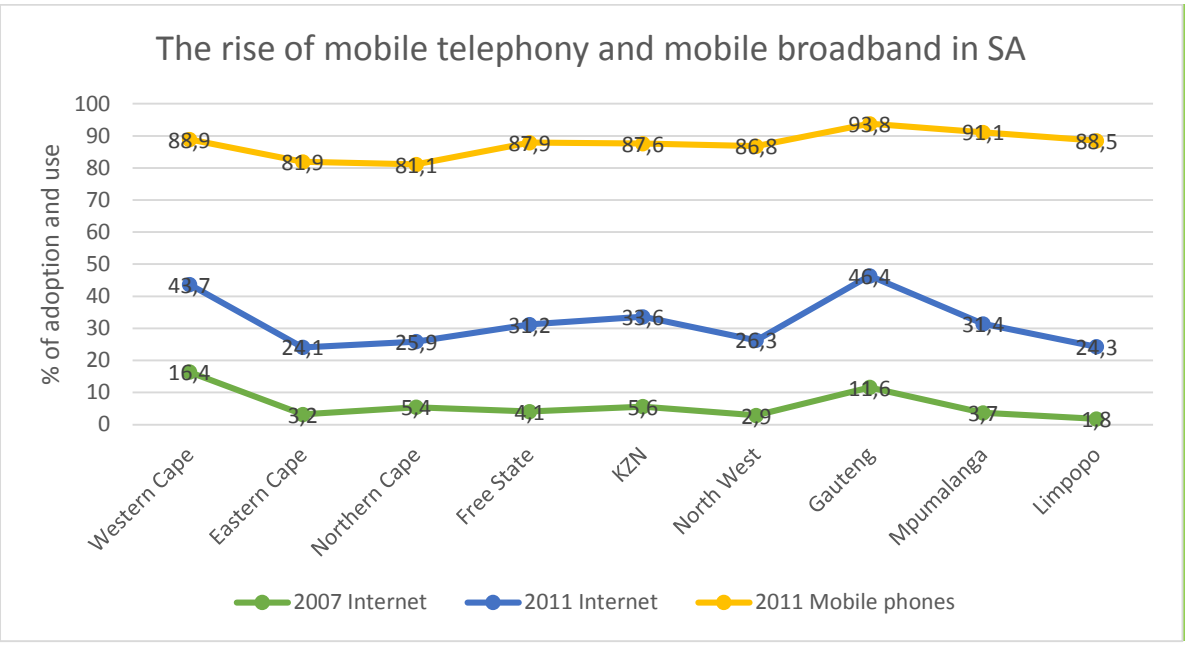
Source: Hawthorne (2013)

Mobile operators invested more than R84bn over 9 years (2005-2012), and while MTN's Capex as a percentage of revenue declined after the call termination rate intervention, Vodacom's increased, and MTN's shows recovery (Hawthorne, 2013).

The positive trends underpinned the growth of the mobile sector and market domination of Vodacom and MTN, driven by high penetration of mobile telephony and the data explosion in South Africa. According to Key Informant MNO-R1, the Altech case could be compared to an unbundling of infrastructure in South Africa, as the self-provisioning trends that emerged meant that operators could

better understand, manage and deploy their inputs and capital to suit their strategies. Firms, according to Key Informant MNO-R1, had better and improved access to sites in order to build their own networks or outsource their towers-build programme, with better and improved turnaround times of just under 45 days.

Figure 23: Penetration of mobile pulls broadband use



Source: Stats SA (2011)

Fig. 23 illustrated that the intensity of penetration of mobile phones had resulted in fixed-to-mobile substitution, and was positively correlated with the rise in internet growth in all provinces, though in some provinces like Gauteng and the Western Cape, Internet use had risen significantly to almost 50% of the population. Key Informant MNO-R2 stated that the investment period post the judgment suited MNO's investments in fibre optic infrastructure and metro rings, whereas investments in radio access networks were difficult to implement due to scale. Firms like Cell C, who did not have the big capital reserves, have had to settle for a share of the capacity as opposed to full infrastructure.

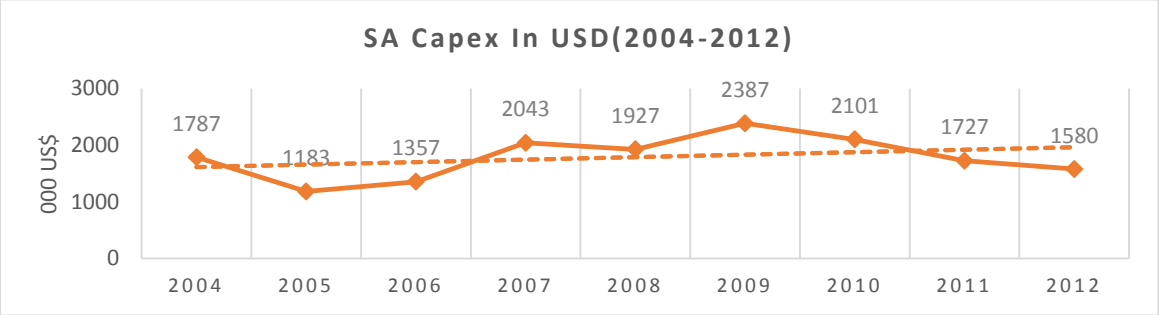
Respondents (RR-1, MNO-R2) observed that the adoption of self-provision by the firms could create an explosion of investors in infrastructure; meaning that the sector could become less competitive if all had to dig for their fibre networks and radio access networks. Costs like pricing of interconnection, national distribution, roaming and other OPEX items across the value chain were impervious and created tensions with the regulator through information asymmetries.

4.2. Investment defies the USD/ZAR exchange differentials

Fig. 24 shows that investment had been consistent between 2004-2012, averaging around $USD2 billion per annum and a cumulative amount of an estimated US$27billion over that period, the

equivalent of R243 billion with an average exchange rate of UDS1/R9 using the exchange rates from the South Africa Reserve Bank (SARB, 2014) in Fig 25.

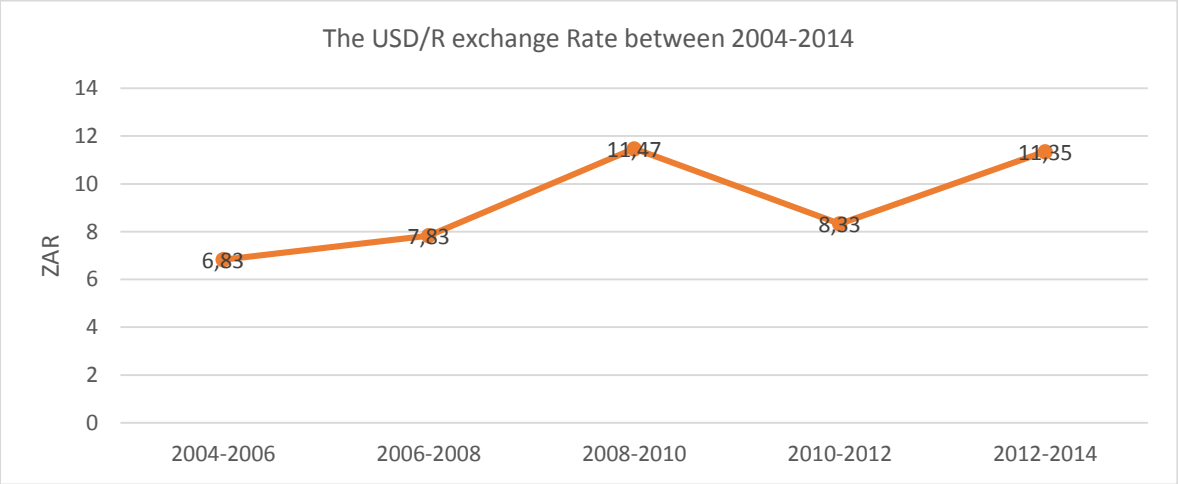
Figure 24: Overview of investment by SA telecoms entities



Sources: ITU (2013)

The pattern above was that the spend spiked up around 2008 and 2009 after the Altech judgement, despite the fact that the USD/ZAR was at its highest in that period and almost doubled the USD1/R6.200 exchange rates from back in 2004.

Figure 25: USD/ZAR exchange rate peaks 2008-2010

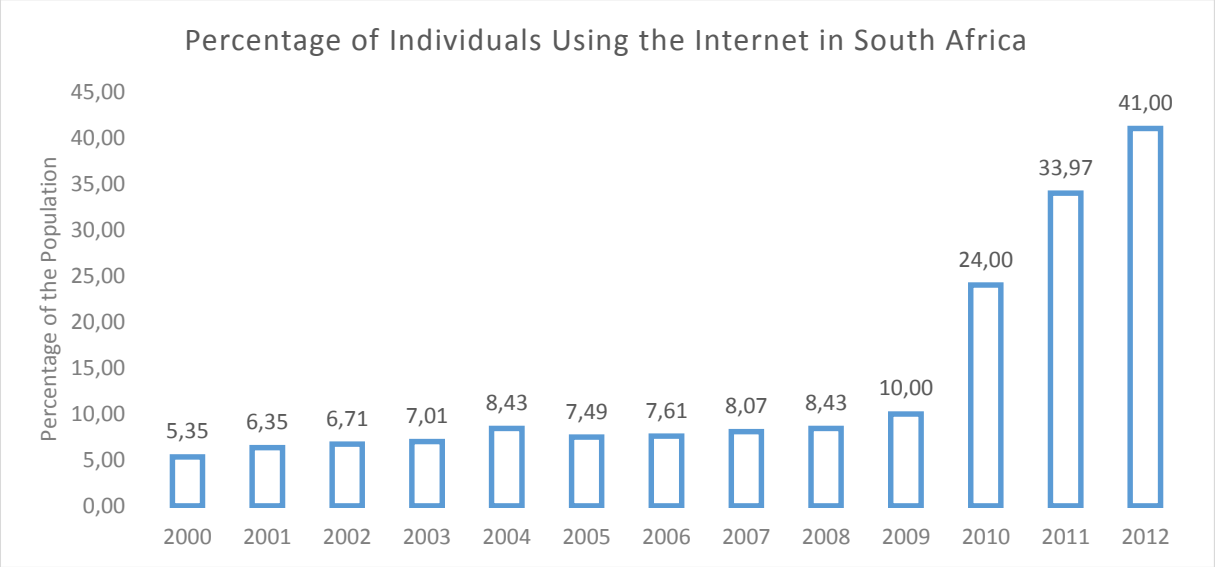


Source: SARB (2014)

Key Informant SAR-2 observed that the steep currency exchange differentials had driven the costs of laying down of infrastructure high, and some entities in South Africa initiated strategic partnerships where special purpose vehicles were created in order to mitigate the high costs of carrying the burden of infrastructure on an individual basis; as applied by FibreCo. These expenditures were investments laid out to massive undersea and terrestrial cable consortiums, terrestrial fibre, mergers and acquisitions of satellite companies and tower management deals in foreign currencies. Firms could diversify their equipment import strategies better, with countries like China producing equipment with better commercial deals than Europe. Due to the availability of better priced options and the

integration of trade arrangements with suppliers, there were benefits of currency differentials. The downside, according to Key Informant RR-1, was that cheaper infrastructure could result in an oversupply due to multiple investors, and both public and private sector investors should be mindful of the repeating the mistakes of the overexposure that affected US entities during the Dotcom crisis. A positive dividend of the judgement was the correlational increase in growth of internet users in South Africa.

Figure 26: The number of Internet users spikes after the Altech judgement



Source: ITU (2013)

The exponential increase in Internet use in South Africa was noticeable after defining 2008 judgement, underpinning that despite the lamentable high costs of mobile telephony, the market reflected a consumer surplus trend that was positive for both the firms and consumers; though there was continued indignation by the regulator and government in an attempt to stem the high wholesale and consumer prices.

4.3. Private sector broadband investment trends in the period 2007-2013

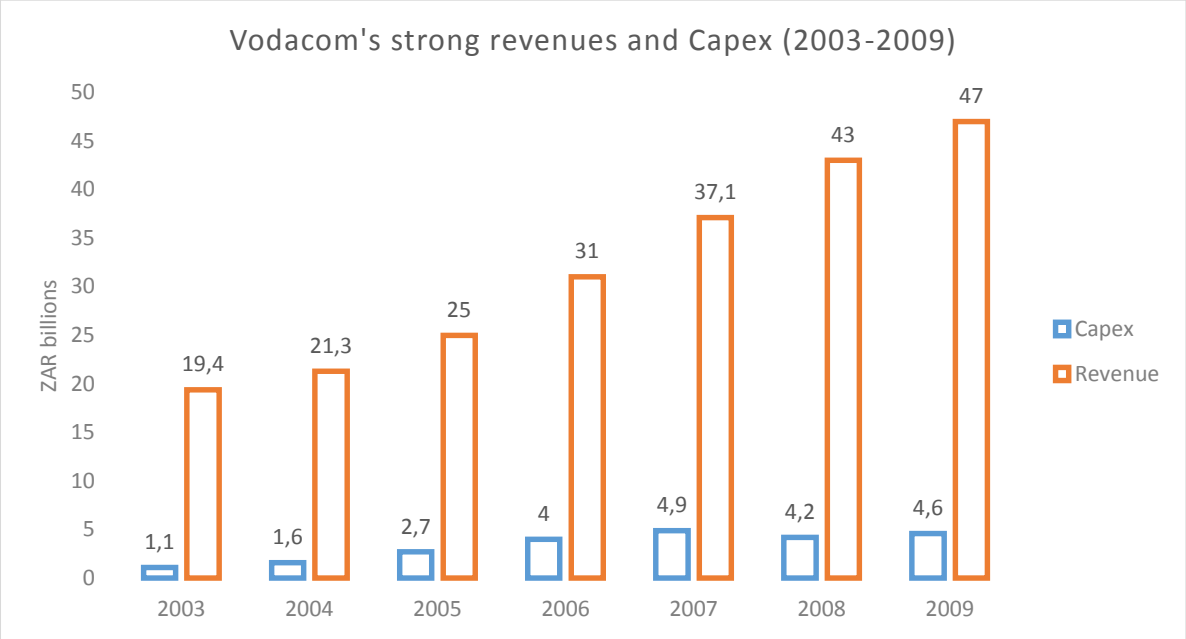
The purpose of this step was to establish the investment trends of the private sector investors in broadband and self-provision infrastructure networks. The trends were derived from data on how a few selected firms responded to the ruling, specifically with the advent of pending investment in own network infrastructures by new entrants and the smaller operators.

4.3.1. Vodacom at pole position with investment

Vodacom was the largest investor in fibre transmission and radio access networks as a direct result of their investment strength; boosted by further injection of capital from shareholders with sufficient positive currency differentials. Vodacom's investment strategy was targeted at data with the company

launching 3G infrastructure and Blackberry's 'pocket office" in 2005 and the 2008-2009 $700million (5,4 billion purchase of Gateway Communications, a pan-African satellite communications operator as part of the operator's drive to expand coverage in its core SA market and new frontiers on the continent.

Figure 27: Vodacom leads with CAPEX for network expansion

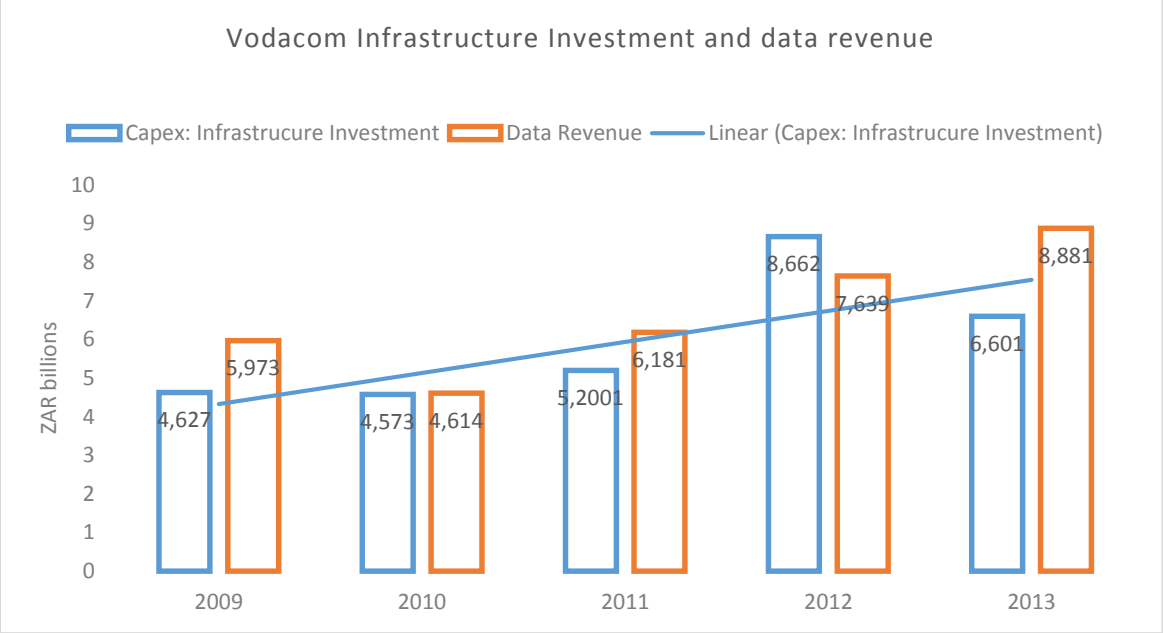


Source: Vodacom (2003-2009)

Vodacom stated that self-provision made it easier and less expensive for the company to upgrade the transmission infrastructure in future and gave the firm more redundancy options to reduce the chance of network outages (Vodacom , 2012). According to Vodacom (2013) , "global growth in mobile data traffic was expected at 66% a year for the next five years to 11.2 Exabyte's a month, equivalent to 5 billion hours of HD video, with smartphones driving this growth spurred on by more affordable devices and faster download speeds through new technologies such as 4G".

Vodacom stated that where there was a sound business case, they will invest in their own capacities (self-provision) in order to reduce the costs of having to enter into infrastructure sharing arrangements with third parties, which was seen as a drawback to improved organisational efficiencies and better QOS (Vodacom , 2012).

Figure 28: Vodacom Capex and data revenues correlate



Source: Vodacom (2011-2013)

Vodacom were publicly critical of the MTRs, which they suggested were unnecessary in a matured market like South Africa, stating that they discouraged investment and new entrants should hold their shareholders accountable for further investments (Vodacom, 2013).

Vodacom has also initiated the following strategies:

- Table 15: Vodacom demand and innovation

Innovation	▪ testing high speed broadband, with speeds of 43Mbps piloted and enabled 60% of the network on dual carrier (Vodacom , 2012).
Demand	▪ promotion of smart phones through provision of affordable financing incentives ▪ Engaging tax authorities to reduce the import costs of these devices, (Vodacom, 2013).
Future Self-provisioning	▪ Additional funding to boost their fixed line business, with FTTP and FTTH layouts ▪ Prospects of additional funding of $11,4 billion from Vodafone after US Verizon sale (Spillane, 2013). ▪ Formal takeover discussions started with Neotel to acquire high speed data and spectrum efficiencies (Vodacom,2013).

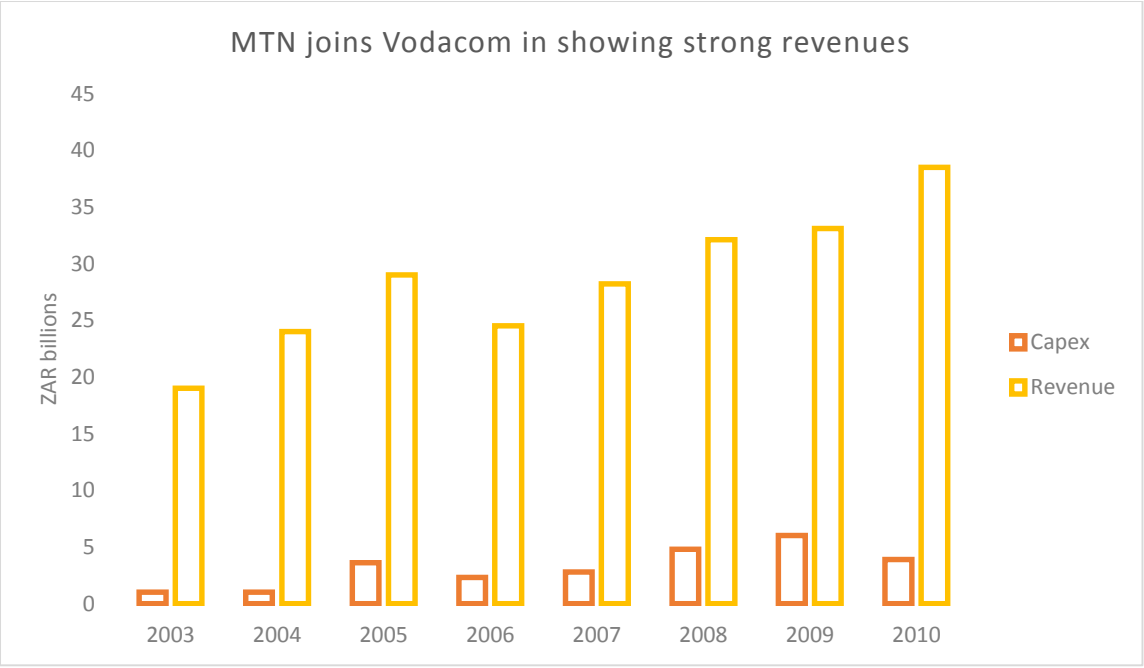
Source: Adapted from Vodacom (2011-2013)

According to SAR-2 and RR-1, whilst investment meant increased competition through new technologies, infrastructure sharing is cost-effective, and firms should explore best-practise industry infrastructure sharing in order to avoid duplicities.

4.3.2. MTN SA competes for market share

In the period just after the definitive Altech judgment, MTN's data revenue grew by 47% , which allowed the firm to focus on network upgrades, self-provisioning and rolling out 3G and 3G base stations , with most of the capital deployed towards modernisation and expansion of core capacity to cater for the expected growth of smartphones on their network. (MTN, 2010). With rivals splashing out on new, self-provided capacities, MTN laid out their largest investment post the judgment in 2009, with the CAPEX decline of 2010 attributed to lower interconnection revenue on their network, meaning that they paid more interconnection that was earned. Further pressures were attributed to increased competition, MTRs and a mature market having more than 100% mobile penetration (MTN, 2010).

Figure 29: MTN's CAPEX builds up

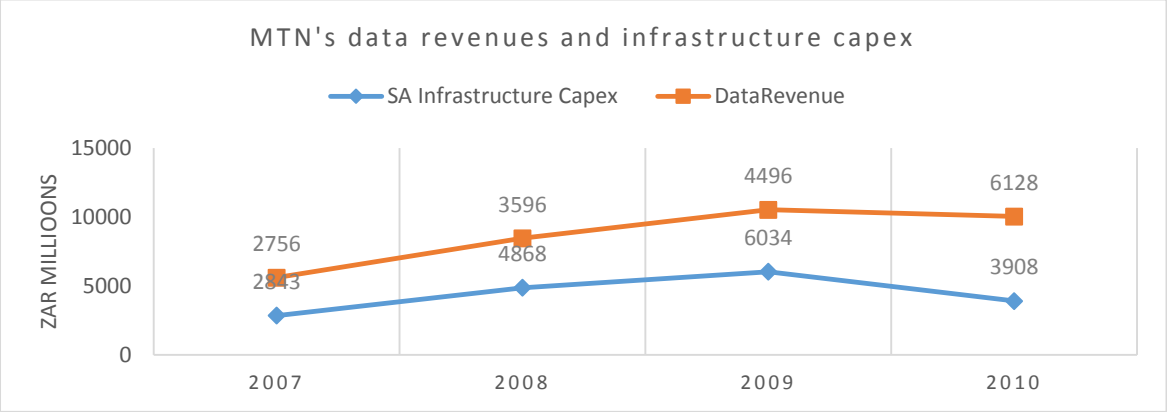


Source: MTN (2010)

Key Informant SAR-1 noted that MTRs were crocodile tears for the MNOs, as they had deeper pockets, specifically Vodacom and MTN. The entities were reaping the rewards of being first to the and had entrenched themselves in the market to their advantage. According to SAR-1, the MNOs had long been investing with the advent of the ECA, and capital expenditures of both MTN and Vodacom were targeted at the growing data market and gearing up for the market disruption imminent after the Altech judgement.

Fig. 30 showed that MTN's expenditures and data have been consistently increasing, and the firm's data revenues appeared to be a strategic cushion or a hedge dwindling voice revenues. To further self-provide on the transmission rung, MTN completed the southern and northern Gauteng metropolitan rings which comprised of 220 km fibre rings to support the core needs in the Gauteng region (MTN, 2010).

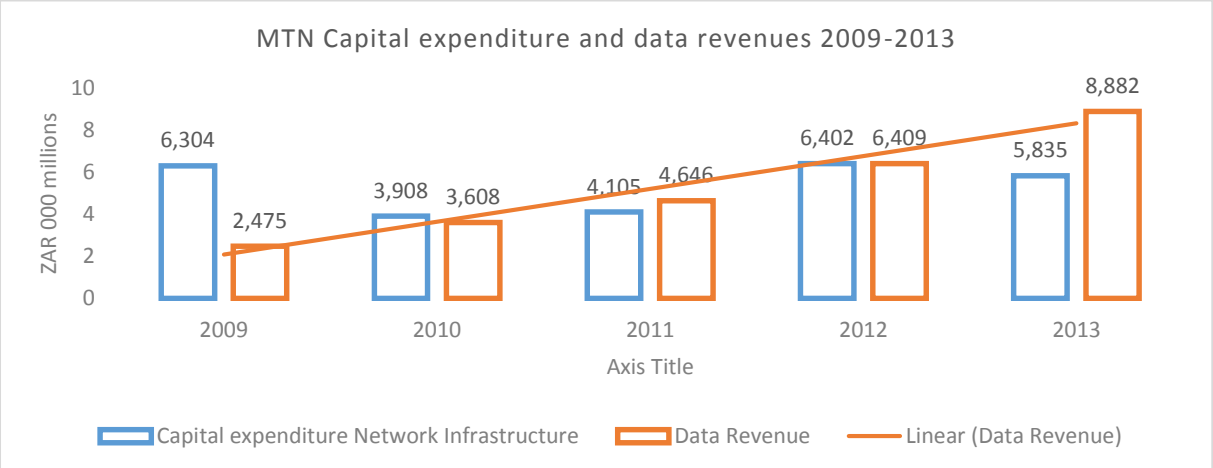
Figure 30: MTN's CAPEX and data revenues



Source: MTN (2010)

MTN stated that 3G data services and smartphone and partnerships in the mobile content application space will be key drivers of revenue growth (MTN, 2010). This growth was forecast to come not only from higher income users but also from the lower end of the market as the cost of smart phones and data dongles was expected to decrease . MTN's data revenues of 2011 had doubled by 2013; from R4billion to R8billion, showing that the capacity to earn lager revenues depended on the amount of investment made upfront to enable consumption.

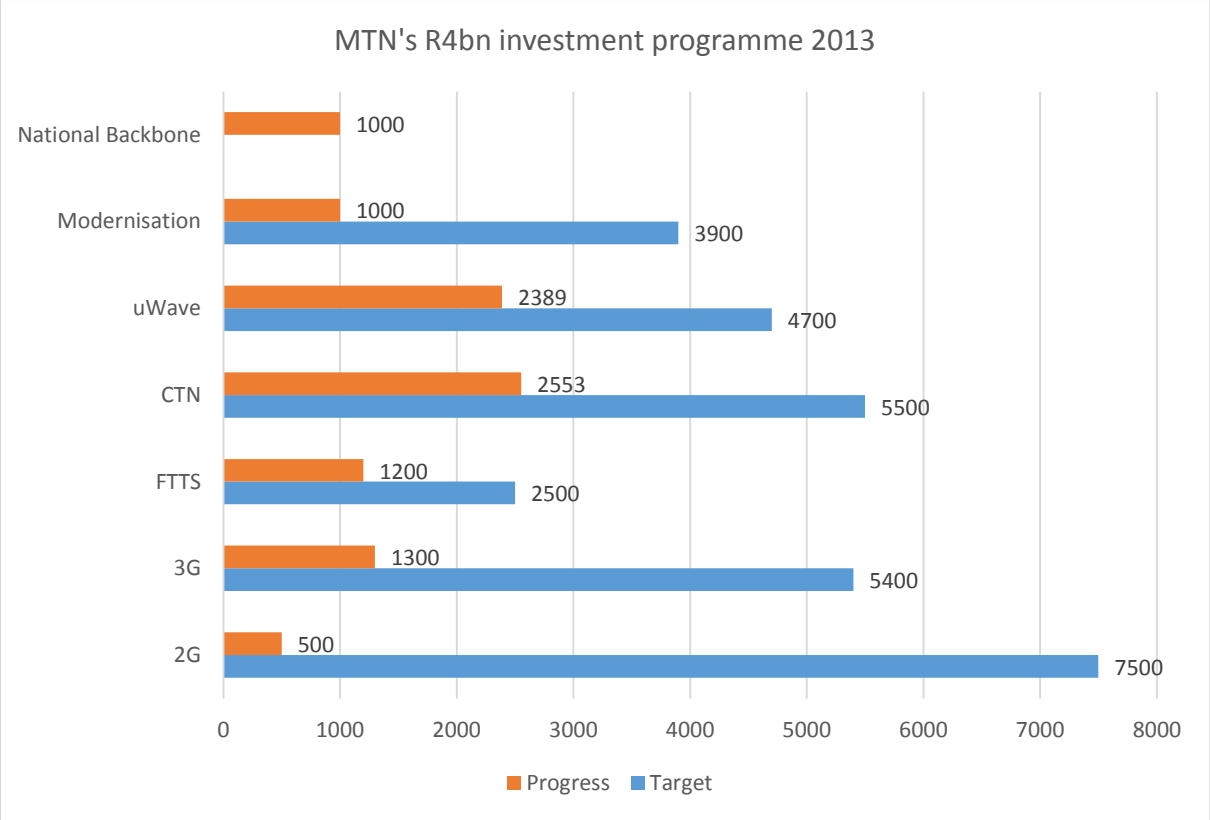
Figure 31: MTN's capital expenditures rewarded by large data revenues



Source: MTN (2010-13)

By 2012 data revenue had increased by 37, 6% to R6, 4billion from 13, 4 million data users, on the back of increased 3G coverage (56% through 1000 3G sites and connections of 800 sites to fibre, with improvements done towards building LTE capacities (MTN Group Ltd, 2012). According to Key Informants SAR-1 and MNO-1, regulatory uncertainty remained a niggling point, specifically with spectrum allocations of 2.69 GHz and 800 MHz, with firms having to adapt to spectrum refarming (MTN refarmed 900MHz for 2G and 3G; 1800 MHz into LTE compatibility whist refarming 2100MHzexclusively for 3G) which was costly and had increased upfront costs for MTN.

Figure 32: MTN's CAPEX items 2013



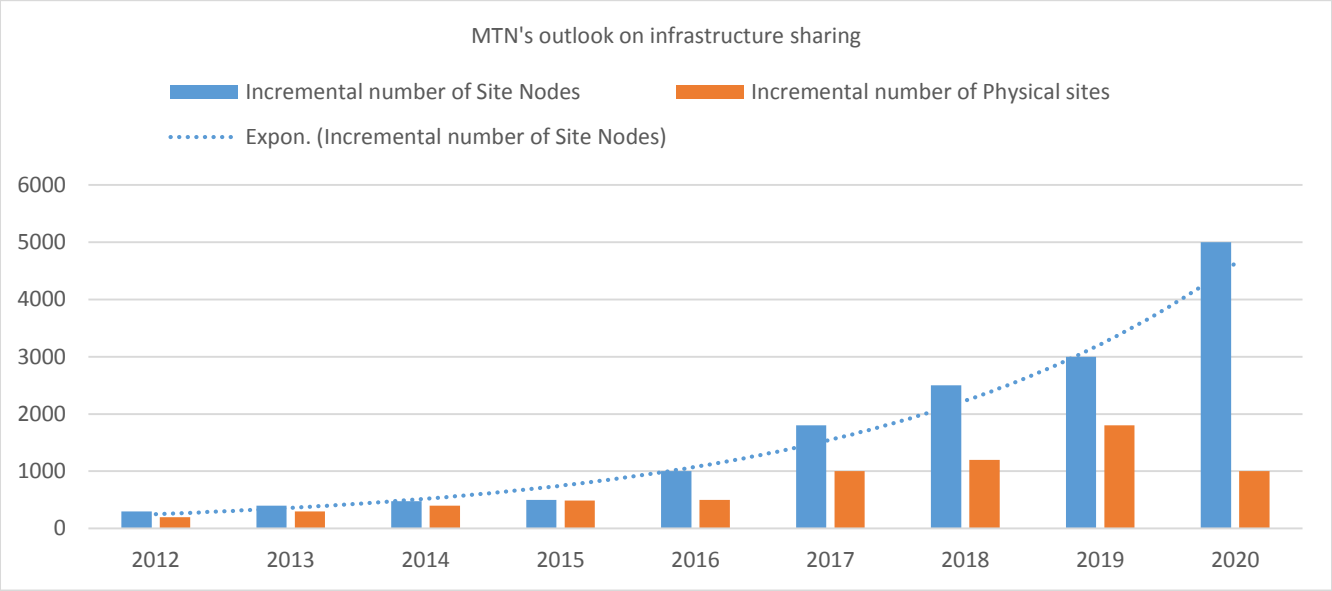
Source: Adapted from MTN (2012)

According to MTN, current technologies would need to be combined in order to meet the demand explosion.

LTE was regarded as the catalyst but would be used in conjunction with 3G/HSPA and 2G/EDGE, and infrastructure sharing, fibre, active RAN sharing and passive networks is a reality that will be part of the sector (MTN, 2008). MTN projected that "by 2020 it estimated that Fibre, LTE and LTE+ technologies will carry more that 60% of total data traffic in South Africa" (MTN, 2008).

Fig.33 shows that in order to match the demand, infrastructure sharing would be inevitable, specifically with the growth of new sites appearing stagnant and declining by 2020, in contrast to the nodes.

Figure 33: MTN's future outlook on infrastructure sharing



Source: MTN (2008)

FAccording to MTN, South Africa needed speed in policy and execution through sufficient LTE spectrum, effective use of USO funds, wayleave approvals, digital dividend and discussions about Public-Private investment (MTN, 2008)

Table 16: MTN's demand and innovation

Innovation	▪ Growth in South Africa for mobile money and data applications (MN0-R1, 2014)
Demand	▪ New intelligent devices to support consumption like social networks and YouTube,MTN Mahala, MTN Zone, Opera Mini, diagnostics and the imminent internet of things (MN0-R1, 2014).
Future Self-provisioning	▪ investment in metropolitan and national fibre and well as undersea cables to service evolving voice requirements as well potential for data growth (MTN, 2010). ▪ 2G and 3G network modernisation. ▪ Fibre roll out planned and LTE capacities added to major SA cities .

Source: MTN Results (2010-2013)

4.3.3. Cell C joins the fray

Cell C launched its pre-paid and post-paid services in late 2001; 6 months after being awarded the license, initially through a roaming agreement (infrastructure sharing) with Vodacom, but was later to roll out its own network (Saudi Oger, 2014). Oger Telecom, the majority shareholders, offer fixed-

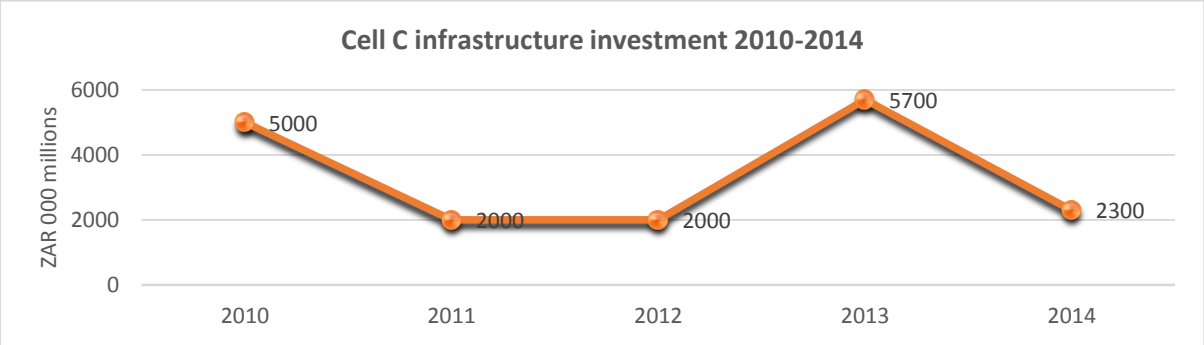
line communication and Internet/data services; and infrastructure and wholesale voice services to incumbents, alternative carriers, mobile operators, cable TV companies, Internet service providers, and corporate customers (Bloomberg, 2014).Investment in Cell C's infrastructure strategy is unclear, due to the unavailability of financial statements in South Africa as the operator is not listed in the JSE.

Cell C's decision not to invest in infrastructure in 2007 was based on a decision by CEO Jeffrey Hedberg, who stated that "he did not see a good business case at the time for investing in a 3G/HSDPA network, adding that it will be difficult for a cellular provider to show a return on its mobile broadband investment" (Muller, 2009). Hedberg reiterated this view in 2008, saying that while they have a 3G-ready core network, '3G is hype and we won't fall prey to hype' (Muller, 2009).

By the end of 2009 , when other firms were investing post the Altech judgment, Hedberg was shown the door; and incoming CEO Lars Reichelt announced that Cell C would be investing in their own 3G/HSPA+ network, with the initial R5-billion on broadband network in 2010, and that there will be a strong focus on broadband to support speeds of up to 21 Mbps, significantly faster than Vodacom and MTN's current peak speed of 7.2 Mbps (Muller, 2009).

The funding would be contributed by all shareholders, including CellSaf, Cell C's black economic empowerment shareholder (TechCentral, 2009) .The 3G network would make use of all the frequencies that Cell C had access to, namely: the 900MHz, 1,8GHz and 2,1GHz bands. Cell C's opportunities to develop a national footprint through a bigger network countrywide were enhanced in 2011-2012, with their investment in FibreCo Telecommunications, a joint venture with Convergence Partners and Internet Solutions.

Fig 34: Cell C's investment in infrastructure



Source: Various press reports

The biggest expenditure by Cell C shows in 2013, when the company was under the leadership of Alan Knott-Craig, former Chief Executive of Vodacom, who was recruited from retirement by Cell C to lead an aggressive strategy of shoring up Cell C's competitiveness in the market. The capital expenditure (R5,7billion) was constituted of a hybrid funding structure of both equity from majority shareholder

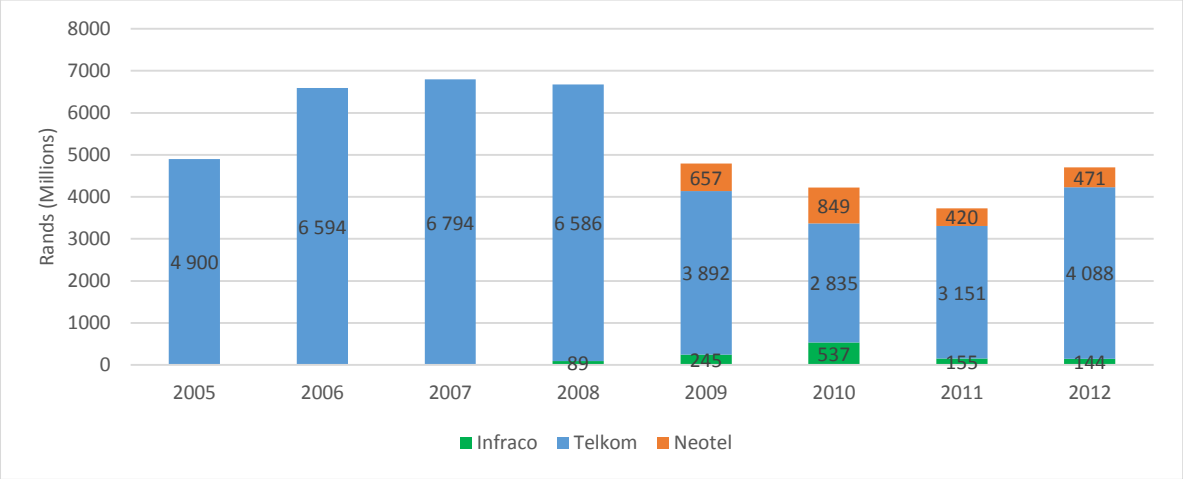
Oger Telecom and loans from Nedbank and the Development Bank of Southern Africa, with Knott-Craig stating that shareholders were concerned about " high termination rates, which were seen as a barrier to smaller networks and new entrants being able to compete effectively on price because they have fewer customers and most of their calls are made to other networks" (Mochiko, 2013). The investment was also linked to ICASA's decision to conduct a market review of the remedies under the call termination regulations (Mochiko, 2013)

Knott-Craig retired from Cell C due to ill health, leaving newly appointed CE Jose dos Santos to continue the aggressive price wars. By their own admission , Cell C "conceded the price wars were a risk for the company but said MTN and Vodacom left it with little choice when they slashed their prepaid rates to 79c" (Morokolo, 2014). Respondents (MNO-R1, SAR-1) stated that Cell C was seen as taking a bigger risk in the price wars, noting that they were the smaller company by clients and as such may not be sustainable over the long run, which could lead to making both Cell C and Telkom Mobile targets of takeover by the bigger operators.

4.3.4. Telkom leads the fixed pack

By the time the Altech judgement was delivered in 2008, Telkom's investment appetite was at an all-time high, particularly with intentions to boost data competitiveness and defend its position from the enthusiasm of MNOs who had just been afforded the opportunity to self-provide by the ECA.

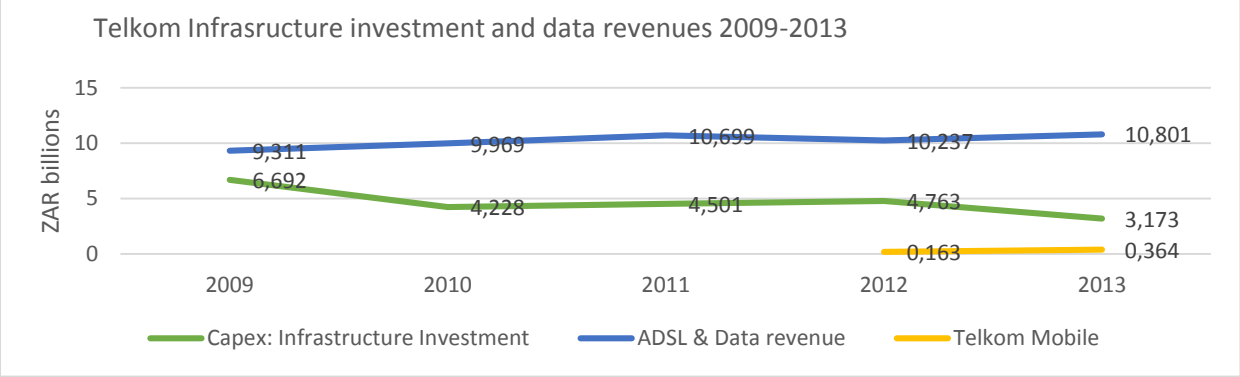
Figure 34: Fixed line firms invest to compete in the converged space



Source: Hawthorne (2013)

The trend in Fig. 34 showed Telkom's leadership of the fixed broadband market. Whereas Telkom had competitive advantage over years of investing in copper, the new wave of fibre optic cables meant they had to invest to modernise antiquated networks that were a limitation to their mobile aspirations.

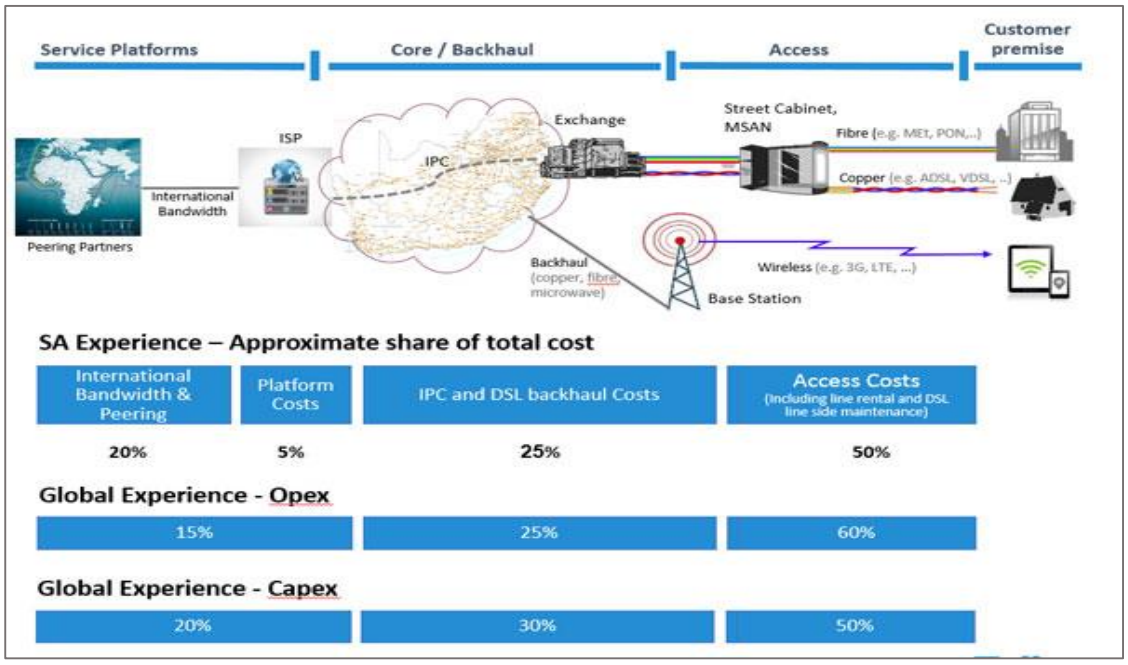
Figure 35: Telkom's investment trends show ADSL dominance



Source: Telkom Results (2009, 2010, 2011, 2012, 2013)

Initial outlays at Telkom showed that ADSL was a big driver of their revenue; specifically with dwindling core voice subscriber numbers after the implosion of mobile networks. Investment was geared at delivering fixed line broadband through retiring "legacy technology" and replacing that with new fibre to the business and access networks. Armstrong, the group's Chief Operating Officer in 2013, stated that globally "access accounts for 50% to 60% of the cost, the core and the backhaul is 25% to 30% of the cost, and the service platforms are 15% to 20% of the cost. In South Africa access is about 50% of the cost, the IPC and DSL backhaul is 25% of the cost, the platform is 5% of the cost, and international bandwidth and peering is 20% of the cost" (Armstrong, 2013).

Figure 36: Telkom's four components of broadband CAPEX



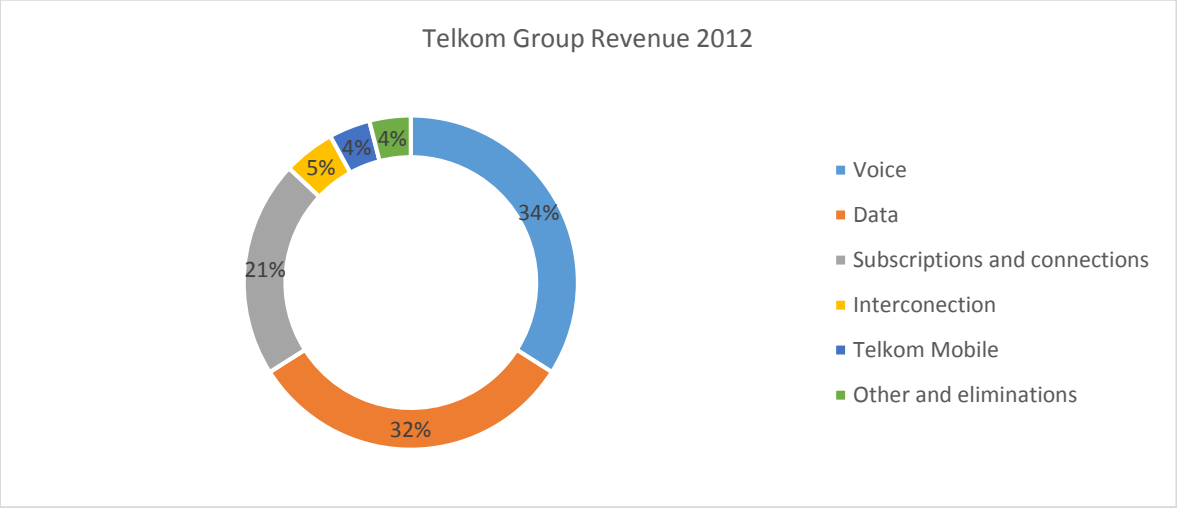
Source: Armstrong (2013)

This investment in the access network was important for large data content and VoIP offerings that were specifically marketed to the enterprise for “greater capacity a bandwidth flexibility” (Telkom , 2011). Key Informant SAR-2 noted that the investment case for Telkom mobile was hampered by their late arrival into an already saturated market, with the big MNOs dominant in the mobile data and voice space, thereby necessitating a strategic review by Telkom, notably with RANS which had become the competitive preserve of the MNOS post Altech and liberalisation.

Telkom stated that the new mobile business was taking time to find its feet and will continue to do so, hence the need to meet the evolving needs for speed, bandwidth, convergence and quality (Telkom , 2011). Telkom South Africa’s capital expenditure decreased in 2011 to R2.8 billion, and the company secured a seven year USD127 million Sinosure-backed loan facility to finance capital expenditure, the bulk of which was allocated to mobile capital expenditure as part of Telkom’s expansion into the mobile telecommunications market in South Africa (Telkom , 2011).

By 2012 the group profile had transformed in terms of revenue, with data showing an increase against reduced voice revenues.

Figure 37: Telkom group’s revenue profile 2012

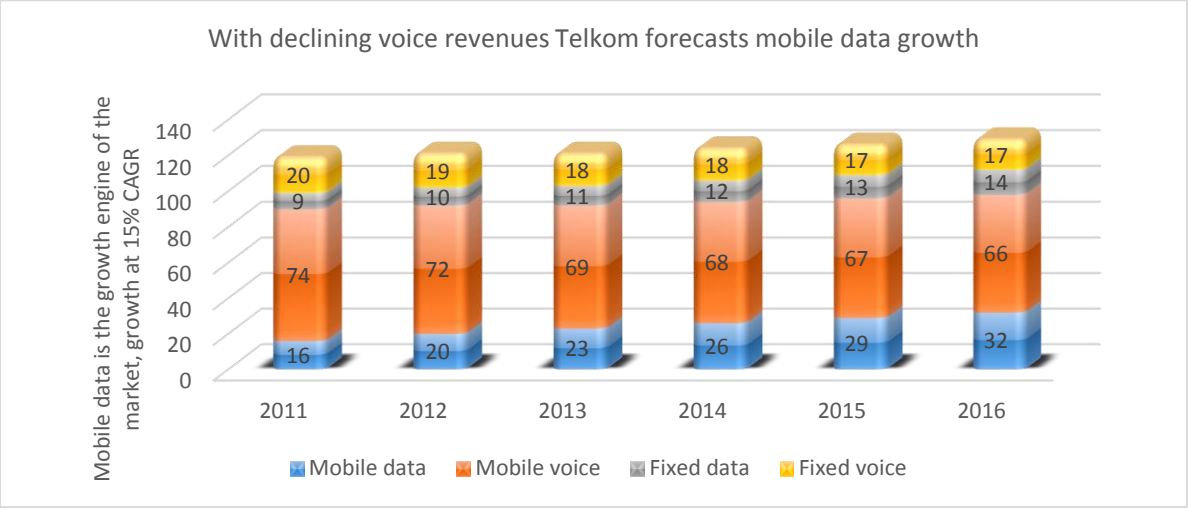


Source: Telkom Annual Results (2012)

Telkom noted that though Telkom mobile was well-received by the market and the acquisition of customers had exceeded expectations, converting customer numbers into strong revenue was difficult, especially in the pre-paid segment; a trend which the company attributed to the distributive strengths of the incumbent MNOs (Telkom, 2012).

Telkom noted that the fastest and most viable means of ensuring broadband accessibility was using wireless technology going into the future, and they would be engaging the government in order to roll out mobile broadband.

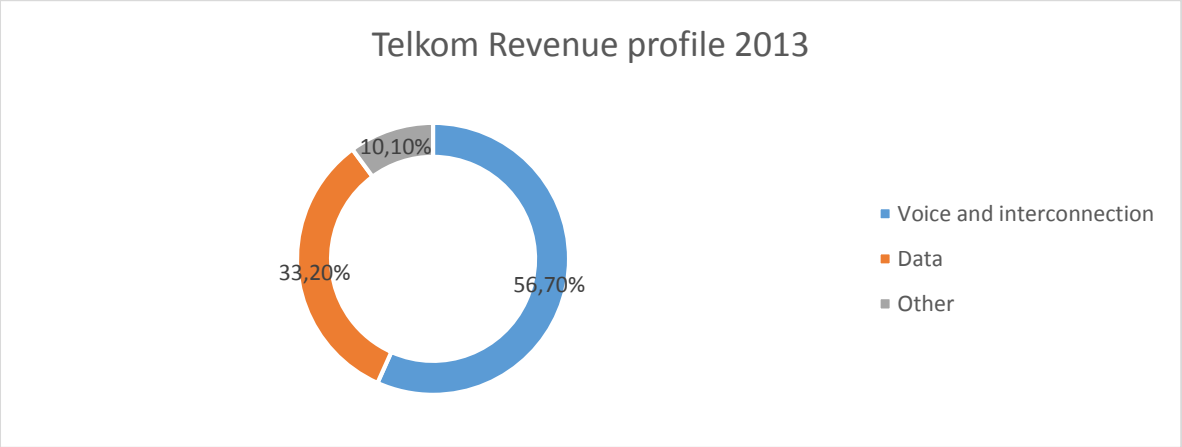
Figure 38: Telkom's future scenario of broadband mix



Source: Adapted from Telkom presentation to SA Parliament: (Mavuso, 2012)

Fig. 38 shows that Telkom believed that fixed voice growth would be flat going into the future, whilst mobile voice growth would be high but consistent. This trend, according to Telkom, was a global phenomenon where companies in the fixed line space were battling fixed-to-mobile substitution. Telkom stated their intention to use their extensive network to integrate converged products such as mobile to deliver value-added broadband services like video-on-demand services; and to that end have entered into a partnership with global giant Samsung to provide entry-level Smart TV services to consumers (Telkom, 2012). In the 2013 reporting period data had grown to become one of the biggest earners in the group.

Figure 39: Telkom's revenue profile 2013

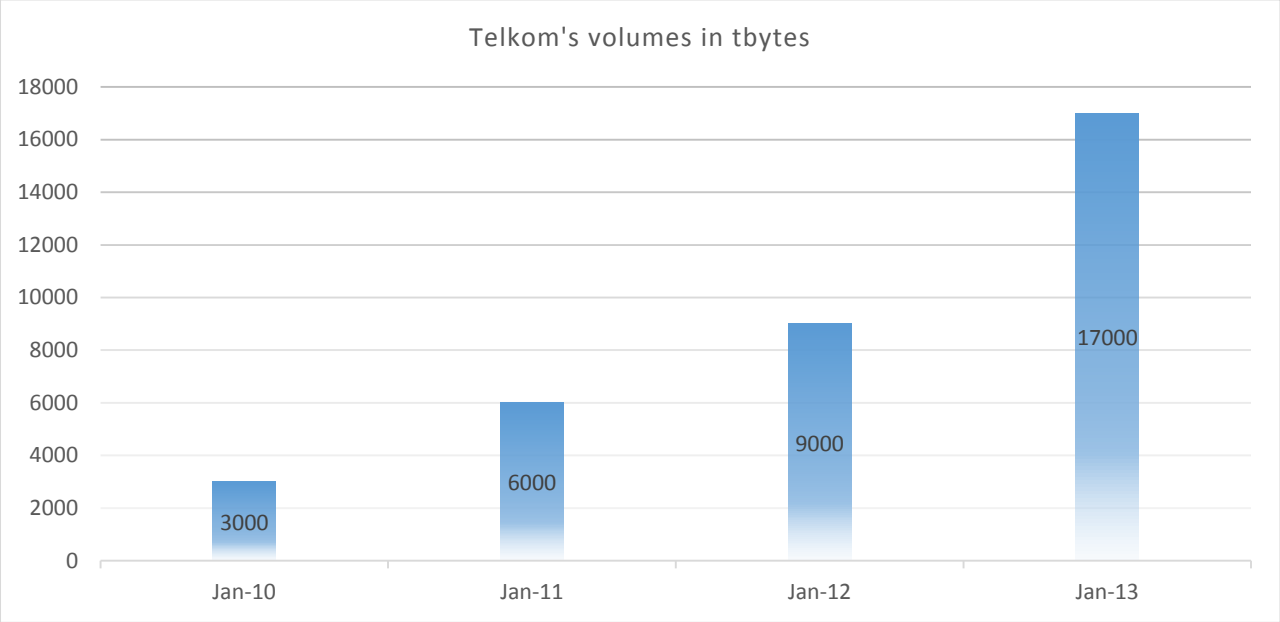


Source: Telkom Results Presentation (2013)

Telkom reported that their investments have made the firm to have the largest footprint in South Africa, with over 147 000km of coverage, 80% of which was fibre and network upgrades from cash

operations delivering speeds of up to 40Mbps and reduced fault rates (Telkom, 2013). The group was showing a balanced performance in data markets, with overall increase in terabytes.

Figure 40: Telkom's data volumes in SA



Source: Telkom (2013)

By 2014, with reduced prices and growing but slow market confidence, Telkom announced that they had entered into an agreement with MTN, where " the parties intend to conclude network management services and reciprocal roaming agreements, whereby MTN will take over financial and operational responsibility for the rollout and operation of Telkom's radio access network (RAN)" (Telkom, 2014). MNO-R1 stated that the smaller firms like Telkom Mobile and Cell C had eroded their revenues and value by entering into dangerous and unsustainable price wars with the large incumbents.

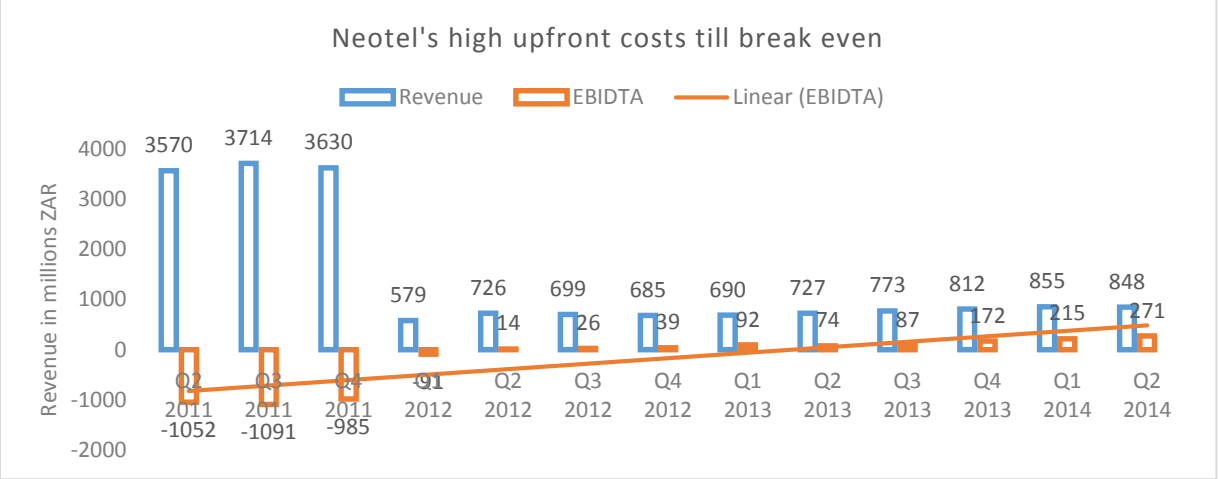
Telkom has pushed back the demands by the market for the implementation of LLU, stating fixed-line broadband has been overtaken by mobile in terms of numbers and subscribers (Telkom, 2012). According to respondents, the debate on LLU had become insignificant in the broader investment space, as technology had evolved and the sector's mobile vertical players have since developed technological and wireless capacities that can serve the last mile efficiently (SAR-R1).

According to RR-1, should ICASA decide to proceed with unbundling Telkom's last loop, it could have major implications as this should be universally applied and unbundling should affect all operators with networks, subject to new market definitions.

4.3.5. Neotel's SNO lands in the rapids

The initial years of Neotel saw vast capital investments in the delivery of fibre networks, with great investment capital leverage from Tata, a company that is regarded as the largest investor in submarine cables and global fibre networks. Fig.41 shows significant upfront capital expenditures by Neotel as they sought to scale the high barriers of a solid market, made worse by their late entry.

Figure 41: Neotel scales the high barriers to entry in the tight SA broadband market



Source: (Tata Communications, 2014)

By 2013 the investment trend swung with a profit, and Neotel made a "pre-tax profit for the first time in its seven-year history after growing revenue by 21 percent despite price erosion and lethargic uptake of fixed lines" (Business Report, 2013). Tired from the slow growth of their investment in South Africa and the realisation that they would require further costly investment to compete in the fast converging market in the country, Tata decided to review their strategy in South Africa and decided to enter into discussions with Vodacom to sell off Neotel to the country's largest mobile operator. Reports from India also speculated that Tata had put a deal to UK investor Vodafone, Vodacom's parent company to make a full purchase of Tata's full portfolio in telecoms; and since the "government of India holds 26% in Tata Communications and as part of the deal negotiations with Vodafone, Tata Group will first buy out government's stake in the company and then sell to the UK based telecom giant" (Poddar, 2014).

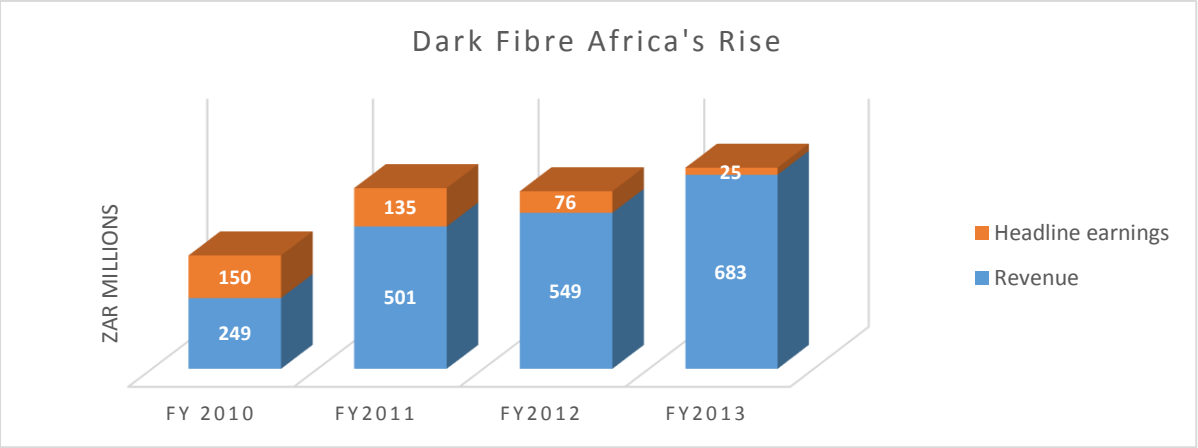
4.3.6. Dark Fibre Africa invests quietly in dark fibre

Dark Fibre Africa was bought in 2010 as part of the R3.7 billion Venin re-acquisition by diversified listed entity REMGRO. VenFin's most significant investees were Sabido, SEACOM, Tracker and CIV Group, which included the investment in Dark Fibre Africa (DFA) (REMGRO, 2010). In the acquisition package REMGRO acquired 25% of undersea cable SEACOM, 31% of ETV, commercial radio station YFM and little known fibre optics company DFA, a struggling unit that they capitalised for R85million over ten

years. CIV Fibre Network Solutions (CIV FNS) and DFA build, own, maintain and monitor infrastructure suitable to carry services such as fibre optic network. (REMGRO, 2010).

Investors in SEACOM have agreements in place that safeguard the flow of information about the project. In terms of the agreement binding shareholders, investors in SEACOM, which launched the first terabit in 2009, are not allowed financial disclosures (REMGRO, 2011).

Figure 42: DFA shows positive revenues with increased market uptake



Source: REMGRO Annual Report 2010-201

Before the watershed Altech ruling, DFA had "only eight drilling machines , roughly 200km of ducted cabling in the ground in the Gauteng-KZN-Cape Town, and anticipated to have laid 700kmby year-end" (Anderson, 2008, p. 15). REMGRO increased their equity in 2013 to 50.8% of DFA, with the value of fibre capacity in the group having grown to R4-billion from R3-billion, and the group planned further investment in multi-channel television and radio stations.MNO-R1 stated that DFA could be a new significant player in the services levels of the value chain on the basis of the fibre network they have already laid countrywide, but could be limited by the availability of spectrum. RR-1 highlighted that DFA had also become the preferred lease partner for public utilities' networks, and have earned huge incomes from the lease agreements.

4.4. Public investment in broadband

The purpose of this step was to establish the extent to which Government played its role in investing in broadband infrastructure. Government was seen as the custodian of policy, which influenced regulatory interventions and thereby a major determinant of investment patterns/appetite and the evolution of market structure. This step also focused on the role of state-owned entities (SOEs) that had mandates of investing or influenced broadband investment trends**.**

4.4.1. National Treasury Provisions for Broadband Infrastructure

The national government of South Africa has adopted the National Development Plan as the policy blueprint for various infrastructure development interventions and programmes of the national government. Focusing on broadband infrastructure, the NDP laid down enabling conditions : NDP (RSA, 2012): establishing a national, regional and municipal fibre-optic network to provide the backbone for broadband access; driven by private investment, complemented by public funds required to meet social objectives; and changing the regulatory framework to ensure that Internet broadband capacity improves, prices fall significantly and access improve.

Table 17: SA Government allocation for investment in broadband

ICT infrastructure Support	2013/14.	2014/15	2015/16	2016/17
Sub-programme	Adjusted appropriation	Medium-term Expenditure estimate	Medium-term Expenditure estimate	Medium-term Expenditure estimate
Broadband	R419,780,000	R68,231,000	R71,995,000	R162,478,000
Digital Terrestrial Television	R852,459,000	R454,679,000	R697,002,000	R732,634,000
Total	R1,272,239,000	R523,000,000	R768,997,000	R895,112,000
Change to 2013 budget estimate	R691,355,000	R397,464,000	R710,702,000	R108,105,000

Source: (MyBroadband, 2014)

Broadband investment was addressed through the policy mandate of the Department of Communications, which is : “To create a vibrant ICT Sector that ensures that all South Africans have access to affordable and accessible ICT services in order to advance socio-economic development goals in support of the African Agenda and contribute to building a better world” (DoC, 2014).

Key Informant RR-1 stated that the protracted arrival of the national broadband policy and inefficient regulation by ICASA has led to a market where investment in broadband networks was an inadvertent prerogative of the private sector, which meant that the state had little broadband of its own. The private sector had also evolved and exploited regulatory loopholes that undermined competition and raised entry barriers (refusal to access, non-disclosure, and high prices).

According to Key Informants SAR-1 and NGO-R1, the fiscus provisions were a positive development to the creation of local area networks, and government structures like Provincial governments and municipalities, could methodically develop a resource pool and execute competitive public bidding or open tender processes with other local institutions. Respondents lauded the National Development Plan’s as a clear indication that structural bottlenecks would be loosened and community participation in the delivery of local broadband enhanced.

4.4.2. Municipal Broadband

Municipal broadband licences are a derivative of the ECA's classification of licences into service licence and network infrastructure licence .Furthermore, these two broad categories can be divided into two specific licences, a class license and an individual license. The class license could simply be applied for, and allowed for the provision of electronic communications services/infrastructure deployment on a municipal scope, provided there was no significant impact on socio-economic development (UniNet, 2006).

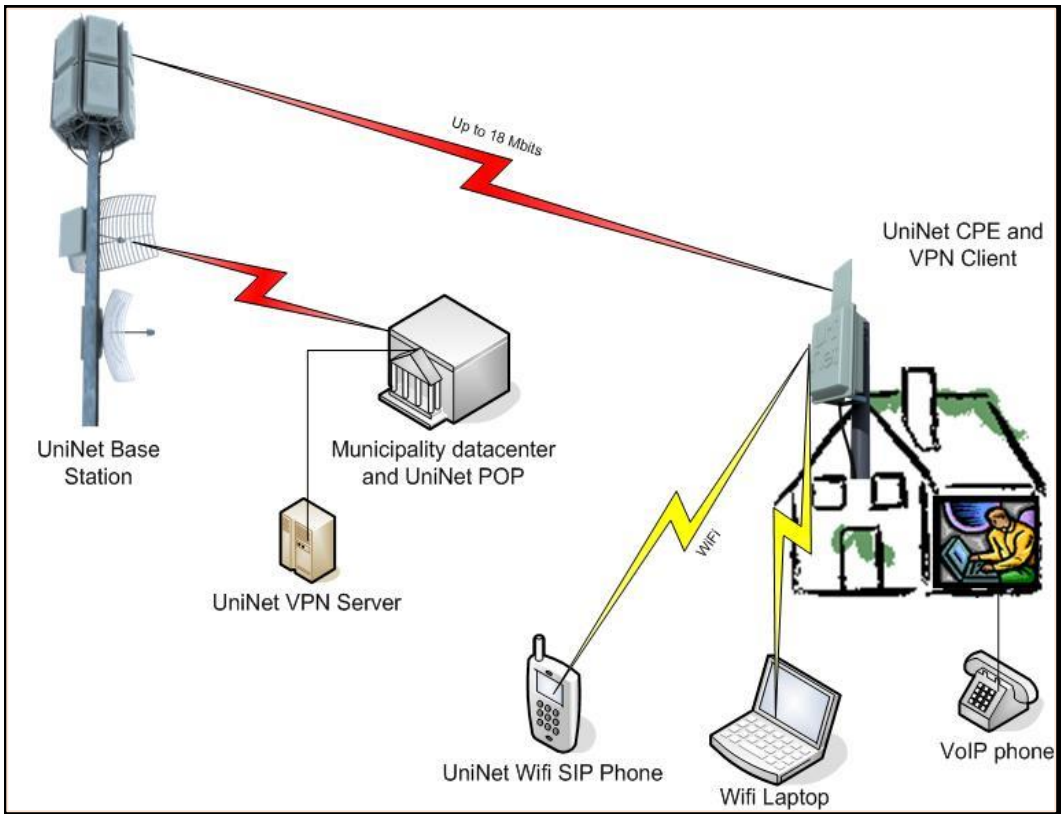
Table 18: Municipal broadband investments in South Africa

Municipality	Strategy	Investment
City of Tshwane	Provision of free internet at Wi-Fi hotspots in the city, each supporting 10000 connections at a time (Mudzuli, 2013).	R250 million over 3 years
City of Joburg	900 kilometre of fibre optic broadband cable rolled out as part of Johannesburg's efforts to provide strategic infrastructure which will accelerate economic growth and development (City of Joburg, 2014)	R1-billion Johannesburg Broadband Network Project (JBNP wireless data network supported by power line communications aimed at transforming Johannesburg into a "digital city" over the next three years (Otter, 2009)
Knysna Municipality	Knysna, in partnership with UniNet, wireless network providing its inhabitants with broadband and telephony services (Otter, 2009).	UniNet innovatively proposed that the Knysna Municipality reallocate a percentage of the total telecommunications budget (which stood at R12 million or 3% of their R400 million tax revenues) towards funding the project (UniNet, 2006)
City of Cape Town	Rolling out fast internet to the public (Mudzuli, 2013)	R1,3 billion over 7 years
eThekwini Municipality	eThekwini expanding its network and means of developing it into more than connectivity for city offices. The fibre network will ultimately span the entire municipal area (Perry, 2008)	Unspecified

Source: Adapted from various sources

Knysna's partnership with UniNet, heralded as an international case study due to its success, was established through open tender. In terms of contract roles and responsibilities with the municipality of Knysna, it would be UniNet's task to install/roll out the necessary infrastructure required to provide VoIP telephony and broadband data connectivity between council buildings as well as at public hotspots (UniNet, 2006).

Figure 43: The Knysna Municipality broadband case



Source: UniNet (2006)

The result of this agreement is a case of international scrutiny and awards, due to its benefits to the local citizens and business through open access.

Table 19: The UniNet price effect in Knysna

Voice Pricing

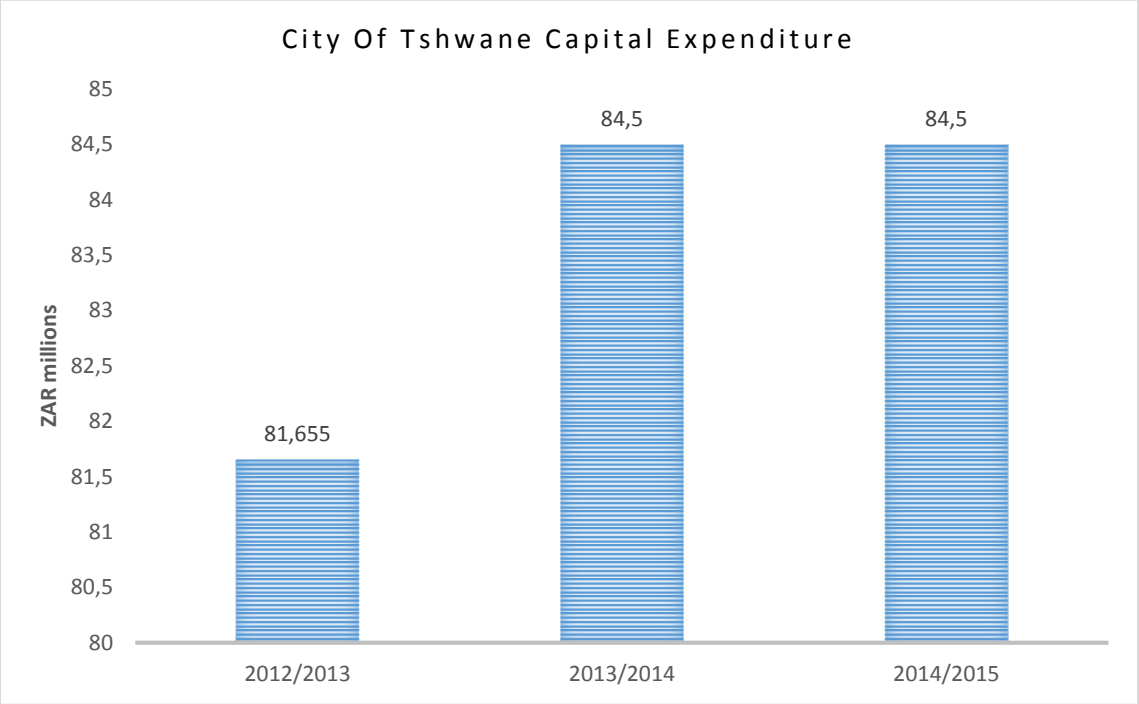
Comparative Rates	UniNet	Cellular Pre-Paid (average)	Land-Line (average)
All Prices VAT inclusive		Rate Per Minute (peak / off-peak)	
Cellular	R 1.65 / R 1.10	R 2.85 / R 1.60	R 1.88 / R 1.17
Local	R 0.37 / R 0.15	R 2.62 / R 1.45	R 0.38 / R 0.16
National	R 0.79 / R 0.39	R 2.62 / R 1.45	R 0.80 / R 0.40
Calls on same Network	R 0.20 / R 0.10	R 2.55 / R 1.40	R 0.38 / R 0.16
Data Rates per MB	R 0.50	R 2.00	N/A

Source: UniNet (2006)

The pricing structure in Knysna shows immediate benefits to the locality through costs that are comparatively favourable and cheaper than the industry norms. Respondents (MNO-R1, RR-1)

observed that municipalities and their broadband plans were frowned upon since they were seen to be less effective and wasted tax payers' resources as they still resell their fibre networks to private operators. In Gauteng the City of Tshwane provided free internet access in the city with a determined investment strategy that seemed to have paid off dividends of connectivity to the local citizenry.

Figure 44: City of Tshwane's broadband CAPEX plan



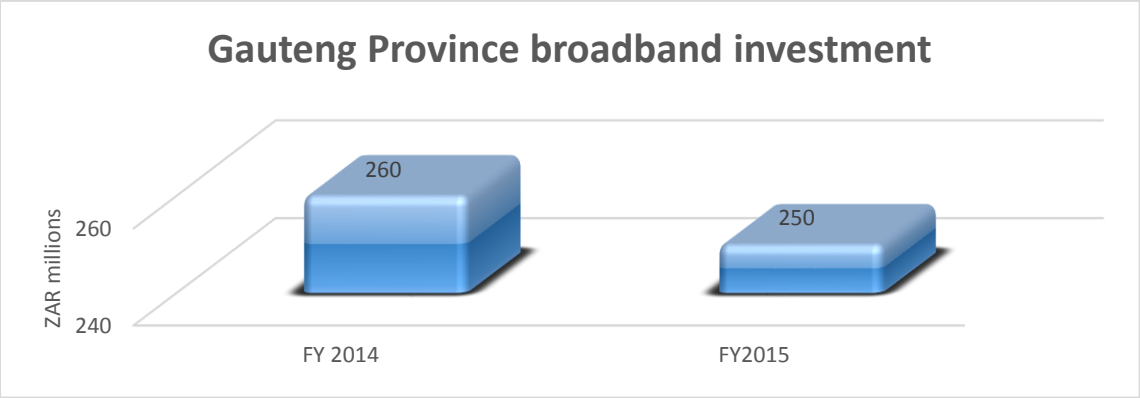
Source: Tshwane (2012/13)

The City of Tshwane (COT) planned to implement a roll-out of over 600 hotspots spread across Tshwane in order to close the gap on the digital divide. The municipality said that it had already rolled out approximately 500km of fibre to support the business of the City, thus saving through on-net costs in the city (Morokolo, 2014).

4.4.3. Gauteng Province and the provincial broadband strategy

Gauteng province announced their network plans in 2014 after appointing Altech Alcom Matomo, to a five year tender to "build, operate and maintain a 1600 km fibre optic broadband network that will offer broadband fibre internet access to the province's 316 government-owned buildings, 45 Thusong centres, nine economic development zones and 20 priority townships covering 95% of Gauteng" (Mtshali & Ndaba, 2014).

Figure 45: Gauteng province's ICT plan



Source: Press reports (2014)

Amongst the priorities of the phased investment would be "connecting government building to the Gauteng online network, sustaining stable LAN and WANs, prioritisation of VoIP as soon as 1Gbps bandwidth is available and establishing a managed data centre and fibre optic network" (Roane, 2014). Gauteng had a total of 376 exchanges, the same number as the province has had since 1980 (South African Broadband, 2012).

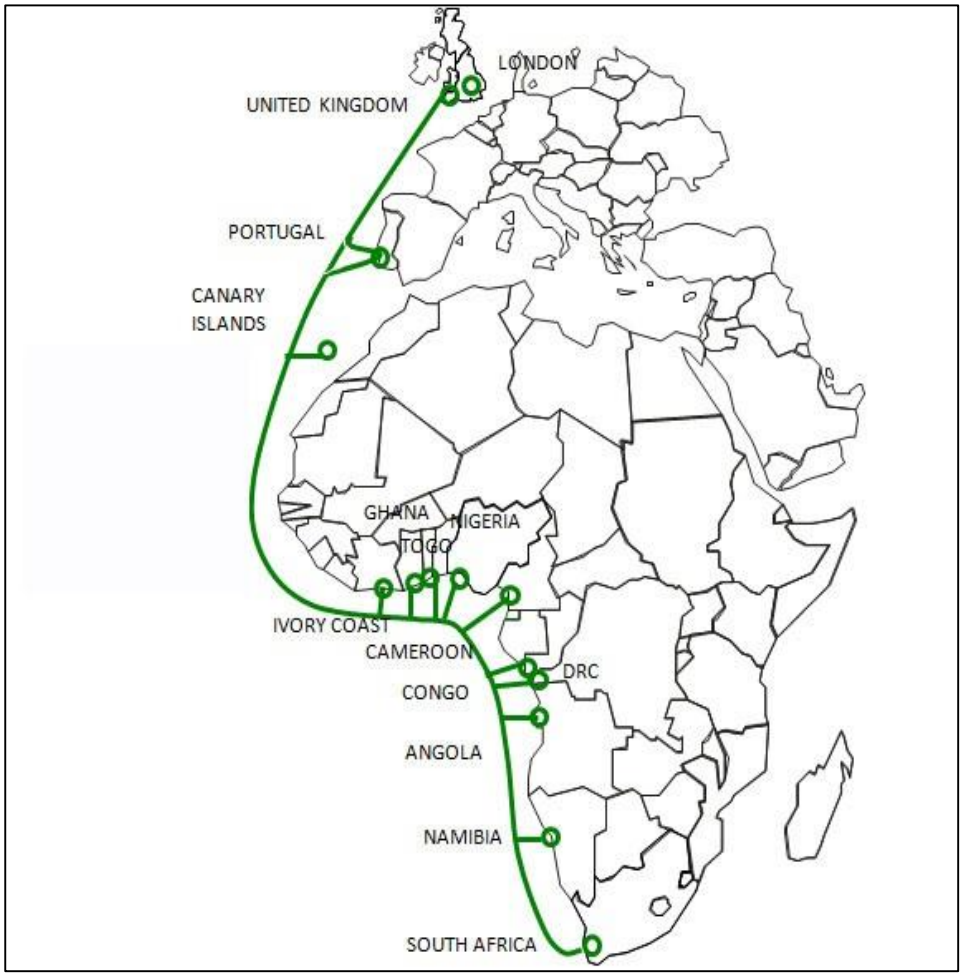
4.4.4. Broadband Infraco

Broadband Infraco, established through the Broadband Infraco Act, No 33 of 2007, is an SOE that resulted from the merged telecommunications assets of government owned Eskom Telecommunications (a division of Eskom Enterprises (Pty) Limited) and Transtel (a division of Transnet Limited); both of which had designed and constructed telecommunications assets, both in the long-distance, metro and access environments of the network with the intention of guaranteeing Eskom and Transnet 30% equity stake in the Second Network Operator (SNO), now Neotel (Pty) Limited (Broadband Infraco, 2008)

To ensure that Infraco realised international connectivity, the company became a major shareholder in the West African Cable System (WACS), a partnership with private sector investors that comprised

“of a 5.1 Tbit/s submarine cable deployed between South Africa and the United Kingdom with 14 landings on the west coast of Africa and Europe, terminating in London” (Broadband Infraco, 2014).

Figure 46: Broadband Infraco's WACS network



Source: Broadband Infraco (2014)

Broadband Infraco received an I-ECNS licence from ICASA at the end of 2009, thereby obtaining the required “legal framework within which the company could execute its wholesale business model, that is, to provide long distance telecommunications services to other licenced or licence exempt operators in South Africa” (Broadband Infraco, 2010).

By 2011 Infraco declared that they had grown to become the second national long-distance network operator in South Africa (after Telkom). Though this was a positive development, Infraco suffered losses of several hundred millions; which the entity attributed to start-up wobbles, stating that it was very typical for new start-up telecommunications entities to experience negative operating results for the first 5 years of operations (Broadband Infraco, 2011). Losses were contained in 2012, with the company recording improved cash flows of R52.8 million (Broadband Infraco, 2012), on the back of new customers and an aggressive capital expenditure that had delivered 12 765km of fibre optic

network bypassing most major cities and towns and all nine provinces (Broadband Infraco, 2012). Broadband Infraco's customers included with Neotel, Liquid Telecommunications and MTN, contracts with SALT/KAT (via Neotel), Seacom, Vodacom, Internet Technologies (Namibia) and Business Connexion (Broadband Infraco, 2012). Neotel reduced their commitment to Infraco in 2013, which inflicted a loss of 40% to Infraco's revenues and forced Infraco to sell their 70% shareholding of WACS to the CSIR in order to raise liquidity in the forthcoming financial year (Broadband Infraco, 2013). Infraco's infrastructure programmes were presented to the SA parliament and aimed, through loan funding from commercial institutions, development finance institutions and the Universal Services Fund, to target the rollout of fibre and access networks infrastructure rollout in the provinces (Broadband Infraco, 2012).

Table 20: Broadband Infraco's envisaged CAPEX

Project	Province	2013/14	2014/15	2015/16	2016/17	2017/18	TOTAL
EC Inland connectivity	EC	244 166					**244 166**
2nd Northern Ring	LP, MP	220 202	181 217				**404 419**
Access network connection	GP,WC,KZN, FS		426 556	285 091		122 154	**833 801**
Northern Cape Connection	NC				364 344		**364 344**
NW Connection	NW					125 177	**125 177**
TOTAL EXPANSION		**464 368**	**607 773**	**285**	**364 344**	**247 331**	**1 968 907**
Customer expansion							**741 000**
Total Replacement Upgrade	All provinces	440 516	173 924	200 985	197 988	315 368	**1 328 781**
TOTAL EXPENDITURE		**904 884**	**781 697**	**486 076**	**562 332**	**562 699**	**4 038 688**

Source: Broadband Infraco (2012)

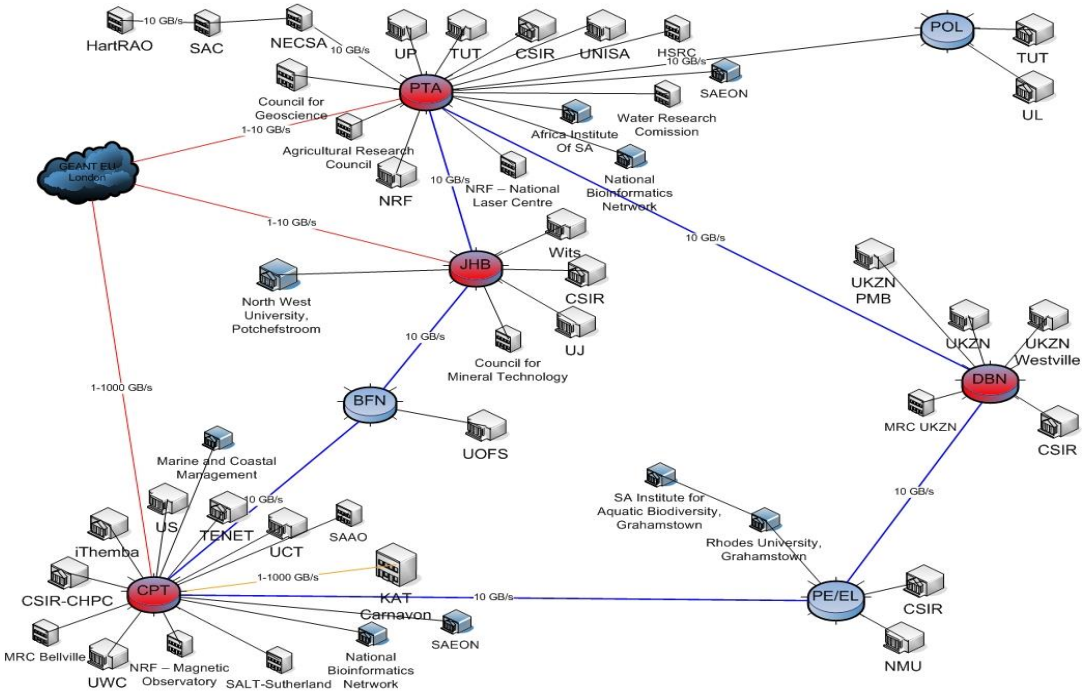
Infraco had been critical of SA Connect, as the role for the SOE was not clarified, and the Board of Infraco suggested that the National Broadband Policy aligns itself with the Broadband Infraco Act of 2007, the draft Broadband Policy and work done by the Presidential Infrastructure Coordination Commission (PICC), the ICT Policy Review and legislation underway to enhance the Electronic Communications Act and the ICASA Act, in order to limit duplication and waste of state resources (Broadband Infraco, 2013).

4.4.5. South Africa National Research Network gets in the mix

SANReN was launched as part of a R36 million investment in Pretoria. The network formed part of the a high speed network that aimed to connect more than 200 research and tertiary sites around the country with one another as well as with international research and education organisations globally (Mahlong, 2011). SANReN provides international connectivity via the SEACOM submarine cable through an arrangement with SANReN's operating partner TENET. The 245 kilometre Pretoria link

constituted a dark fibre network installed by DARK Fibre Africa – which was awarded the contract for this part of the SANReN network (Mahlong, 2011).

Figure 47: SANReN's network to educational institutions in SA



Source: (Wright, Kuun, Mahalima, & Daniel, 2006)

SANReN's network "allows researchers in South Africa to collaborate with their colleagues locally and internationally, supports other large scale initiatives such as SALT, KAT, eVLBI and SKA which require high capacity communications infrastructure via a country-wide fibre optic network" (Wright, Kuun, Mahalima, & Daniel, 2006). SANReN had no clear profit driven strategy, and their intention to work with commercial partners to roll out the network in the country's big metropolitan municipalities provided a basis from which ultra-broadband could be tested amongst various end users, e.g. organised communities like Cooperatives and farmers. By the end of 2012, a total of R 783 million was expected to have been invested by the DST to complete the SANReN network roll-out, with the entire network architecture consists of a national backbone connecting Durban, Pretoria, Johannesburg, Bloemfontein, Cape Town, Port Elizabeth and East London on a Gigabits per second network (Mahlong, 2011).

4.5. Some key factors contributory to the market structure and competition

This step looks at major contributory factors s of both private and public investors in broadband, with the purpose of establishing the developing market structure at wholesale level. Investment trends and notably the investments in various layers of the network by specific stakeholders has an impact on

both the sustainability of entities and normative/welfare targets of broadband investment. This step will also look at aligning data to developing trends that affect market competitiveness. Regulatory trends that impact on the market will be looked at, whilst mergers and acquisitions that will be looked at will yield data on the future trends of market structure due to possible consolidation.

4.5.1. Governance and ownership of major infrastructure in South Africa

The investment patterns of both the private sector and the public sector were evidence that South Africa had no shortage of investors in the telecommunications sector, though ownership structures were complicated and undermined competition. According to Key Informant SAR-5, though substantial investments have been sunk in undersea cables to increase capacity, investors in these undersea cables had tended to be the same people, and this has lessened competition.

Table 21: Ownership of Undersea cables

	Seacom	EASSy	WACS	SAT-3	MainOne
Cost (millions USD)	650	265	600	23,4	240
SA Investors	VenFin (25%=$75m), Convergence Partners (12,5%=$37.5m), Shanduka Group (12,5%=$37,5m)	Telkom, Neotel,MTN, Development Financial Institutions (DFIs) including World Bank/IFC, EIB, AfDB, AFD, and DfW	Broadband Infraco , Telkom, Vodacom, MTN, Tata Communications (Neotel	Telkom (20%=$4,7m)	Privately owned, African Development Bank confirmed USD 66 million financing for the project
Length (KM)	13,700	10000	14000	27,850	7000
Capacity	1.28 TB/s	4.72TB/s	5.12TB/s	720 Gbp/s	1.92 TB/s
Completion	July 2009	July 2010	Q3 2011	April 2002	Q2 2010

Sources: Adapted from various press reports

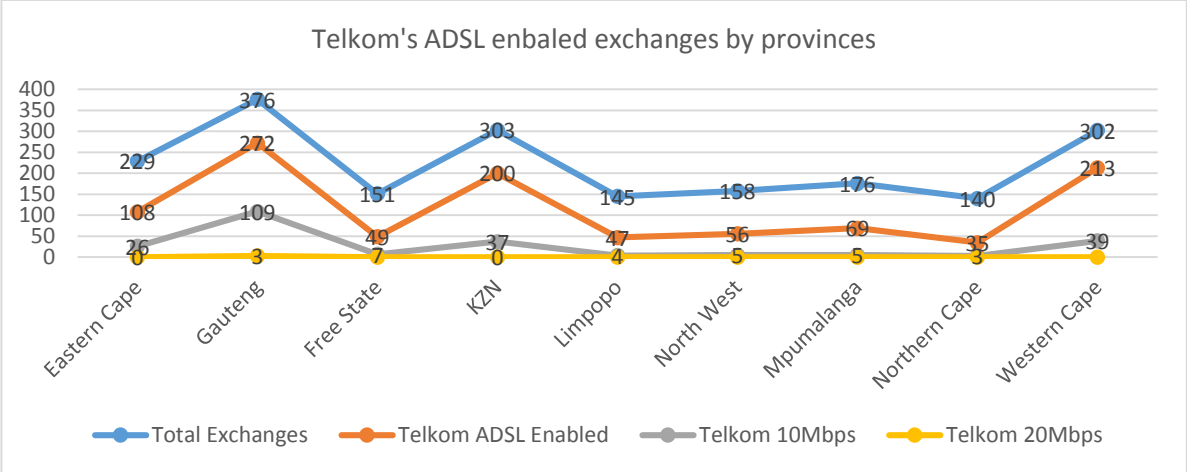
Key Informant SAR-5 narrated that ownership structures of undersea cables was always a complicated item, and monopolies still existed, with the propensity for role layers to be in conflicted roles widespread as shown by the former Director General of Communications, who was a shareholder in one of the undersea cables, and current Deputy President Cyril Ramaphosa, whose company Shanduka invested in undersea cables whilst he was chairman of MTN .Investors in undersea cables showed a substantial number of operators that were active in terrestrial, fixed networks and wireless broadband networks, thereby displaying tendencies of being active in all rungs of the broadband value chain and implicitly raising questions about the competitiveness of the market. For instance, VenFin now called Dark Fibre Africa, was one of the largest fibre backbone networks that benefited immensely from the self-provision stampede of VANS, in partnership with Convergence Partners of Andile Ngcaba, former DG of Communications and the Shanduka Group of current Deputy President Cyril Ramaphosa. Telkom, 40% owned by the South African government, were investors in EASSy,

WACS and SAT-3; MTN were investors in both EASSy and WACS and were in partnership with a few other players in terrestrial fibre. These ownership structures displayed clear potential for conflicts of interest, and the structures were further complicated by the sources of their funding being the same development finance institutions like the African Development Bank and Development Bank of Southern Africa.

4.5.2. Spatial bias of investment

The focus on commercial hubs at the expense of outlying rural areas showed spatial bias. SAR-4 noted that most of the firms were focusing on the metros and office parks, where the market was self-sufficient; while the rural and under-developed areas in the provinces, (as illustrated in Fig 49) had shown insufficient demand and consumer access had been hampered by little affordability.

Figure 48: Telkom's ADSL-enabled infrastructure by province



Source: Broadbandstats (2014)

The spread of ADSL showed that Telkom had invested in telephone exchanges countrywide; though these were concentrated in the urban areas and the majority at 10Mb/s. It therefore followed that the larger portion of access to Telkom broadband would be in the urban areas. Key Informant SAR 5 noted that there was a growing contrast of investment. Whilst South Africa could boast significant investment in undersea, the country did not possess large investments in terrestrial backhaul that is able to move from South Africa through to neighbouring states.

4.5.3. Lack of clear infrastructure sharing strategies

According to Key Informant SAR-4, the fibre and wholesale market had been allowed to develop by itself, ensuring that technology evolution happens at own space and creating abundance of fibre in urban areas, much to the exclusion of rural areas and lack of competitive infrastructure sharing strategies .

Figure 49: FibreCo fibre network across South Africa



Source: FibreCo (2014)

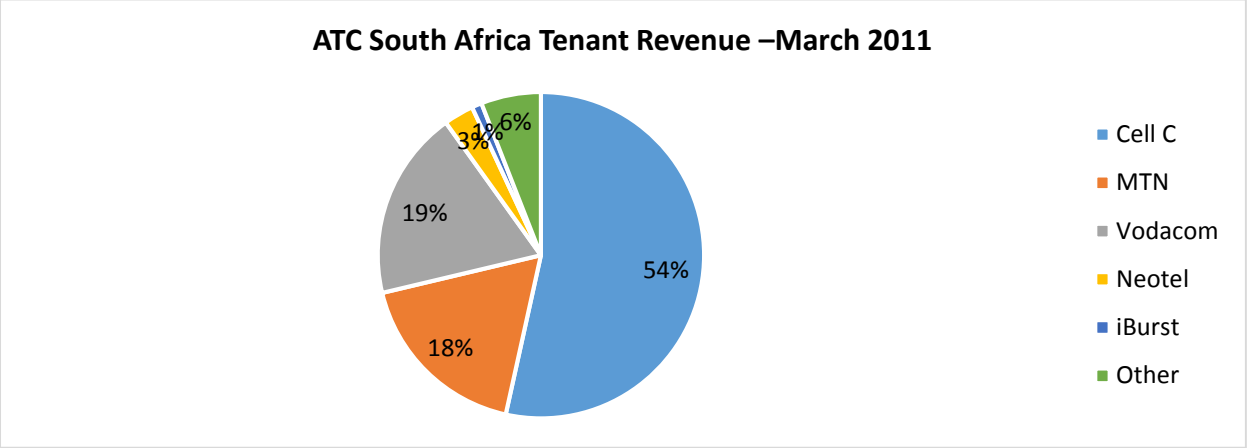
According to Key Informants SAR-4 and SAR-5, the FibreCo was evidence of a growing pattern where firms had invested in co-building for their own organic requirements than with the intention to open up their infrastructure to possibilities of sharing with new entrants, just as Telkom had not done. Fibreco and Telkom had bypassed rural areas of the country, and by so doing cherry picked their areas of competitiveness and commercial focus. Respondents stated that there were positives to this category of investment, as the country had built an abundance of cables that have provided sufficient long distance and international connectivity, allowing for the sector to explore FTTH and office parks, and thus stimulate local investment through the involvement of community based organisations or cooperatives in the implementation formations.

4.5.4. Investment in unregulated access infrastructure

According to both Key Informants SAR-5 and MNO-R1, investments into access networks had manifested a huge, unregulated industry that by itself had the potential to distort the market structure further, due to the huge upfront investments made and the type of players.

A big player in this rung is the American Tower Corporation, “a leading wireless and broadcast communications infrastructure company with a portfolio of over 35,000 communications sites, including wireless communications towers, broadcast communications towers and distributed antenna system (DAS) networks” (ATC, 2010) that entered South Africa in 2010 to become South Africa’s “largest independent wireless infrastructure company” (ATC South Africa, 2014).

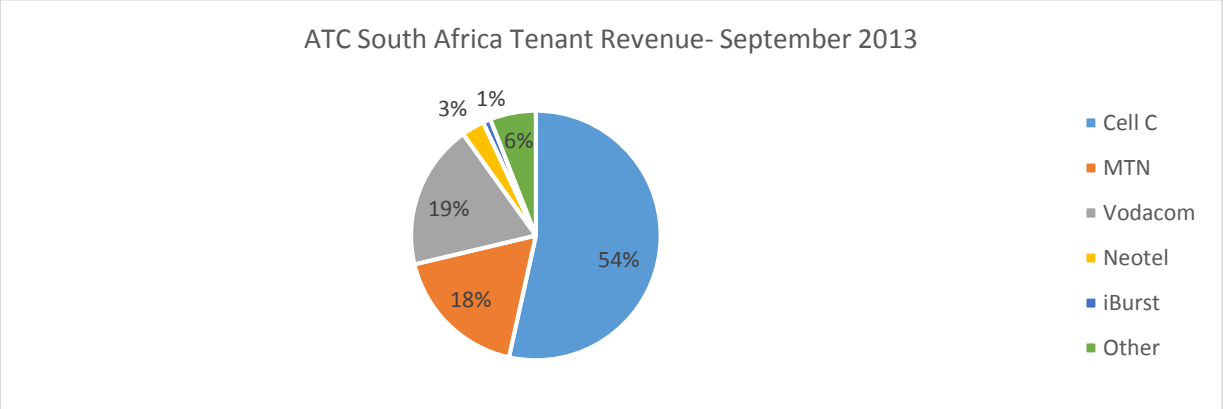
Figure 50: ATC started their South Arica operations in 2010



Source: ATC (2013)

Demand drivers for the growing uptake of ATC infrastructure in South Africa was led by high smartphone penetration and broadband usage, with Vodacom average smartphone usage up 78.9% to 220MB / month and mobile data traffic expected to grow at 58% CAGR over the next five years (Hess, 2013).

Figure 51: Significant increase in demand for ATC infrastructure



Source: ATC (2013)

The growth of ATC was attributed to firms in South Africa seeking to scale up capacity with 4G deployment and launching LTE in major cities of South Africa in 2013, whilst mobile data traffic was expected to grow at 58% CAGR over the next five years (Hess, 2013). Respondents stated that the

draw back in the development of tower tenants for ATC was the fact that this investment in broadband capacities in the country remained unregulated with onerous lease conditions, and as such the development seemed to be aiding the trend of consolidating advantage for the larger firms.

4.5.5. The spectrum bottleneck

Broadcasters and telecommunication companies have tussled over the imminence of the digital dividend spectrum as a direct result of the expected digital migration. The frequency bands termed Digital Dividend 1 (790MHz–862MHz) and Digital Dividend 2 (694MHz–790MHz) , currently occupied by broadcasters, were set to become available by 2015 when South Africa was expected to have concluded its migration from analogue to digital broadcasting (Bronkhorst, 2013). Timeframes to complete digital migration could be affected, with SMPs having demanded more allocations to match their market needs in the densely populated cities where they faced network congestions and higher demands of data. According to MNO-R1, the ECA eliminated the various technology standards and replaced with technology neutrality, but had not completed allocative strategies due to the pending policy guidelines. RR-1 highlighted that allocation before the National Broadband Policy's implementation would perpetuated the current, less efficient market structure as allocation could favour the SMPs. There were benefits of scale that accrued from the spectrum blocks and these reduced the investment prerogative on some of the operators; hence the regulator needed sufficient consultation with all stakeholders in order to develop allocation models that would be accepted and not lead to endless litigations.

Table 22: The Top 4 carrier characteristics

	ATC Customer	Subscriber market share	Spectrum holdings	Current technology	LTE
Vodacom Vodafone	Yes	44%	11 MHz in 900 12MHz in 1800 30Mhz in 1.9/2.1	3G/4G	4G launched in 2012, continued expansion 2013
MTN MTN Group	Yes	37%	11 MHz in 900 12MHz in 1800 30Mhz in 1.9/2.1	3G/4G	Launched in Johannesburg, Pretoria, Durban in 2012
CELL C Saudi Oger Ltd	Yes	17%	11 MHz in 900 12MHz in 1800 30Mhz in 1.9/2.1	3G/4G	Started testing in major cities in Q4 2012, limited to major cities in Q3 2013
8.Ta Telkom SA	Yes	2%	12MHz in 1800 30Mhz in 1.9/2.1	3G/4G	LTE started testing 2012. Coverage limited to major cities in Q3 2013

Source: ATC (2013)

MNO-R1 suggested that a new spectrum policy should be based on the number of connections, and rural areas should be serviced by mobile firms with lower frequencies on the spectrum (450Mghz), and ICASA should seek independent consultants to assist with the process in order to counter industry lobbying.

4.5.6. Mergers and acquisitions in the developing market consolidation

According to SAR-4, the delays by ICASA and the Department of Communications in the development of the country's spectrum policy had fostered the inadvertent outcome of a market where companies were inevitably starting to seek horizontal mergers and acquisitions in order to develop certain competitive capacities.

Table 23: Mergers and acquisitions at time of compiling research report

Operator	Commercial transaction	Stage	Amount	Strategic Rationale
Telkom	With BCX	Subject to regulatory approval	R2.7billion	Enable Telkom to expand existing offerings, providing scale in IT services, enhance Telkom's convergence strategy (Telkom-BCX, 2014).
Vox Telecom	Merger with preferred suitors	Bids invited	Undisclosed	Selling off customer profile of 16000 corporates and enterprises and 100 000 consumers (Techcentral, 2014)
MTN	With Afrihost	Completed	Undisclosed	Add to MTN SA's ICT service offering, focused on the consumer and small business market (Mungadze, 2014)
MTN	With Telkom Mobile	Heads of Agreement exchanged	Undisclosed	Telkom to access MTN's RAN countrywide for its Telkom Mobile Unit
Vodacom and MTN	With Nashua Mobile	Completed	R2.26 billion	South Africa's Vodacom Group and MTN Group will buy 900 000 mobile-phone subscribers from Nashua Mobile after the service provider deemed its business model unsustainable
Vodacom	With Neotel	Subject to regulatory approvals	R7billion	Synergies of fixed fibre network and access technology (Fin24, 2014)
Dark Fibre Africa	With Conduct	Market reports	Undisclosed	DFA to benefit from Conduct's last mile access technology (ITNewsAfrica, 2014)
Cell C	With various suitors	Market speculation	Undisclosed	Balance sheet restructuring

Source: Adapted from various media reports

SAR-4 revealed that other market speculations on possible takeovers included Vodacom's ambition to buy Dark Fibre Africa, and according SAR-5, Cell C remained a takeover target for other overseas investors who were seeking a foothold into the South African market. Respondents (SAR-4, SAR5) stated that the market of mobile features normally pairs out; due to the required scale of investments required in order to compete; which inevitably led to consolidation. According to SAR-5 and SAR-4, in economies of scale consolidation was the logical outcome, normally between the first and fourth years of operations, and the MNO duopoly is "cleaning up "competition.

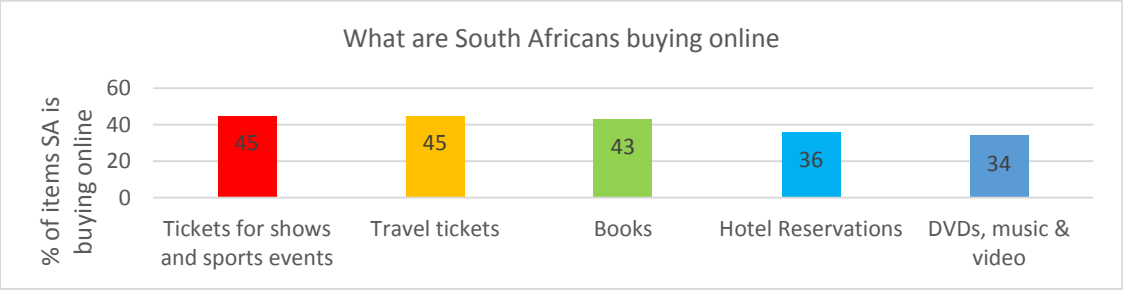
4.6. Broadband demand and access

The purpose of this step is to understand the developing trends of demand development of both the private sector and the public sector investors. Market developments are also taken into consideration, in view of the fact that firms invest in innovation to cater for growing market demands.

4.6.1. Demand and innovation

Key informants SAR1 and SAR-2observed that the private sector was a leader in developing innovations and new applications; specifically with enabling services for small and medium enterprises that require online support and quick access to bank services. Though these services were still in the infantile stages they were known amongst serious business players and most have tried to use at one point or another. Fig 52 illustrates the rising confidence in the country to access online service.

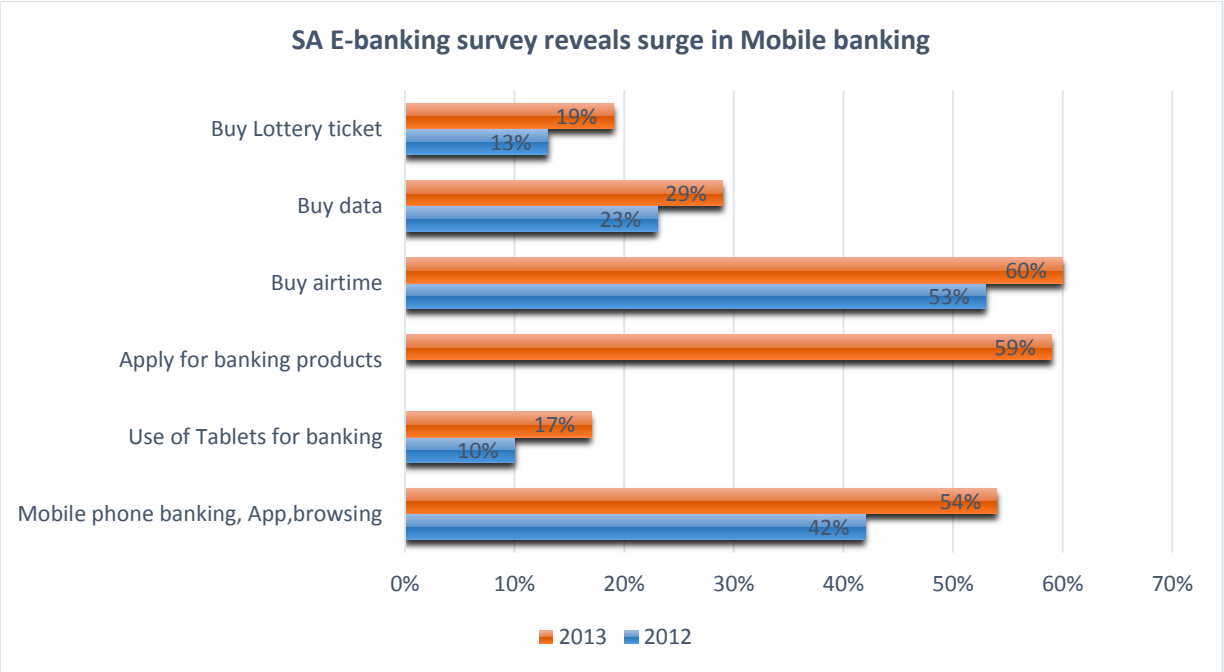
Figure 52: South Africans are increasingly turning to online purchases



Source: (Digital Media & Marketing Association, 2013)

Services like Government on-line programmes of SARS and Department of Home Affairs had also grown into useful platforms for technology diffusion. South Africans, according to Key Informant SAR-2, were slowly awakening to the reality of the digital shortcuts and they preferred that to long queues that were pervasive in many government departments, for instance with passport applications.

Figure 53: e-Banking survey shows growth in accessing online services

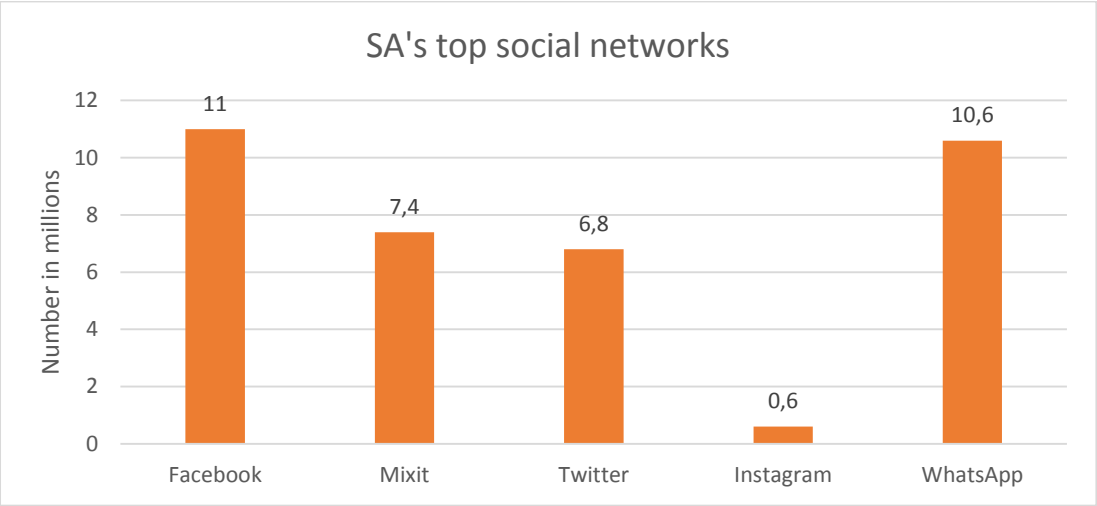


Source: Adapted from Bizcommunity (2013)

4.6.2. Data hungry Social Media

According to SAR-2, technology developments that are current in the market derive from market developments, where the use of smart phones had shifted the investment strategies of the MNOs.

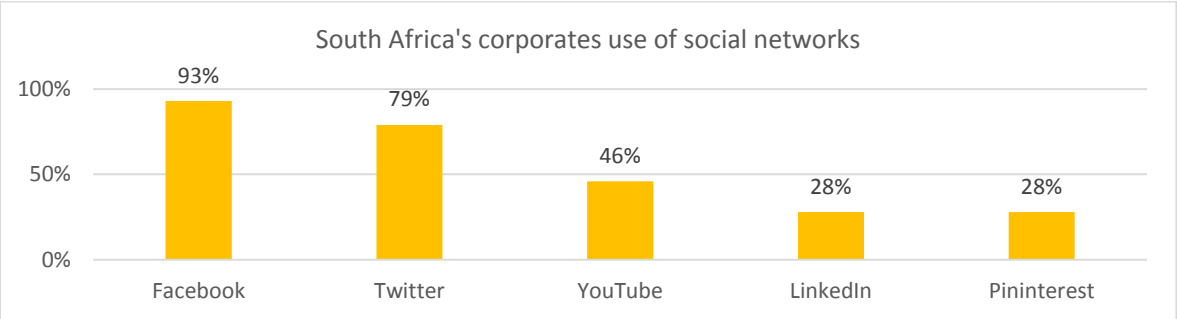
Figure 54: Social networks and IM growth in SA



Source: Goldstuck (2014)

Instant messaging applications and social networks like Black Berry Messenger (BBM) and WhatsApp, Mxit, Facebook and Twitter had contributed to a significant uptick in data consumption on smart phones, thereby creating the need for fresh investment by firms in core, transmission and access networks in order to boost increased traffic and better QoS on the networks. These networks, had become useful tools for SMEs and large corporates (Fig. 55), to market their products

Figure 55: South Africa's corporates use of social media



Source: (2014)

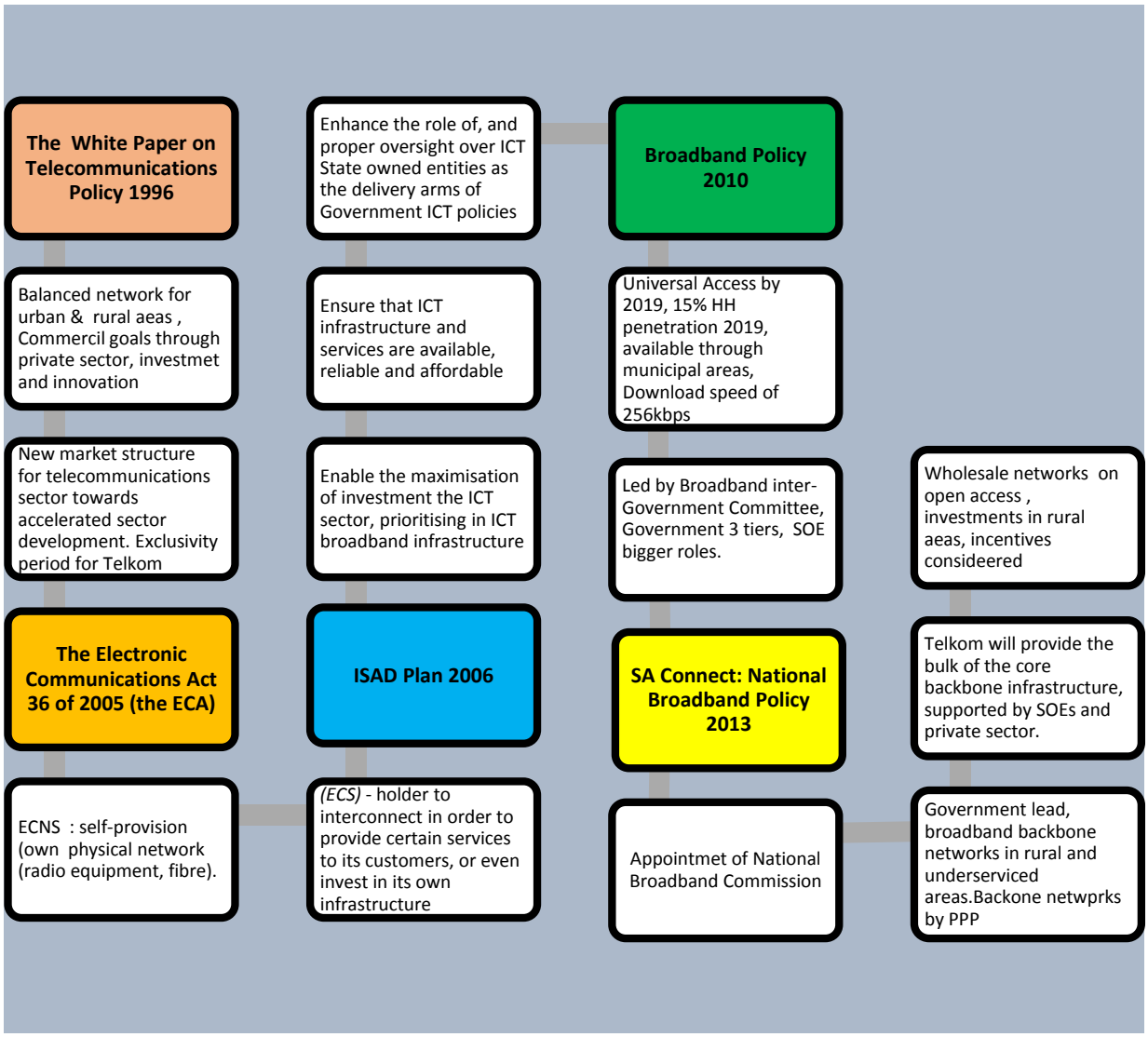
4.7. SA Connect ushers in policy optimism

The purpose of this step is to illustrate the various policies that had impacted investment appetite, and as such shape the market structure.

4.7.1. Policy milestones in South Africa

Despite the emergence of a sophisticated telecommunications market in South Africa in the democratic era, the central policy issue that has not been adequately addressed is that of achieving affordable access to reliable and robust communications infrastructure and services (DoC, 2014). According to MNO-R1 the protracted period before the national ICT plan had created bottlenecks amongst the three tiers of government and subsequently created indirect governance conundrums.

Figure 56: The various policy milestones towards SA Connect



Source: Adapted from various Broadband policies (1996-2013)

Respondents appreciated the final adoption of SA Connect and the political will showed by government. Key Informant MNO-R1 observed that from a policy perspective, Government had finally got the right policy response strategy with the PICC; which showed political will and commitment to infrastructure integration, as the PICC would lead in providing a well-defied infrastructure investment environment that would provide ex ante clarities on government investment contribution, roles and

responsibilities, governance and economic value. Whilst there are various facets of the Broadband Policy 2013, the following are poignant for this discussion (RSA, 2013).

Table 24: Policy recommendations of SA Connect 2013

Strategic Pillar	**Policy Recommendation**
Social redress	▪ Government will lead in the deployment of broadband backbone networks especially in rural and underserviced areas, which are regarded as not being commercially viable by operators
PPP	▪ Policy advocates for the deployment of wholesale backbone networks by the public and private sector players.
ROI	▪ Incentives to encourage investment in underserviced and rural areas that are traditionally not attractive to private sector investors.
Access Regulation	▪ Wholesale networks will be operated on open access and non-discriminatory principles
ICASA	▪ ICASA will develop requisite wholesale regulations to support service-based competition.
Price Regulation	▪ Interventions to reduce firms' ROI requirements being barriers to entry at wholesale and retail levels.
Fixed Incumbent	▪ Telkom, along with private sector firms and SOEs, will provide the bulk of the core backbone infrastructure.

Source: Adapted SA Connect, National Broadband Policy (RSA, 2013)

Key Informant MNO-R2 highlighted that the appointment of the National Broadband Advisory Council (NBAC) was a welcome, positive development and showed leadership at political level was charging forward to implementation levels, and the ICT sector awaited to see how the NBAC executed their mandate specifically with unblocking broadband bottlenecks and encouraging SOEs like DFIs to participate. DFIs, according to MNO-R1, were shy of participating in investing in the ICT due to its risk profile and generally untested innovations.

Table 25: Some comments from respondents on regulatory gaps

RR-1	Rapid Deployment Guidelines and Access regulations reviews in the coming months should be able to enhance roll-outs
MNO-R2	Review of broadband capacities in the country should include aligning institutions for servitudes like Eskom, Transnet and the SASOL gas lines

MN0-R2	Public utilities have also developed their own fibre capacities and have identified substantial revenue potential from leasing some of the capacities they have.
RR-1	Access regulation remains an item that is difficult to enforce by ICASA, specifically because some of the aspects are left to the discretion of the operators and as such market forces
MNO-R2	Firms believe that USAASA has been ineffective in utilising the billions of contributions from the industry revenues to catalyse investment in underserviced areas.

Source: Respondents interviews (2014)

4.8. Summary of the emerging market structure

Based on revenues that were publicly available and used in this report, the resultant market structure showed it was almost 3 times the "moderate concentration target of 1800" (Mohr & Fourie, 2004, p. 277), which shows a high market concentration and thus a market that is a duopoly in mobile broadband and a monopoly in fixed broadband, thus making the broadband market fall short of acceptable HHI competitiveness.

Table 26: The HHI Index for SA broadband market concentration based on revenues of firms

	2009	2010	2011	2012	2013	Totals
Vodacom	5,9	4,6	6,1	7,6	8,8	36
MTN	2,4	3,6	4,6	6,4	8,8	26
Cell C#	6,5	7,5	9,3	10,2	9,3	43
Telkom	9,3	9,9	10,6	10,2	10,8	51
Neotel#				4,0	4,7	9
DFA#		0,25	0,5	0,5	0,6	2

Source: Financial results and press statements (2009-2013) *(# not publicly traded/available)*

By using these revenues of publicly listed Vodacom, MTN, Telkom, and other press items for Neotel, Cell C and DFA, the HHI for the market structure stands at HHI 6507, showing significant levels of concentration and lack of effective market competitiveness.

It is important to state that these revenues do not necessarily reflect market shares; for instance Cell C's cost structures and leverage distorted their performance in the market, and revealed insufficient organisational real options to ensure sustainability and competitiveness, despite their vocal price wars. The concentration levels were also reflective of the hypercompetition discussed in Chapter 3, where Rindova & Kotha (2001) alluded to organisational instabilities resultant from escalated market competition and the pressure on the firms to establish new revenues from different strategic values

(new product mixes, markets or technologies). Chapter 5 will provide analysis on how broadband firms in South Africa have used the period of increased investment in infrastructure to enter the network "Schumpeterian race for market dominance" (Economides, 2006, p. 486), which inherently created inequality and an uncompetitive market structure.

CHAPTER 5: ANALYSIS OF THE RESEARCH RESULTS ON INVESTMENT IN BROADBAND INFRASTRUCTURE AND THE EMERGING MARKET STRUCTURE IN SOUTH AFRICA

This chapter analyses the investment in broadband infrastructure (supply-side) by both private and public sector investors, and used Bauer's calculus(2010) in alignment with the conceptual framework in order to develop an understanding of supply-side investment decisions that investors have taken, and the variables of regulation, market competition and revenues generated that have affected re-investment and innovation (demand and universal access).

5.1. Bauer's calculus is aligned to the conceptual framework

As discussed in Chapter 2 (2.4.1), Bauer's calculus (2010) was used to understand the investment strategies and to provide clarities on the elements of the conceptual framework. Bauer's calculus (2010) challenged to capture the various facets of variables that exist in the complex relationship between economic regulation and investment, through the proposal "of a framework for the design of regulation and the evaluation of implications of regulatory choices on investment and innovation in the communication industries" (Bauer, 2010). Table 27 aligns the framework of analysis with the conceptual framework.

Table 27: Alignment of the conceptual framework and the applied framework of analysis

The Conceptual Framework of Analysis	Bauer's Calculus (2010)	Risk Variables in Reilly & Brown (2006)	Regulatory ambivalences in Vogelsang (2010)
Supply-side investment in broadband. Discussed in 5.2.	Appropriability, ENPV and option values	The business cycle and industry sectors	Regulation lowers price of the output, increases the demanded output quantity and consequently the capacity required to produce this output.
Market Structure Discussed in 5.3	Intensity of competition opportunity.	Analysis of the competitive environment in an industry	Ex post policies detrimental to investment
Demand and broadband access Discussed in 5.4	Radical innovation, super-normal returns, critical mass coordination	Industry's Life Cycle	Truncation of uncertain investment outcomes that are caused by price constraints, thereby shifting investment risks from consumers and the access seekers to the regulated firm.
Macro-factors of Policy and Regulation Discussed in 5.5	Regulatory intervention (unbundling, open access, separation, MTRs).	Structural economic changes and alternative industries	Successful bottleneck regulation leads to enhanced competition

Source: Bauer(2010), Reilly & Brown (2006) , Vogelsang (2010)

5.2. Self-provision spurred investment and better business modelling

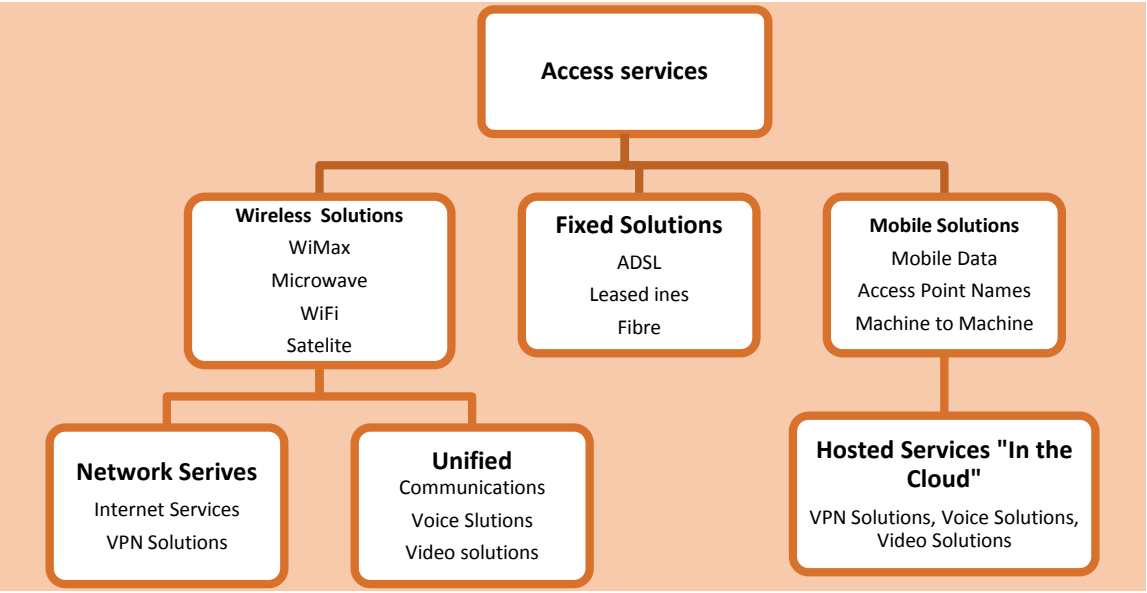
The Altech court judgement's interpretation of the ECA licencing and stipulations of self-provisioning set in motion a heightened period of infrastructure in investment in South Africa. The judgment's

dramatic emphasis on VAN's entitlement to undertake self-provision investment effectively determined the ECA as the regulatory and administrative bedrock of the ICT industry post the repressive and industry constraining TA and its biases towards the state's managed liberalisation of the sector in South Africa. ECAA not only empowered ICASA through the unshackling of the ECA from the Minister's unfettered prerogative to determine the market structure of telecommunications; but also emboldened industry players to challenge decisions made by ICASA and the Minister simply ignoring the law in pursuit of poorly-formulated policy objectives (Cull, 2008). Firms could invest with the benefit of better understanding of their business model, and determine where their sustainability (ENPVs) would best be served. Business model is referred to as " the architecture of the value creation, delivery, and capture mechanisms employed to deliver a service, including offerings, strategies, infrastructure, organization, trading practices, and operational processes and policies" (Katz, 2011, p. 2).

5.2.1. Vodacom's business model

Vodacom stated that their business model had allowed for "better segmentation of their clients" (Vodacom, 2013) through their business model, and by so doing showed the "real options approach" through electing investment strategies that guaranteed profitability (ENPV) of business model.

Figure 57: Vodacom services portfolio



Source: Adapted from Vodacom (2013

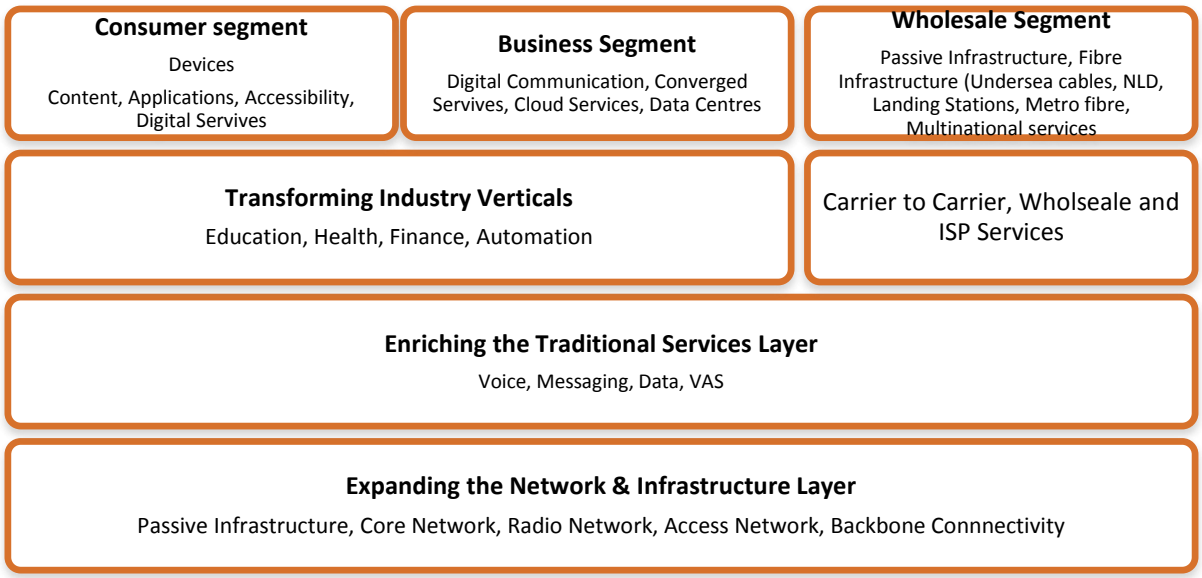
This understanding of their business allowed them to target "medium-sized companies and regionally dispersed companies, or entities with a large number of leased lines which are interested in cost savings offered by bandwidth consolidation on VPN" (Vodacom, 2013). This implied that investment

would be allocated based on their segmentation strategy and even better to match their distribution capacities, and therefore unlock potential to have better earnings (ENPV) and better innovation

5.2.2. MTN's portfolio of business

MTN observed that "from a fixed line perspective SA was sliding back relative to other developing economies, and the gap was widening, hence mobile is winning this race because of the fact that these technologies are designed to achieve the reach and scale needed for success (MTN, 2008); which confirmed that their approach to investment would be biased towards the growth of mobile telephony (both voice and data), as reflected in their portfolio of products.

Figure 58: MTN services portfolio



Source: MTN (2008)

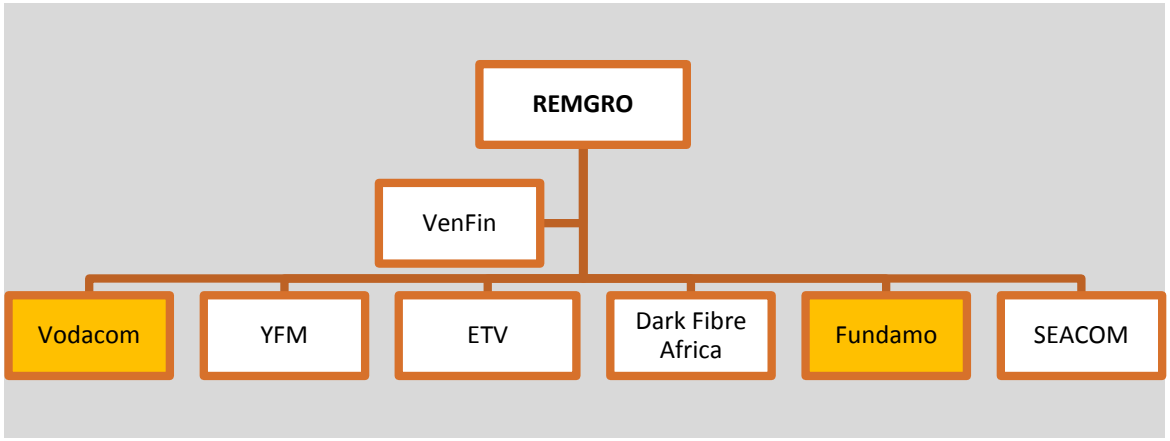
According to Bauer's real options theory, the exercise of an option (to invest in chosen fixed or wireless) had another option as a payoff, meaning that it is rational to commit if it is a precondition to secure future investment (Bauer, 2009, p. 10). The bias to the provinces with big metropolitan areas like Gauteng and Western Cape showed the real options decisions by the firms to invest where costs could be high, though this is offset by the high revenues the firms could potentially due to the compoundedness of mobile broadband services; reflected in the business models of the network operators in the figures above.

5.2.3. DFA 's real options

Bauer's real options example in South Africa was also evidenced by diversified company Rembrandt Group of Anton Rupert, which was better known as REMGRO and owners of Dark Fibre Africa, and shareholders at SEACOM. REMGRO's VenFin owned shares at Vodacom, and these were sold to Vodafone whilst the company recapitalised DFA for the company to align their fixed strategy with

SEACOM. The divestment from Vodacom and Fundamo (highlighted in Fig 59) was a "call option" that was exercised and capital reallocated to growing other assets in the media portfolio, in particular the telecommunications business.

Figure 59: REMGRO's media portfolio



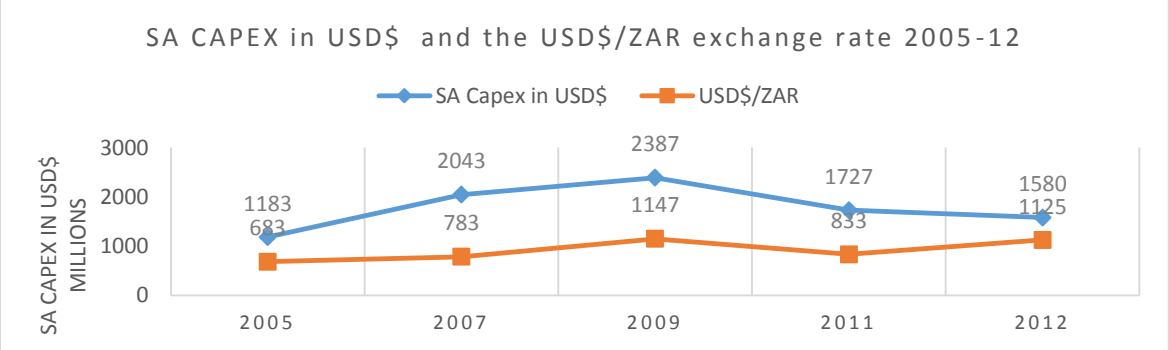
Source: Adapted from REMGRO (2013)

Self-provisioning of infrastructure allowed for entities to better understand their scale of investment and appropriability of their entities and infrastructure. Bauer's calculus clearly fits this activity through its ability to evaluate options and values of investment ex ante in order to maximise ENPV.

5.2.4. Supply-side costs of investment match the (USD/ZAR) costs and appropriabilities

Bauer's emphasis of investment and ENPV "assumes that an investor possesses all the relevant information, can develop a most likely scenario for a project and faces a decision to committing between this investment, and not making it all" (Bauer, 2009, p. 9); inclusive of currency fluctuations and differentials (USD/ZAR) in capital budgeting plans.

Figure 60: SA telecommunications investment (2005-2012) and the USD/ZAR exchange rate



Source: ITU (2013) and SARB (2014)

Exchange rates, specifically USD/ZAR exchange rates, remain a major determinant of capital inputs as the sector procures international bandwidth and infrastructure equipment from international markets

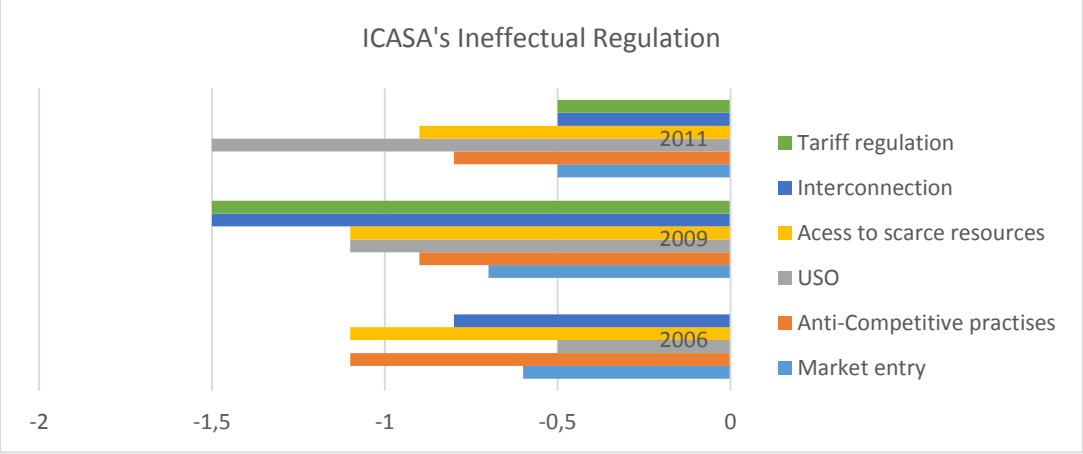
where trade is USD-denominated. Analysis of Fig.60 illustrates the investment curve over the period under review for broadband infrastructure, shows that investors in South Africa were buoyed by fixed-to-mobile substitution, and invested or hedged in order to develop positive, future network externalities and cushion against currency volatilities.

5.2.5. Regulatory intervention by ICASA reflects the calculus

The regulatory variable sits at the core of Bauer's calculus, noting that it remained the major variable that chiefly affected others in the formula, and could the market inefficient. Bauer (2010, p.67) noted that "due to the high degree of interdependence in advanced communication systems, regulation resembles a set of "tuning" parameters more than a set of "controls", notably with its impact on variables that determine cash flows in future periods and option values of strategic management choices".

In South Africa regulatory intervention in telecommunications remained ineffectual. A case in point is ICASA's protracted delays in fully implementing the ECA licencing conditions to the benefit of the broad sector. The latter scenario would have allowed VANS to invest alongside MNOs, and discourage the court action that brought forth the Altech judgment.

Figure 61: The ICT Green Paper cites ineffectual regulation



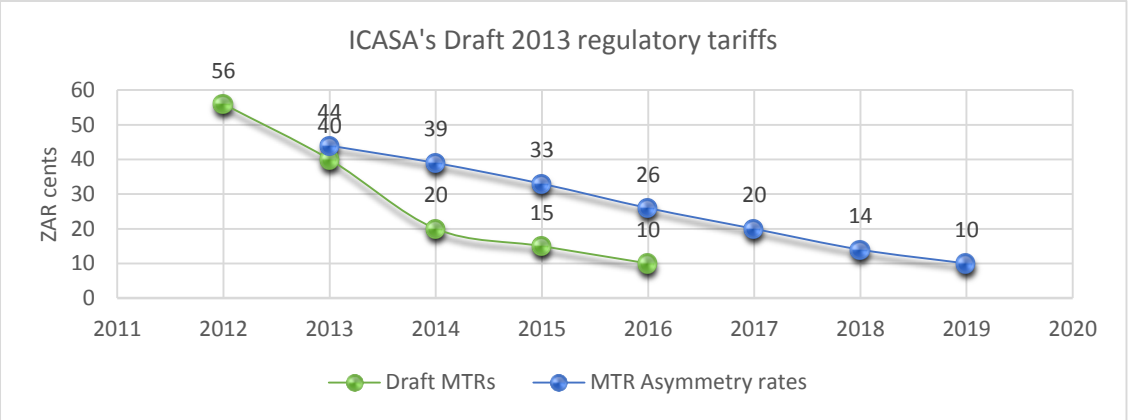
Source: Adapted from DoC (2013)

Whilst ICASA had sought to develop mobile termination rates (MTRs) as an effective tool to reduce the high costs to communicate in the country, firms shave dug in through court challenges to ICASA. MTRs or interconnection fees are the fees operators pay each other to terminate calls on each other's networks (Tubbs, 2014).

Fig.61 showed that ICASA's successes had been minimal. Respondents pointed at the lack of strategic capacities at the regulator to effectively understand the market and develop sufficient ex ante

provisions; specifically against powerful operators who had capital and access to sophisticated legal recourse.

Figure 62: ICASA's wholesale tariff interventions



Source: ICASA (2014)

Fig 62 shows ICASA's proposed glide path of the termination rates, and the asymmetry rates applicable to smaller operators like Cell C with expected market share of less than 20% terminating on the SMPs, with the regulator stating that "the decision to reduce termination rates and increase the asymmetric rate was to provide an environment that was conducive to smaller operators investing in infrastructure" (Mochiko, 2014). According to Mochiko (2014), "high termination rates are seen as keeping small and new entrants from competing on price because they have fewer customers, and most of their customers' calls are made to other networks, which results in them paying more in termination fees to bigger operators".

5.3. Supply-side (private and public) investment trends confirm consumer surplus

The purpose of this step was to analyse the investment trends by private sector operators, and to describe the market competitiveness through levels of investment as affected by either horizontal or vertical regulation. Horizontal regulation influences investment and innovation, and are typically justified as efforts to capture the benefits of network effects and to neutralise market power, e.g. Interconnection, rights of way, collocation, unbundling, resale, provisions governing number portability and licensing policies (Bauer, 2010, p. 69).

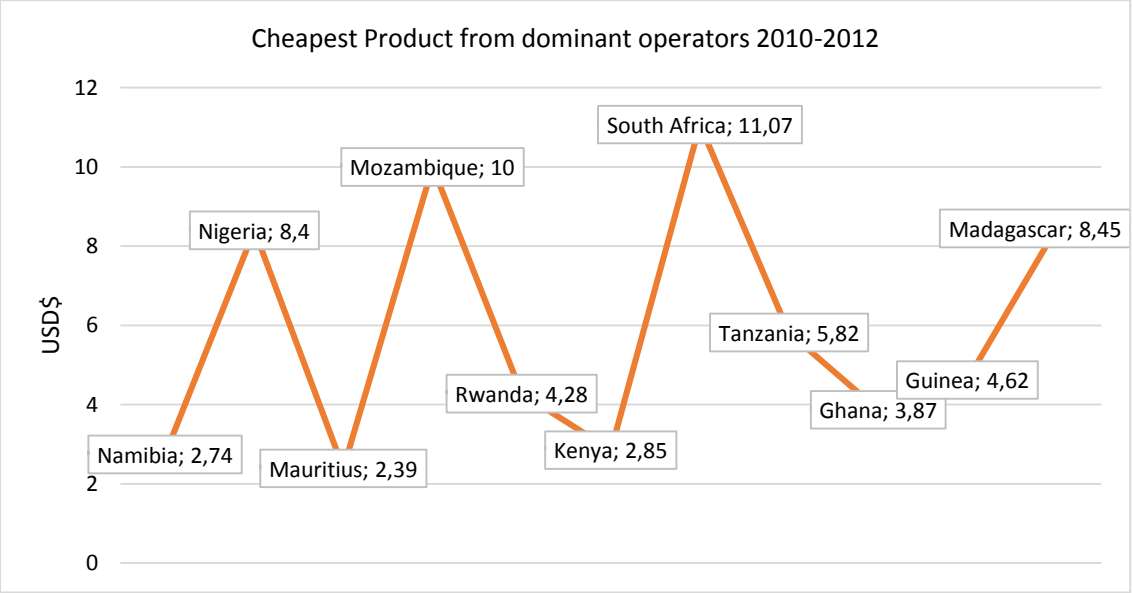
5.3.1. The private sector has located consumer surplus

Observations from respondents and financial statements was that South Africa's broadband had flourished as a result of the regulator's hands-off approach to market development. The diminishing returns of fixed voice and the growth of non-voice revenue imply that the economic relation between

the firms and consumers had inadvertently relegated the (normative) objects of the ECA, specifically with sector competitiveness and high consumer prices.

Using the OECD framework of price analysis, Stork & Gillwald (2012) showed that South Africa competed as one of the most expensive places in telecommunications, both in voice and data.

Figure 63: South Africa's prices comparison with African peers



Source: Adapted from Stork & Gillwald (2012)

Data that was used in the analysis comprised 335 mobile prepaid products from 184 operators from 46 countries collected by Research ICT Africa from Jan 2010 to June 2012 (Stork & Gillwald, 2012, p. 13), and the prices of the cheapest available products showed that South African prices have been high enough to have ensured positive revenues for the firms and a large consumer surplus.

5.3.2. Firms invested for comparative advantage

Respondents had noted that the delayed adoption of the SA Connect and clear ICT sector roles and responsibility guidelines had resulted in incumbent firms developing and entrenching comparative advantages. The sources of comparative advantage can be found in those factors that determine relative demands for and relative supplies of each of the goods produced (Mohr & Fourie, 2004, p. 422). In South Africa, like in most network industries, firms had built significant scale through being first to market, and through capital expansion programmes post the ECA 2005 and the Altech judgement. High barriers to entry in the South African ICT sector and inefficient interconnection arrangements have meant that new ECNS licensees recourse to duplications of network infrastructure, whilst incumbents enjoyed the consumer surplus of their comparative advantages.

5.2.3. Investment in broadband infrastructure lead to new value creation strategies

The quest for broadband value made South African firms to implement investment decisions that were forward looking in order to capture the anticipated data explosion and new video-on-demand services (VOD).

Table 28: Analysis of MNOs

Operator	Investment Strategy	Impact on firm of regulations	Investment in Demand & Innovation
Vodacom	• Launched on Telkom's network and beneficiaries of network externalities from the Telkom network. • Investment to build value scale • Massive dominance of consumer and operator space; positive interconnection revenues • Horizontal growth through M&A • Significant data growth	• Efficiencies in self-provision • SMP benefits of information asymmetries and regulatory capture • MTR intervention insignificant due to SMP • VPN strategy sustainable organically • Limited infrastructure sharing	• Investments made in low-cost device manufacturing • Smart phone subsidies and innovative pricing structures • New apps and media partnerships ensuring further value creation levels. • Massive player in mobile money transaction, and investments made to revive M-Pesa
MTN	• Data revenues catered for since long, though not matched by investment strategy • Lag in Market share due to underinvestment • Successful in other continental markets • Follows market trends carefully with investment • Substantial Capex for redundancies.	• SMP and duopoly benefits, joins Vodacom in regulatory capture • Real options constrained • MTR insignificant impact • Vast consumer surplus • Data growth through SME and corporate targets • Infrastructure sharing with Telkom for roaming and spectrum	• Partnerships for content and apps development • Smartphones strategy to grow demand • Mobile Money strategy to grow demand
Cell C	• Not listed, funding model appears improved through syndications. • Positive benefits from price wars • Massive consumer surplus • Leadership instabilities though on the mend	• Big beneficiary of MTRs • Infrastructure sharing through partnerships both fixed and wireless • Limited investment equals limited revenues • Network sharing means weakened QoS	• Regulatory interventions will benefit Cell C • Stability at strategic level maintained to grow new value and innovations • Price wars risky but paying off with uptick in market share

Table 29: Analysis of fixed networks

Operator	Investment strategy	Impact of regulations	Demand & innovation investment
Telkom	• Conflicted ownership structure both a limitation and strategic cushion • ADSL leadership sustained through modernisation • Could play significant role in mobile through state FMC mix and match • Voice minutes dwindling fast and data the new revenue earner • ADSL like a hedge against loss to mobile • Undersea cable ownership big leg-up	• MTRs benefit to Telkom mobile • Costs of modernisation high • Altech ruling impacts wholesale interconnection earnings • ADSL weakened by distribution capacities • Telkom mobile partnership with MTN to grow efficiencies and this consumer surplus • Regulatory delays of LLU reduces ladder of access earnings	• Big opportunity through SA Connect recommendations • Value innovation through VoD and IP • High speed broadband still in pilot phase • Will be limited by real options test between ADSL and LTE, with ADSL favoured through FTH, FTP and market gradually congested. • Limited scope for participation in emerging price competition
Neotel	• Delayed entry into market makes possibilities for competition constrained by value creation abilities of the incumbents • Significant sunk cost and little initial ROI • Markets going through fixed-to-mobile substitution	• Fibre network significant • Fixed voice revenues dwindling • Significant technical backup • Real options exercised through M&A considerations with Vodacom	• The future looks good with M&A done with Vodacom • Focus on SME and corporates with FMC
Dark Fibre Africa	• Strategy for fixed undersea and terrestrial good but limited, considering ECNS benefits • Owners with deep pockets and previous shareholders of Vodacom • Complement of assets in the portfolio shows DFA a future big player on various value levels	• Big beneficiary of post Altech ruling investment • Backhaul facilities leased to big MNOs • Some assets could be unbundled due to scope of competition provisions in SA.	• Big players on content with investments in both radio and TV • Could be the next big player through new VOD products

Source: Data and Firms annual results

5.4. Public Investment caught in policy knots

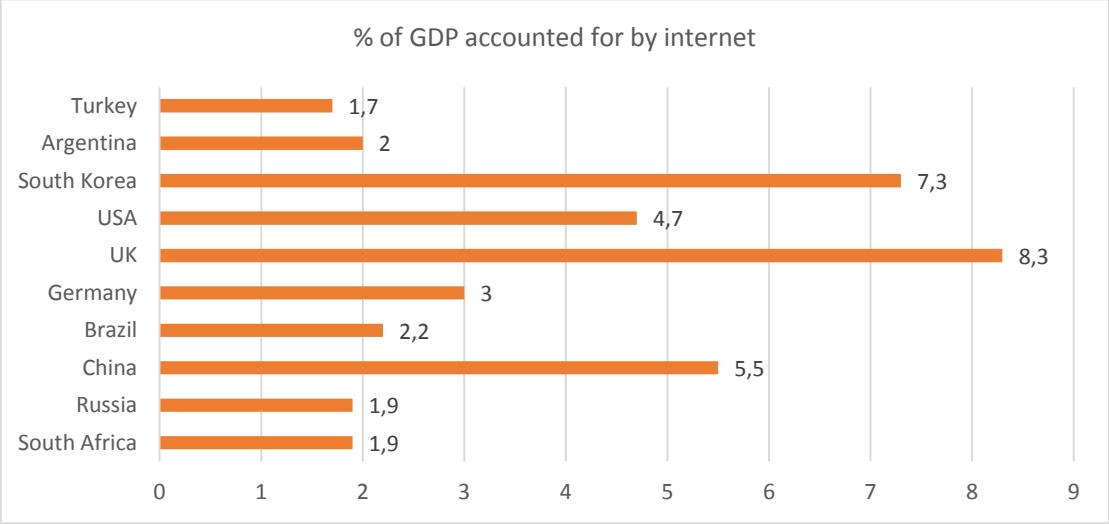
The purpose of this step was to analyse and describe the Government's approach in the provision of broadband infrastructure. This was made clear through the capital quotient allocation to institutions of the state that have mandates of investing in broadband infrastructure. The intention was to

evaluate the levels of investment, efficiencies and how this impacted on the market structure of broadband in South Africa, using Bauer's calculus as a reference.

5.4.1. National Government Strategies as basis for investment policy certainties

South Africa was regarded as underperforming in comparison with its peers in BRICS, and thus presenting a sovereign risk as this could be a trade mismatch with peers in the economic grouping. Telecoms accounted for 3,4% of GDP in South Africa, the internet approximately 2% and wireless broadband alone likely to account for 1,8% in 2015 (Hawthorne, 2013), which underpinned the economic value of investing in broadband infrastructure for the country.

Figure 64: % of GDP accounted for by Internet in 2012



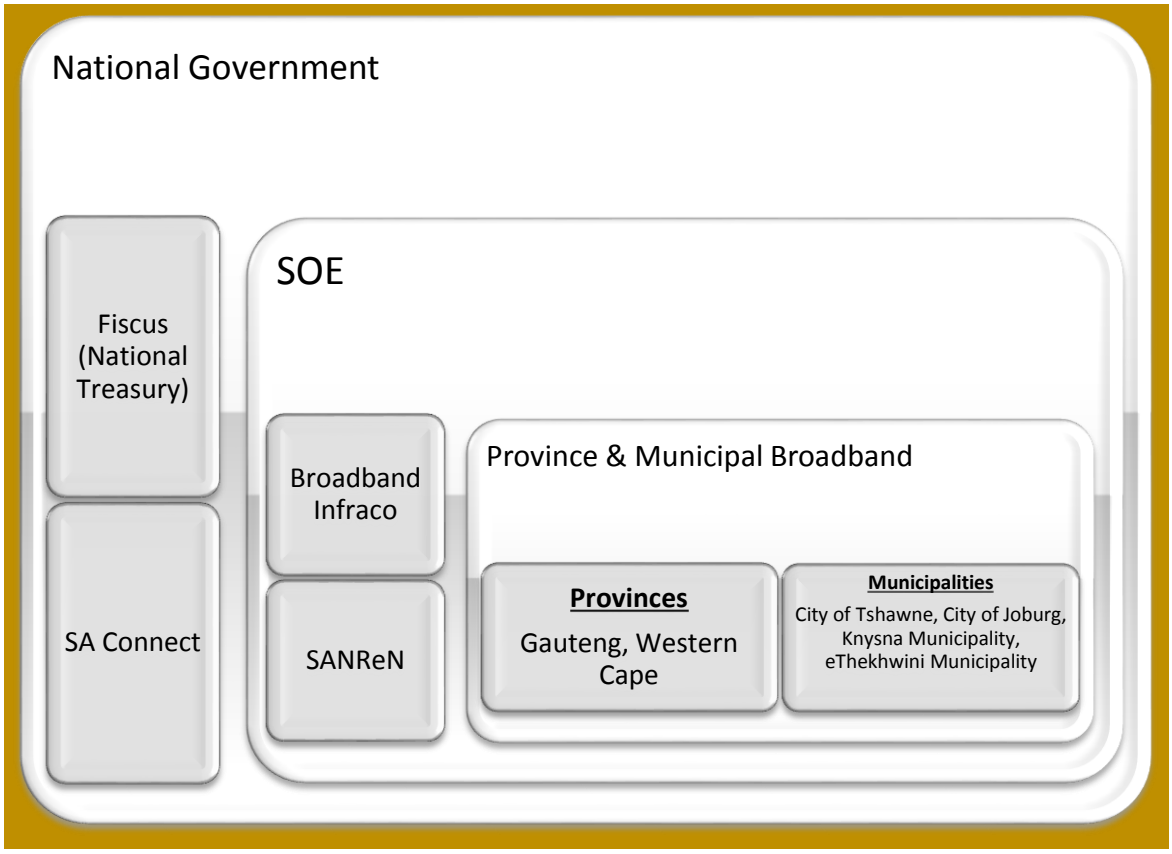
Source: Hawthorne (2013)

According to Bauer (Bauer, 2009, p. 30) the public sector could take a more direct and proactive role either by coordinating infrastructure investment. The ENPV model could not be applied for the public sector, as community coverage was not externality covered by the calculus. The public sector could use an investment calculus that took the externalities and public goods into account, as positive or negative externalities were not part of the private ENPV unless they were internalised (Bauer, 2009, p. 78). A public sector agency could operate using a broader tool for social assessment: a "social ENPV" or SENPV (Bauer, 2009).

The nature of the public sector investment in broadband should therefore be seen as development for the benefit of the public (welfare), and not compete with the private sector. The private sector would also fail if they do not focus on ENPV and focus on internalised targets of universal access. Analysis showed that the state was regarded as the source of policy certainty, specifically with roles allocation for stakeholders and their investment limitations if any; whilst the state-owned entities

should be used for aligning servitudes strategies with those tasked with laying down broadband infrastructure like fibre and metropolitan networks.

Figure 65: Public sector role players in broadband investment in SA (excluding Telkom)



Source: Nedohe (2014)

The analysis of both private public investors showed that the former had focused on fibre exclusively, whilst the private sector had responded positively to the fixed-to-mobile substitution and catered for the massive mobile market. Mobile was regarded, due to the saturation levels and adoption in the rural and underserviced areas, as presenting 'low hanging fruit' to target for technology diffusion. Some entities like the City of Tshwane and Knysna, in partnership with the private sector, have been leading in providing the benefits of wireless broadband through Wi-Fi to their communities, and thereby passed on the price benefit to poor communities around them, whilst provinces like the Gauteng and Western Cape had noted the need for both fixed and wireless networks and were implementing their roll-outs with expected positive, localised externalities.

5.4.2. SOE hobble along with little policy clarities

State owned entities like Broadband Infraco were seen as examples of capacity failures, noting that they possessed vast infrastructure, both under sea and terrestrial backhaul, but remained loss making due to leadership instabilities, weak funding models and governance issues.

Table 30: A summary of public investment in broadband

Operator	Investment Strategy	Impact of regulation	Investment in Demand and Innovation
Broadband Infraco	• Ownership strategy vague and owed to political developments. • Funded from fiscus and SOE. • Initial share of WACS good for bargaining power, but since sold off.	• Exclusive play at fixed meant intense wholesale competition for the market Infraco focused on. • SA Connect ambiguous about role of Infraco • Lack of infrastructure sharing strategy limits	• Captive state customer base for e-Government services • Big enabler of e-learning services • Future coordination with provinces and localities for inland connectivity
Provincial Broadband strategies	• Investment from provincial budgets, means reallocation of resources. • Investment at local value chain means they are price takers at backhaul and transmission.	• Rapid deployment guidelines seen as weak spot • Provincial strategies could conflict stakeholders and delay private sector • State money causes governance weaknesses.	• e-Government services • e-Billing presents an opportunity
Municipal broadband strategies	• Little stakeholder stakeholders • Big focus on Wi-Fi	• Infrastructure sharing strategies unclear • Governance issues and possible corrupt dealing.	• Redundancies for MNOs • Free Wi-Fi, lower localised prices. • Free tablets and devices.
SANReN	• PPI initiative	• Source of pilot high speeds	Captive research base of customers. Cooperative strategy grows demand.

Source: Broadband Infraco (Annual results) and public documents

5.5. The South African market structure: a derivative of ineffectual regulation

The purpose of this step was to analyse the market structure that was evolving, due to the investment trends seen in the supply-side of the value chain. Market structures reflect the stringencies or less stringent provisions of regulations.

Bauer (2010, p.75) states that "an inter-temporal view and the recognition of endogeneity of market structure on regulatory decisions calls for an inclusive, forward-looking and dynamic view of competition".

5.5.1. Supply-side firms dominate the quest for ROI

The analysis showed that the ICT market was dominated by large private sector investors, who had sufficient capital to lead investment and therefore continued to dominate with ROI. The race for investment had also been made complex by the investment intentions of the state. The search for value by both the public and the private sector meant that they both competed for the same market in order to gain different targets: the private sector ROI, and the public sector seeking both ROI and normative targets of welfare and universal access. Observations were that investment patterns had led to overcapacity, complicated supply-side ownership structures that could undermine competition, effective governance, and create space for high market prices that negated diffusion.

5.5.2. Spatially skewed investments compound digital divide

Analysis from the investment, notably private sector, showed that the biggest cash and revenue generators remained new technologies represented by 3G, LTE and high speed broadband, with private sector investment geared at piloting these through partnerships of both private fixed and wireless firms. Firms were targeting FTTH and FTB and similar high capacity networks to the urban areas, where there was sufficient ROI due to the urban sprawls of residential complexes and offices. The investment trends focused on the apartheid spatial patterns where the densely populated areas were the competitive domains of the private sector, and ironically the public sector as well. Telkom's exchanges with ADSL and high capacity, even after modernisation, remained focused to the urban areas and little bypassed in the rural areas, if any. The oversupply of dark fibre in South Africa showed that investors expected the cities to be the next generators of revenue from the expected data explosion, with voice revenues fast reducing.

5.5.3. Lack of enforcement of infrastructure sharing

The analysis of self-provision trends confirmed that ICASA's approach towards infrastructure sharing was not been visibly enforced nor that robust, as noted by specifically by Cell C, in their submissions in favour of asymmetry regulation after the latest round of MTR interventions by the regulator. Since the Altech ruling, firms with resources had become nimble at growing their scale of both backhaul and transmission networks, with the intention of growing market share and entrenching the SMP status.

Observations were that these facilities had been difficult to lease with either lease prices or application conversion times creating significant bottlenecks to access to markets by new entrants. The SMPs had built these capacities in order to ensure their own rapid deployment or quick access to market, which was a fundamental competitive advantage in network economies. The sector's growth is therefore limited by the unwillingness of the consortiums that build the networks to share their infrastructure. Some of the agreements are shrouded in confidential agreements that have terms that are not disclosed even to the regulator, and as such constrain the regulator to enforce infrastructure lease terms or hold the parties to certain service levels of QoS.

5.5.4. The new unregulated ATC and wireless broadband diffusion in SA

Analysis showed that the entry of ATC in the ICT sector in South Africa addressed the firms' demand towers for 2G, 3G and LTE for the firms. ATC had taken self-provision to a different level; and competition on their towers was not only for new technologies, but their distribution networks could mean success or failure for some of the networks in South Africa. New operators like Cell C had taken a huge chunk of their investment to this level of access infrastructure in order to gain scale, and as such relied on ATC to wage their price wars against the bigger operators. The latter also relied on ATC, thereby placing ATC in the crucial position where they are the indispensable level of core LTE broadband. Observations from the data showed that ATC was not regulated by ICASA, and operated an input component that until recently was an organic capacity of the firms.

5.5.5. Spectrum resolution creates a bottleneck to full liberalisation

Spectrum is a major determination of investment and in this case, resides in the regulation component of the Bauer's calculus, implying that its availability or lack thereof could limit the performance of other variables and ultimately innovation and investment. Observations from financial reports and respondents confirms that firms had frequently lamented the inefficiencies of institutions tasked with the allocation of spectrum, and had resorted to RAN renewals and spectrum refarming in some bands in order to meet the requirements of their networks, specifically with frustrations on the protracted resolution of high demand spectrum of 2.6 GHz and 800 MHz which were critical for mobile telephony.

Analysis also shows that the sector still has to agree on the methods of allocation, with ICASA-initiated ITA (in terms of Section 31 (3) of the ECA and regulation 7(2) of the Radio Frequency Spectrum Regulation 2011) delayed as stakeholders through clarities on policy decisions.

5.5.6. Mergers and Acquisitions show sector maturity

Observations from the data and respondents confirm that the sector has grown post the Altech ruling through investments in various elements of the value chain, thereby creating pockets of excellence inputs that could combine to create bigger and mutually beneficial value for stakeholders. Whereas firms could approach the market individually, the benefits of scale through cooperation were

substantial. Nashua Mobile's recent division of their customers between MTN and Vodacom shows how the lack of scale limits smaller firms against the SMPs.

On the other hand, observations was that the South African market showed sophistication and maturity that represented immense potential to international investors, with plans for takeovers or increase in equity stakes confirming that the ICT sector in South Africa is its early stages of the business cycle. Government's role in investing approach had also shown an appetite for rolling out wireless networks. Policy clarities were seen as a weakness, but also seen as an essential element of arbitrage that could be exploited.

5.6. Broadband demand grows access and innovation

The purpose of this step is to analyse and develop and understanding on how regulation has affected the demand development and innovation strategies of the firms. Demand development and innovation requires significant investment, as they are the source of competitive advantage and as consumer surplus.

5.6.1. Less stringent regulation allows for private sector investment in innovation

E-commerce and mobile money transactions in South Africa benefited from inadvertent hands-off approach to regulation by ICASA: growth in the sense that firms have grown both requisites: the network layers (infrastructure, distribution and retail); and also service layers levels, thus accumulating vertical capacities. On the other hand, growing these capacities could present horizontal or competition inefficiencies. Vodacom's M-pesa's growth was constrained by its closeness to the mother brand, which limited subscribers of other networks and those not on their networks to try the innovation. Rural networks have also been constrained by the unavailability of sufficient backhaul and access networks that allowed better broadband like 3G and LTE, which were suitable for M-Pesa. Whilst there was an uptick on online purchases, IMs and social media, the networks were susceptible to interruptions due to spectrum limitations.

5.6.2. e-Government is limited by spectrum and lack of policy clarities

Government and its related entities had displayed tentative steps to developing e-government demand strategies through innovations like e-Health and those that serviced critical services like Home Affairs and South African Revenue Services. Government operations and IT systems had also made firms grow investment towards supporting welfare and service delivery targets. Observations show that the significant penetration of mobile telephony grew the opportunity for mobile broadband; and private sector firms were leading with investment for 2G, 3G and recently LTE. Whilst Telkom has a vast network across the country, the ADSL limitations of the exchanges in the countryside would not be sufficient to meet the growing data demands driven by all forms of sophisticated media.

Analysis showed that these services would be constrained to the urban, densely populated areas due to insufficient backhaul and spectrum.

5.6.3. Innovation presents competition dynamics to some of the operators

Basing this analysis on Bauer's calculus, the innovation that firms have been implementing could be a challenge for both the ECA and the Competition Commission, as the market could become inefficient due to market conduct and complicated ownership structures of the firms. The diffusion of digital technology, the increasing availability of high-capacity networks, and a proliferation of access devices have fundamentally altered the ways in which innovations unfold in ICT (Bauer & Shim, 2012, p. 8). A typical example would be DFA, whose ownership of vast fibre networks in undersea, long-distance, terrestrial and metro-fibre rings was complemented by ownership of ETV and YFM, after their holding company REMGRO divested from Vodacom and their mobile money business.

5.7. SA Connect hoists the sails of policy certainty

This step looks at the policy environment in South Africa, and analyses the data using the current policy provisions and respondents' observations on how policy influenced investment, and through investment, the market structure. Whilst not focused on the chronological development of policy, it is important to state that " in 1998 South Africa formally adopted the WTO GATS Basic Agreement on Telecommunications reference paper on basic communications…with a reform model including three integrated components- privatisation, competition and independent regulation" (Gillwald, 2005, p. 473), and the country has implemented various broadband policies till the adoption of SA Connect as the National Broadband Policy in 2013.

5.7.1. SA Connect and a SWOT of some policy recommendations

Non-regulatory government policies are designed to affect the investment incentives of market players; and properly designed, are capable of achieving the desired expansionary effect on investment and innovation in NGN networks (Bauer, 2010, p. 72). In South Africa the National broadband policy's protracted adoption resulted in a market structure that was close to self-regulation, specifically with investment in infrastructure by both private and public sector investors.

Though SA Connect proposes some interventions (1.5.7, Table 4) observations were that the Altech judgement's definitive interpretations of the ECA on self-provision, was still case-law in South Africa and remained instructive of investment patterns and the subsequent market structure.

PPP: Government will work with the private sector and will provide policy and regulatory guidance.

Access regulation: The recommendations of open access in the era of self-provision appeared self-contradictory, and would require a bolstered institutional and regulatory framework with effective market definition and clear enforcement.

ICASA: Institutional design weakens ICASA's enforcement of ECA, leading to regulatory capture and information asymmetries.

Role of the State: Telkom shareholding and control of Broadband Infraco creates conflict of interest for Government.

Spectrum: Spectrum resolution and policy on allocation could make SA Connect ineffective. The industry perceived delays as political and required policy clarities, not just ITA items of Section 31 (3) of the ECA and regulation 7(2) of the Radio Frequency Spectrum Regulation 2011.

5.8. Chapter Summary

This chapter analysed the data gathered through the conceptual framework, using Bauer's calculus as a framework of analysis. By applying Bauer's (2010) calculus to the analysis, this research was able to develop an overview of the firms' investment decisions and the impact these have had on the market structure. The ability of the regulation to unblock the bottlenecks towards sector development was evidenced by the judge's interpretation of the ECA 2005 in the Altech judgment regarding self-provisioning. The judgement launched a period of heightened investment through benefits of the ECA towards self-provisioning by the firms. All firms, specifically the SMPs which possessed better access to the capital markets, implemented vigorous investments in undersea, national backhaul, transmission and access infrastructure that created behemoths of their operations, whilst the smaller firms have battled to compete in a market that was increasingly growing uneven and uncompetitive for both wholesale and retail.

CHAPTER 6: CONCLUSIONS AND OBSERVATIONS OF THE EMERGING MARKET STRUCTURE

6.1. Introduction

The main research question which this report set out to establish was *"How have supply-side (private and public) investment trends in broadband infrastructure in South Africa affected the market structure and demand, and how were these investment trends influenced by the policy and regulatory narrative*?", and the enquiry sought to use the ECA 2005 and the subsequent epoch Altech judgement as the basis from which the researcher could understand the investment trends of both private and public firms, and how the policy and regulatory regimen of South Africa had impacted on the investment, and as such the market structure.

These investment trends were comprehensively captured in Chapter 4, which outlined the investment appetite of both private and public sector players in the provision of broadband in South Africa, and also how the trends have been sustained by the firms despite the attempts at "tuning" by ICASA to make the market of broadband competitive with both regulatory provisions of wholesale access and competitive pricing. The analysis into the developing trends was provided in Chapter 5, using Bauer's calculus to understand how the "tuning" variables impact on investment and to gain insight into the research sub-questions in Chapter 3. This chapter concludes on the investment observations and also provides basis for further research.

6.2. Firms behaviour

6.2.1. Broadband investment makes a sensible business case

This study has shown that the race for infrastructure investment is both opportunistic and defensive for the firms: *opportunistic* in the sense that in network economies, it is scale that determines the ultimate measure of success (more infrastructure coverage, more service products, more customers); *defensive* in the sense that firms felt the only method to shore up a competitive position was to be better positioned than competition in core infrastructure competencies and innovation. With investments in undersea cables, national backbone networks and local access (metropolitan) fixed and wireless networks, it created a logical business case to be defensive of the networks and market position in order to derive the required or super returns on investments.

6.2.2. The ECA shows fundamental ambiguities

ICASA were finding a regulatory dilemma: the issue of open access remains a niggling point; as possible, logical resolution meant that ICASA would sanction LLU/unbundling of the last mile of

Telkom, thereby affecting returns of the state-owned company. The latter eventuality appeared unfavourable, and a weakened ICASA would at all costs avoid further litigious decisions and tensions with the Minister. Firm, uniform enforcement of open access regulation would mean that there would be no asymmetric implementation or deviations to the ECA provisions on open access. Firms were known to have invested heavily for value added products, and appeared rather reluctant to pursue unbundling of Telkom's fixed network whilst they could easily replicate the local loop through other means, both fibre and wireless. FTTH investment strategies of the SMPs have shown that they have ceased regarding LLU as a solution, and they would be investing in self-provision at local loop level.

6.2.3. Self-provision: a double-edged sword

The ECA 2005 and post-Altech period of rapid self-provision inadvertently empowered firms with an opportunity to enter into facilities-based competition. This inversely leads to resource-based competition and shows that firms with large financial bases or better access to financial markets could deploy technology quicker to the market better than smaller firms whose balance sheets have limited liquidity or have onerous interest repayments to lenders like state-owned development finance institutions. Some equity transactions for investment are shrouded in secrecy and non-disclosure clauses, which makes transparency and regulation ineffective due to information asymmetries that disadvantage ICASA.

6.2.4. South African firms have shown strategic resilience

This study has also showed that South African private sector telecommunications firms have been effective, and efficient in their investment strategies. Their investment decisions have been smartly tailored to track the USD$/ZAR curves so well that it showed that they possessed exceptional investment capacities that have marked their currency exposures or investments, to market movements of the exchange rates. The large firms have been able to procure the best investment advice when spending in foreign currency for broadband equipment, and as such created better hedge positions for themselves .

6.2.5. Municipal broadband could be the saving grace of public sector investment

This study showed that public sector or Government investment in broadband lagged behind the private sector's, notably investment in the big urban areas like Gauteng and the Western Cape, though investment trends by municipalities showed resurgence. The individual successes of Knysna and City of Tshwane confirmed that cheaper broadband could be made available to citizens by local authorities. These municipalities had created PPPs to implement and manage fibre, wireless and Wi-Fi projects. Corruption, wasteful expenditures, disregard for provisions of the Public Finance Management Act of 1999 (PFMA) remained limitations to municipal broadband implementations, resulting in low perception levels about the capacities of SOEs to independently manage the financial resources for

rolling out broadband to citizens. The City of Cape Town, Gauteng Province and Broadband Infraco were embroiled in different hues of tender disputes on their strategies.

6.2.6. The spectrum gap in the regulatory regime

This study has identified that firms had concentrated their investment in the urban areas of South Arica, thereby leading to congestion and poor quality of service due to network overloads and lack of additional spectrum that matched rapid adoption of mobile broadband. The absence of a policy framework geared to address the high-demand 2,6GHz (suitable for the densely populated urban areas) and 800MHz bands spectrum , identified as essential for coverage across the country; was identified as a performance risk that created pent-up demand and reduced economic productivity on the networks. The 800MHz is subject to resolution of the country's digital migration process.

6.3. Policy maker elite caught in the act

Analysis showed that there was perceived conflict of interest between the dual interests of the state and business .The close relations between the state and business stemmed from the state's adoption of "neoliberal policies that aimed at redefining the role of the state in the economy through market-oriented reforms: privatisation, regulatory separation, depoliticisation and liberalisation" (Henisz, Zelner, & Guillen, 2005, p. 871), evidenced through South Africa's commitments to WTO Agreement on Basic Telecommunications. Policies such as South Africa's "managed liberalisation" sustained state participation and the transformative dividend to the political elite. In a much publicised remark, former ANC spokesman Smuts Ngonyama was quoted as saying "I did not join the struggle to be poor" in defence of his involvement in a BEE deal involving the sale of a R6.6 billion stake in Telkom to a consortium led by former director-general of communications Andile Ngcaba. Ngonyama alone stood to make up to R160 million (Van Onselen, 2012). According to McChesney et al (2003), the widespread graft associated with neoliberal privatizations and deregulations in telecommunications had resulted in a wave of corruption of world historical proportions.

> If the market is God and public service is bunk, why on Earth would anyone enter government, except to feather their own nest, by any means necessary? For those at the receiving end of neoliberal globalization -the bulk of humanity- the idea that people need to accept neoliberal globalization as a given is untenable. For those committed to democracy above neoliberalism, the struggle is to require informed public participation in government policy making. (McChesney & Schiller, 2003, p. 24)

6.4. Bauer's calculus and its capacity to predict outcomes

The analysis in Chapter 5 provided insight into supply-side investment in broadband infrastructure by both private and public sector investors, using Bauer's calculus(2010). The framework was applied to develop an insight into supply-side investment decisions, intensity of market competitiveness and the "tuning" regulatory variable's impact on appropriabilities, innovation and reinvestment.

In the private sector, the calculus could be applied by investment portfolio managers to perform fundamental analysis of how the major structural issues of policy and regulation impact on profitability and yields in their asset allocation strategies.

Firms used " real options" of the calculus to decide on their preferred broadband mix and investment or divestment decisions. These "real options" were "called" to provide basis for future value creation, specifically noting that investment now (*t=0)* will be worth more in the future *(t+1)* through continuous innovations. As a technology-intensive sector, the ICT infrastructure, including networks, equipment, devices, and services, is the locus of continuous innovation (Bauer & Shim, 2012, p. 3). Telkom's decision to divest from Vodacom and start their own mobile network and Venfin's divestment from to build DFA are typical examples of real option

A possible limitation to the calculus was its emphasis on a linear model of investment. The calculus assumed that once investment was committed by a firm with all information, the next logical steps were ENPV and innovation investment. Such a linear approach also missed what South African firms implemented with ease: SMPs randomly flexing their muscles to collapse policy and regulatory bottlenecks through costly legal recourse in the courts of the land. By doing so, firms brought a critical dimension that was not captured in the calculus: the role of the courts in securing competitive advantage at all costs. The calculus, though acknowledging regulation, discounted the impact of courts in swerving policy and regulatory outcomes. Courts, therefore, are fundamental to real options and competitiveness.

6.5. The role of the Courts

In South Africa, the regulatory environment provided challenges: some ex ante provisions of the ECA were overtaken by innovative infrastructure trends targeting FMC and LTE (though some amendments were underway), leaving only ex post (a domain of the Competition Commission) regulating SMPs and anti-competitive practises. The courts of South Africa have played a significant role in altering the competitive landscape of ICTs in South Africa. Courts were an interesting dimension as they were able to unblock policy and regulatory bottlenecks, as in the case with the Altech judgement which resulted in the development of the ICT market structure that is current in South Africa.

6.5.1. The Court in the Altech judgement created a gap in administrative justice

This research showed that the Altech judgement did not have a component of spectrum contained, due to the fact that it was not the item that the court deliberated on, nor was it the issue of Altech's court contentions. The court ruled to clarify the objects of the ECA relating to the powers of the Minister and the Act's stipulations on self-provisioning of infrastructure, and thus the judgement had no mandate to effect a binding instruction towards resolution of on spectrum. The judgement

therefore had limitations of comprehending future technologies, and lacked fundamental market foresight that self-provisioning would be constrained in some way by the scarcity of spectrum. This court appeared to have founded its judgement on reducing the future propensity for VANS to develop investment appetite for wholesale infrastructure.

This researcher would like to observe that in both the Altech judgement and the judgement of MTRs (*(Mobile Telephone Networks(Pty) Ltd (Applicant) vs The Chairperson of the Independent Communications Authority of South Africa and 30 Others(Respondents*), 2014), the judgements referred to PAJA as the basis for their decisions, notably 3(1) and 4 (1) of PAJA (RSA, 2000):

- According to 3(1) administrative action which materially and adversely affects the rights or legitimate expectations of any person
- According to 4(1) "in cases where administrative action materially and adversely affects the public, an administrator, in order to give effect to the right to procedurally fair action, can decide on (a) holding a public enquiry, and other suggestions are tabulated.

The Altech judgement did not provide nor propose a solution but acknowledged that the spectrum gap existed, which could also mean that the judge (*ment*) could have applied PAJA remedies, e.g. provide an interim measure of spectrum allocation to cater for firms who would self-provide, through interpretations of PAJA (as above); whilst allowing/instructing ICASA the opportunity to develop sustainable spectrum allocation methods. After all, the "Supreme Court of Appeal confirmed that ICASA's regulation process is tantamount to administrative action as contemplated in PAJA" (*Mobile Telephone Networks(Pty) Ltd (Applicant) vs The Chairperson of the Independent Communications Authority of South Africa and 30 Others(Respondents*), 2014, p. 26).

The omission of full application of administrative justice in the judge's interpretation of the ECA in the Altech judgement implied that the court could have erred in not including a resolution, albeit temporary, for spectrum as part of the Altech judgment, and in that way could have unblocked wholesale relief for both VANS and consumers. A cheaper wholesale and pricing regime are legitimate sector expectations, just as self-provisioning was. The administrative justice gap is also reminiscent of ICASA's delayed licence conversions after the promulgation of the ECA.

6.5.2. ICASA's regulation alignment with PAJA creates a regulatory conundrum

It was also a finding of this report that it appeared ICASA did not align sector oversight of the ICTs to PAJA. It was also on this basis that the judgement of the 2014 MTR cases was premised, as the SMP firms that had taken ICASA to court to protest the latest round of MTR regulations had based their submissions to the High Court on PAJA 6 (2), which amongst others:

(a) (ii) (ICASA) acted under a delegation of power which was not authorised by empowering provision, and (c) the action was procedurally unfair.

For purposes of this report, two items stand out in the 2014 judgement (Mobile Telephone Networks(Pty) Ltd (Applicant) vs The Chairperson of the Independent Communications Authority of South Africa and 30 Others(Respondents), 2014):

- (98) MTN and Vodacom have established a clear right to review and set aside the Amended 2014 Regulations (incorporating the 20c determination) for more than one ground of review specified in section 6(2) of PAJA. The Amended 2014 Regulations (or the denuded 2014 Regulations) are accordingly unlawful and invalid.
- (118) Therefore even though ICASA has not promulgated regulations relating to the accounting (as envisaged by the ECA as well as the 2010 Regulations), it seems only logical that the best way of demonstrating the non-efficacy of the 20c figure is to disclose the cost-based relating to that figure. Be that as it may, on the basis of ICASA's answering affidavit, (I) accept for the purposes of exercising my discretion that the 20c exceeded the actual cost terminating calls as at the 1st of April 2014.

Research findings in this report have found that the reasons for the high prices of internet connection were exacerbated by the non-disclosed pricing structure that firms have used to develop prices for broadband, thereby perpetuating the digital divide as the firms seek to realise ROI and profitability. The judgement above referred to MTRs confined findings to voice, and not to the critical component of data.

(118) showed that the courts had the capacity to intervene and provide the lead in shaping the market structure. The courts therefore had the discretion to have resolved both spectrum and wholesale access regulation through including disclosure as part of the (discretionary) judgment.

(98) showed the ever increasing need for regulatory alignment (of the ECA with other essential and complementary pieces of legislation), and the need for ECA reviews to include items of PAJA, as the need for regulatory intervention was urgent in the uneven competitive market structure in South Africa.

6.6. What do the research outcomes tell us about approaches to competition policy in South Africa (historical, current and future?)

In Chapter 3, 3.6.4 proposed to apply inductive reasoning in order to allow for qualitative research methods that allowed for deeper, better and flexible analysis of the data. By applying inductive reasoning in analysis of data, this research was able to pull in other essential insights in order to build further explanations and use these to develop predictive abilities.

6.6.1. The ICT sector still showed traits of managed liberalisation

The attempts at liberalisation through the TA and the ECA were clear indications that the government had an active interest in shaping the market structures, and the development of the current structure with firms with SMPs evolved due to ineffectual regulation in South Africa.

Technology development through convergence had the potential to be future points of contestation and litigation as firms resorted to the courts to ensure appropriability for their investments. Courts would then decide the next levels of liberalisation, sector competitiveness and the market structure.

The Altech judgement had created an "unwarranted regulatory lacuna and vacuum" (MTR Judgement (113)) through the omission of definitive interpretations regarding spectrum availability to ensure effective self-provision; as the ruling was devoid of a committing instruction to ICASA as compared to the 2014 Judgment on cost-based regulations. These inconsistencies in the application of law eventually influenced investment and shaped a market that developed inefficient competition and high prices.

6.6.2. Investment in broadband will be led by the private sector

South Africa's situation of baseline broadband networks that were led by the private sector was not unique, neither were investment patterns and the market structure that developed as a direct result of the variables at play in the ICT ecosystem. With a developing economy that was still scarred by the ravages of a debilitating apartheid economic system, the government would rather focus on delivering essential services like water, sanitation and education to the vast masses of their constituencies first before they invested in broadband. Whilst government acknowledged, through various policies that broadband was a massive enabler, the Government was unwilling to commit significant amounts of money, in full cognisance of the scant resources available and the propensities for corruption that was attendant to public investment. Private entities had the skills and sector insight that both the state and the regulator did not possess, resulting in massive information asymmetries and information gaps that benefited the private sector.

6.6.3. Regulation to placate divergent interests

The need to regulate in the public interest would embolden the regulator and allow them to interfere where appropriate, with the intention to make the market competitive; either through MTRs or open access enforcement. With the government's role of investment in open access wireless networks unclear, regulations to introduce price caps that could impact negatively on the private sectors firms' ROI would create tensions between the regulator and the investing community, both local and international. ICASA's agenda, through regulation, seeks to create a balance between the interests of the investing community and those of the ultimate beneficiaries of the investment: consumers. These

mutual exclusive mandates make the task of even-handedness elusive and could even lead to political tensions.

6.6.4. Mobile broadband will deliver universal access targets

The growth of mobile telephony to saturation levels in South Africa showed that by embracing mobile technology even in the rural areas, consumers have voted with their feet against the high costs of fixed telephone lines. With ADSL still steeply priced for poor households, citizens were increasingly accessing internet through mobile broadband, as evidenced by the rise of smartphones on the MNOs networks. Though still costly through expensive handsets and the high price of broadband, there was a future for mobile telephony in South Africa through vast firm innovations and the convenience that new technology had brought to people across the economic spectrum. New mobile banking innovations, social network innovations and instant messaging platforms increased the value of smartphones in the hands of consumers.

6.6.5. The ICT sector is consolidating

Vertical and horizontal product innovations have collapsed the demarcations between sectors, making the adoption of ICTs part of business strategies across the economy. The proliferation of new apps from both public and private sector entities like government and banks respectively created a stampede towards investment for NGNs. Firms have embarked in frenetic mergers and acquisitions that have endowed their economies of scale, thus their ability to enter into competitive pricing wars that benefit the consumers. Together with efficient and appropriate regulatory interventions, South Africans could experience broadband performance of good speeds and world-class innovations.

6.6.6. ICTs are global, and as such carry global risks

Globalisation of ICTs through equipment and platforms has created a virtual world of connectivity that was ubiquitous, but equally created risks that undermined individual information and privacy, threatened regional and global trade with acts of terrorism and lacked mechanisms protect the details of children from pornography and child trafficking.

South Africa passed the Protection of Personal Information Act, 2013, or POPI, whose objects aims to "regulate , in harmony with international standards, the processing of personal information by public and private bodies in a manner that gives effect to the right to privacy subject to justifiable limitations that are aimed at protecting other rights and important interests" (RSA, 2013). Acts like POPI and the Competitions Act are fundamental to creating a bulwark that sends positive signals to investors that the policy and regulatory environment in South Africa was alive to possible breaches that could undermine operations with a global footprint.

6.7. Recommendations

6.7.1. Better regulation and enforcement of ECA infrastructure sharing provisions

The ECA 2005, and specifically the Altech judgement that waived restrictions to investors by VANS, created a period of increased infrastructure investment that was characterised by lack of coordination, infrastructure duplication and high barriers of entry, due to ineffectual regulation and enforcement of ECA rules of infrastructure sharing and wholesale access. Regulatory lethargy towards clear broadband market definition was leading to market structure unevenness and concentration, consumer price distortions and generally inefficient competition. A better capacitated ICASA would build the right institutional focus and provide effective sector oversight.

6.7.2. Develop wholesale open access wireless

A baseline, wholesale open access wireless network with high speed HSPA capacities of 3G and 4G should be considered through joint development PPP models, in order to increase the use of, and better quality of service of mobile broadband in the rural and underserviced areas. In order to entice firms, strategies of developing a wholesale radio access network should be implemented in partnerships with municipalities or traditional authorities which own the land, on a quid pro quo basis. Access to land should be traded for cheaper services for joint development wholesale benefits for provinces and municipalities; whilst owners of land with claims made by dislodged communities could also opt to build networks that benefited communities, in contrast to complete surrender of productive land.

6.7.3. Local investment should include local partners

This report also identified increasing investment by municipalities in fibre networks and Wi-Fi. These are positive developments as these structures are familiar with the lay of the land and are closer to their customers, as shown by Knysna and City of Tshwane. Local strategies like the Integrated Development plans (IDPs) should provide brush strokes of the plans and indicate where possible interventions by both Government and the private sector could be made. Municipalities that lack capacities could encourage the formation of cooperatives that could partner with private sector implementing agents.

6.7.4. Public investment to stimulate demand and public usage

The adoption of e-services by various structures of government should be encouraged and matched with public investment in innovation. In rural areas where traditional authorities remained the first port of call and the visible structures of governance, innovative campaigns could use social networks and Q&As with leadership. Leadership should therefore be motivated to communicate and share development plans or disaster response mechanisms with their localities through social networks.

These are interventions that aim at democratising the internet and increase local leadership visibility and accountability, and also increase local participation and economic development.

6.7.5. The role of SOEs and state agencies

This research showed that USAASA and Broadband Infraco had limited capacities to investment in broadband, primarily through operational and governance challenges. The shifting tides of broadband favoured mobile broadband, though in the densely populated areas the private sector had equally shown appetite for fixed fibre networks as part of local loops due to high demand in the lucrative areas. SOEs like Broadband Infraco remain strategically vital and should be encouraged to lead the state's market mitigation strategy through crowding in or mobilising the private sector to invest in better access capacities in the underserviced or rural areas, ideally jointly with the provincial and municipal structures.

6.7.6. Spectrum resolution

The resolution of high demand spectrum represented one of the largest points where firms butted heads with the regulator frequently; perhaps not out of the regulators' own doing, but largely attributed to the lack of policy leadership on the issue and sector consensus on the allocation mechanisms. Firms required the high demand 2.6 GHz to match the vast uptake of smartphones on their networks and thereby create a further business case that justifies capital expenditures in wireless networks. Aligning the resolution of both 2.6GHz and 800MHz bands to the targets of universal access sounds sensible; but the resolution remained entangled with the protracted and politicised digital migration.

6.8. Areas for further research

This study illustrates that investment in broadband services in South Africa is the exclusive domain of the private sector, with little coming from the public sector. This situation creates a policy conundrum when the state requires to develop policies that will assist with regulation of the sector or universal access, as these policies affect the profitability of the private sector and create tensions between the regulator and the ICT sector.

Other topics that could be a source of new knowledge could be:

6.8.1. A study on the governance of private sector broadband firms; with the intention at looking at how shareholders of firms like Telkom, Vodacom or MTN affect the performance of the firm in terms of "real options". Investment decisions are not taken in a vacuum and shareholders weigh in on firm strategy.

6.8.2. The lack of coordination amongst SOE servitude networks and private sector investors. What are the benefits of coordination and what international benchmarks exist in harmonisation of infrastructure investment?

6.8.3. A study that focuses on how South African traditional authorities can lead in value innovation and demand development in the communities. Chiefs still hold sway in community development and cooperation with them could assist certain benefits of both supply-side and demand-side innovations.

6.8.4. A study that focuses on broadband infrastructure as a resource in the shifting tides of resource nationalism. Could disproportionate diffusion result in the resource nationalism felt by mining companies?

In conclusion, it is obvious that the ECA 2005, and dramatic Altech judgment of 2008 pushed aside investment constraints created by policy and regulation. However, due to ineffectual policy and regulation, investment trends of the supply-side have influenced the nature of the competitive market structure in such a way that gains are exclusive for urban, and specific high income categories and have adopted the spatial patterns of apartheid; but remain weak for universal access and service.

LIST OF REFERENCES

Africa Telecom & IT. (2013, November 13). *Vodacom to accelerate Capex after strong growth in H1*. Retrieved from www.africatelecomit.com: http://www.africatelecomit.com/vodacom-to-accelerate-capex-after-strong-growth-in-h1

Allen, D. (1988). New Telecommunications Services. *Telecommunications Policy*, 257-271.

Altech. (2008, August 29). *Altech Wins High Court Verdict (Press Release).* Retrieved from www.mybroadband.co.za: http://mybroadband.co.za/vb/showthread.php/133380-Altech-s-press-release

Altech Autopage Cellular (Pty) Ltd v the Chairperson of the Council of the Independent Communications Authority of South Africa and Others, 2002/08 (High Court August 2008).

American Tower Corporation. (2014, June 16). *Annual Results*. Retrieved from www.financials.morningstar.com: http://financials.morningstar.com/income-statement/is.html?t=AMT&region=USA&culture=en-US

Anderson, B. (2008, September 11). How Atech's Case will allow SA telecoms to move into the real world. *FINWEEK*, pp. 14-17.

Andes, S., & Castro, D. (2009). Driving a Digital Recovery: IT Investments in the G-20 Stimulus Plans. *The Information Technololy & Innovative Foundation*, 1-17.

Annamalai, T., Mahalingam, A., & Deep, A. (2012). *Does private involvement(including public private partnerships) in dellivery of water, telecommunications and electricity services lead to improved access and quality of service.* London: EPPI .

Armstrong, B. (2013). Broadband in South Africa. *MyBroadband 2013* (pp. 2-44). Johannesburg: Telkom.

Aschauer, D. (1990). *Public Investment and Private Sector Growth: The Economic Benefits of Reducing America's "Third Deficit.* Wahington, DC: Economic Policy Institute.

ATC. (2010). *Annual Report.* ATC.

ATC. (2013). *American Tower Semi-Annual International Market Overview.* New York: ATC.

ATC. (2014). *Financial and Operational Update Q2 .* New York: ATC.

ATC South Africa. (2014, May 24). *Corporate Profile*. Retrieved from www.americantower.com: http://www.americantower.com/South%20Africa/AboutUs.aspx

Atkinson, R. (2007). Framing a National Broadband Policy. *Commlaw Conspectus Vol.16*, 145-177.

Atkinson, R. (2008). The role of competition policy in a National Broadband Policy. *Journal on Telecommunications and High Technology Law, Vol.7*, 1-18.

Balancingact-africa. (2014, March 29). *Minister, ICASA in Court Over self-provisioning licence for JSE-listed Altech*. Retrieved from www.balancingact-africa.com: http://www.balancingact-africa.com/news/en/issue-no-428/telecoms/minister-icasa-in-co/en

Bauer. (2009). *Regulation , Public Policy, and Investment in Communication Infrastructure, Version 1.0.* Michigan: Quello Center.

Bauer. (2009). *Regulation , Public Policy, and Investment in Communication Infrastructure, Version 1.0, p.8.* Michigan: Quello Center.

Bauer. (2010). Regulation, Public Policy and Investment in Communication Infrastructure. *Telecommunications Policy 34*, 65-79.

Bauer. (2010). Regulation, Public Policy and Investment in Communication Infrastructure . *Telecommunications Policy 34*, 65-79.

Bauer, J., & Shim, W. (2012). *Regulation and Innovation in Telecommunications.* Michigan: Quello Center.

Bauer, J., & Shim, W. (2012). *Regulation and Innovation in Telecommunications, Working Paper 01-2012.* Michigan: Quello Center.

Bauer, J., & Wildman, S. (2012). *The Economics of Usage-Based Pricing in Local Broadband Markets.* Michigan: Michigan State University.

Benjamin, C. (2013, November 08). *Will Vodacom take the Gap?* Retrieved from www.mg. co.za: http://mg.co.za/article/2013-11-08-00-will-vodacom-take-the-gap

Bernal, D. (2013). Providing Broadband services through PPP(Public Private Partnership) models. *Regional Seminar on Costs and Tariffs for Asia and Pacific and meetin of the SG3RG-AO* (pp. 4-41). Tokyo: ITU.

Bessis, J. (2005). *Risk Management in Banking.* West Sussex: John Wiley & Sons, Ltd.

Bhattacharyay, B. (2009, May). *Infrastructure Development for ASEAN Economic Infrastructure.* Retrieved from www.adbi.org: www.adbi.org/.../2009.05.27.wp138.infrastructure.dev.asean.economic

Bizcommunity. (2013, 08 May). *E-banking survey reveals surge in mobile banking.* Retrieved from www.ibzcommunity.co.za: http://www.bizcommunity.com/Article/196/19/93088.html

Bloomberg. (2014, April 05). *Company Overview of Oger Telecom Limited*. Retrieved from www.investing.businessweek.com: http://investing.businessweek.com/research/stocks/private/snapshot.asp?privcapId=24083186

BMI. (2014). *South Africa Telecommunications Report.* London: Business Monitor International.

Booz & Co. (2011). *Connecting Africa: The Next 10 Years of Mobile Growth.* Booz & Co.

Boshoff, W. (2013). *Why define markets in competition cases : Stellenbosch Economic Working Papers: 10/13.* Stellenbosch: Department of Economics, University of Stellenbosch.

Bowman Gilfillan. (2014, June 14). *Commission reaches settlement agreement with Telkom.* Retrieved from www.bowman.co.za: http://www.bowman.co.za/News-Blog/Blog/Commission-reaches-settlement-agreement-with-Telkom

Bowman, C., & Ambrosini, V. (2000). Value creatio versus value capture. *British Journal of Management, 11(1)*, 1-15.

Brand SA. (2014, February 19). *How the World Rates SA*. Retrieved from www.southafrica.info: http://www.southafrica.info/business/economy/globalsurveys.htm#.UygSAUkaLmI

Broadband Infraco. (2008). *Annual Report* . Johannesburg: Broadband Infraco.

Broadband Infraco. (2009). *Annual Report.* Johannesburg: Broadband Infraco.

Broadband Infraco. (2012). *Annual Report.* Johannesburg: Broadband Infraco.

Broadband Infraco. (2012). Presentation to Select Committee on Labour and Public Enterprises. *Select Committee on Labour and Public Enterprises* (pp. 1-23). Cape Town: Broadband Infraco.

Broadband Infraco. (2012). *Presentation to the Select Committee on Labout and Public Enterprises.* Broadband Infraco.

Broadband Infraco. (2013). *Annual Report.* Johannesburg: Broadband Infraco.

Broadband Infraco. (2014, April 23). *Corporate Profile*. Retrieved from www.infraco.co.za: http://www.infraco.co.za/CorpProfile/default.aspx

Bronkhorst, Q. (2013, February 22). *Battle for Spectrum in SA*. Retrieved from www.businesstech.co.za: http://businesstech.co.za/news/telecommunications/32038/battle-for-spectrum-in-sa/

Bruner, R. (2003). *HHI Model (Exhibit from Applied Mergers and Aquisitions)*. Retrieved from www.fisher.osu.edu: fisher.osu.edu/fin/faculty/walkling/.../HHI.xls

Buiges, P. (2006). *Competition Policy Versus Sector-Specific Regulation in Network Industries.* Geneva: UNCTAD.

Business Report. (2013, October 13). *Neotel turns profitable for the first time*. Retrieved from www.iol.co.za: http://www.iol.co.za/business/companies/neotel-turns-profitable-for-first-time-1.1599712#.Ux3xvEkaL4g

Businesstech. (2014, July 24). *Broadband to save Gauteng R162 million*. Retrieved from www.businesstech.co.za: http://businesstech.co.za/news/government/63806/broadband-to-save-gauteng-r162-million/

Cairns, P. (2011, July 26). *The Investment Case-Remgro Ltd.* Retrieved from www.moneyweb.co.za: http://www.moneyweb.co.za/moneyweb-101-for-beginners/the-investment-case--remgro-ltd-2

Calvo, A. (2012). *Universal Service Policies in the Context of National Broadband Plans: OECD Digital Economy Papers, No. 203*. Retrieved from OECD Digital Economy Papers, No. 203, OECD Publishing.: http://dx.doi.org/10.1787/5k94gz19flq4-en.

Cambini, C., & Jiang, Y. (2009). Broadband Investment and Regulation: A literature Review. *Telecommunications Policy*, 559-574.

Cave, M. (2007). *The Regulation of Access in Telecommunications.* Warwick Business School.

CBC. (2013). *The Africa Infrastructure Investment Report.* London: Commonwealth Business Communication Limited.

Cell C. (2009). *Cell C grabs market share despite tough times*. Retrieved from www.cellc.co.za: http://www.cellc.co.za/explore/newsroom/cell-c-grabs-market--share-despite-tough--times

Cell C. (2013). *CELL C'S WRITTEN RESPONSE TO DRAFT CALL TERMINATION REGULATIONS, 2013 .* Johannesburg: ICASA.

Cell C. (2014, April 05). *Cell C By Numbers*. Retrieved from www.cellc.co.za: http://www.cellc.co.za/explore/additionalinfo/cell-c-by-numbers

City of Joburg. (2014, January 31). *Broadband Network Transforming Johannesburg into "Digital City"*. Retrieved from www.joburg.org.za: http://www.joburg.org.za/index.php?option=com_content&view=article&id=8996:31-01-2014-broadband-network-transforming-johannesburg-into-digital-city&catid=217:press-releases-2013&Itemid=114

Cochran, C., Meyer, L., Carr, T., & Cayer, N. (2009). *American Public Policy: An introduction, 9th edition.* Boston: Wadsworth Cengage Learning.

Competition Commission. (1998). *Competition Act (No.89 of 1998).* Pretoria: Competition Commission.

Convergence Partners. (2012, 05). *Fibreco breaks new ground on fibre*. Retrieved from www.convergencepartners.co.za: http://www.convergencepartners.com/2012/05/fibreco-breaks-ground-on-r5-billion-fibre-optic-network/

Convergence Partners. (2012, September 13). *FibreCo Completes forst 600km of R5bn broadband network*. Retrieved from www.convergencepartners.com: http://www.convergencepartners.com/2012/09/fibreco-completes-first-600-km-of-r5-billion-broadband-network/

Corbin, J., & Strauss, A. (1996). *Basics of Qualitative Research: Techniques and Procedures.* London: Sage Publications.

Correia, D., Flynn, D., Uliana, E., & Wormald, M. (2000). *Financial Management Fourth Edition.* Cape Town: Juta & Co. Ltd.

Crandal, R., & Aron, D. (2008). *Investment in Next Generation Networks and Wholsale Telecommunications Regulation.* LECG ,Northwestern University and The Brookings Institution and Criterion Economics.

Crandall, R., & Aron, D. (2008, November 03). *Investment in Next Generation Networks and Wholesale Communations.* Retrieved from www.papers.ssrn.com: http://papers.ssrn.com/sol3/papers.cfm?abstract_id=1294910

Crandall, R., & Jackson, C. (2001). *The $500 Billion Opportunity: The Potential Benefit of Widespread Diffusion of Broadband Internet Access.* Criterion Economics.

Cresswell, J. (2013, December 23). *Research Design: Qualitative, Quantitative and Mixed Methods appraches, 2nd Edition*. Retrieved from www.sita-malang.com: www.stiba-malang.com/.../RESEARCH%20DESIGN%20QUA%20QUA...

Crownfibre. (2014, February 23). *Ultra-Fast Broadband*. Retrieved from www.crownfibre.govt.za: http://www.crownfibre.govt.nz/ufb-initiative/

Cull, D. (2008, September 01). *Note on the Altech Judgement.* Retrieved from www.michaelsons.co.za: http://www.michalsons.co.za/note-on-the-altech-judgement/350

Dark Fibre Africa. (2009, 09 03). *DFA ploughs R2bn into fibre*. Retrieved from www.dfafrica.co.za: http://www.dfafrica.co.za/press-releases/2008-09-03

Dark Fibre Africa. (2014, February 21). *Corporate Profile*. Retrieved from www.dafrica.co.za: http://www.dfafrica.co.za/

Deloitte. (2012). *Sub-Saharan Africa Moile Observatory 2012.* Deloitte.

Deloitte. (2013, February 2013). *2013 Forecast for the South African Telecoms Market*. Retrieved from www.delloitedigital.co.za: http://www.deloittedigital.co.za/blog/2013-forecast-for-the-south-african-telecoms-market

Digital Focus. (2013, October). Broadband in a nutshell. *Digital Focus, 2nd Edition*, pp. 6-7.

Digital Media & Marketing Association. (2013). *SA Online Report 2013.* Cape Town: DMMA.

Dnes, A. (October 1995). Post-Privatisation Performance- Regulating Telecommunications in the U.K.: Testing Regulatory Capture. *Public Policy for the Private Sector No.60*, 2-4.

DoC. (2012, November 06). *Making South Africa a Global Leader in Harnessing ICTs for Socio-economic Developmen.* Retrieved from www.doc.gov.za: www.doc.gov.za/presentations-2.html?download=49:presentations

DoC. (2013). *Electronic Communications Ammendment Bill: Presentation to the Portfolio Commnications Committee.* Pretoria: Department of Communications.

DoC. (2013). *ICT Policy Green Paper.* Pretoria: DoC.

DoC. (2013). Presentation on CTC to Portfolio Committee on Communication. *Cost to Communicate 2014* (p. 14). Cape Town: Department of Communications.

DoC. (2014, March 06). *Constitutional mandates*. Retrieved from www.doc.gov.za: http://www.doc.gov.za/about-us/legislative-and-constitutional-mandates.html

DoC. (2014, March 04). *ICT Policy Review*. Retrieved from www.doc.gov.za: http://www.doc.gov.za/key-programmes/ict-policy-review.html

DoC. (2014, May 23). *Statement on Broadband Radio Spectrum Policy*. Retrieved from www.doc.gov.za: http://www.doc.gov.za/mediaroom/media-statements/326-statement-on-broadband-radio-policy-directives.html

DoC. (2014). *The National Integrated Policy Review: Green Paper.* Pretoria: DoC.

Douglas, D. (2003). Inductive theory generation: A grounded approach to business inquiry. *Electroni Journal of Business Research Methods , 2 (1)*, 47-54.

Dymond, A., & Oestman, S. (2003). The Role of Sector Reform in Achieving Universal Access. *Trends in Telecommunications Reform*, 51-65.

Economides, N. (2005). Telecommunications Regulation: An Introduction. In R. R. Nelson, *The Limits and Complexity of Orgaizations* (pp. 48-76). New York: Russel Sage Foundation Press.

Economides, N. (2006). *Public Policy in Network Industries*. Retrieved from www.stern.nyu.edu: www.stern.nyu.edu/networks/Economides_Public_Policy_In_Network_I...

Elder, J. (2013). *Review of Policy Measures to Stimulate Private Demands for Innovation.* University of Manchester: Manchester Institute of Innovation Research.

Ellipis. (2014, July 11). *ICASA Framework for introducing Local Loop Unbundling.* Retrieved from www.ellipsis.co.za: www.ellipsis.co.za/wp-content/.../06/LLU-Discussion-paper-Final.docx

Ellipsis. (2008, September 01). *Note on the "Altech Judgement" Introduction to Self Provisioning*. Retrieved from www.ellipsis.co.za: www.ellipsis.co.za/wp.../note_altech_judgement_web_03092008.pdf

Ellipsis Regulatory Solutions. (2008, September 01). *Note on the Altech Judgement.* Retrieved from www.ellipsis.co.za: www.ellipsis.co.za/wp.../2008/.../note_altech_judgement_web_0309200

Ellipsis Regulatory Solutions. (2011). *Overvew of Electronic Regulation in South Africa.* Johannesburg: Ellipsis.

Esselaar, S. (2008, 09 09). *A friendly network is coming your way*. Retrieved from www.mg.co.za: http://mg.co.za/article/2008-09-09-a-friendly-network-is-coming-your-way

Esselaar, S., Gillwald, A., Moyo, M., & Naidoo, K. (2010). *South African ICT Sector eview 2009/2010.* Cape Town: Research ICT Africa.

European Commission. (2013). *The Broadband State Aid Rules Explained: An eGuide for Decision Makers, ISBN 978-92-79-35280-5.* Bad Honnef, Germany: European Commission.

Family Health International. (2013, December 20). *Qualitative Research Methods: A Data Collectors Field Guide*. Retrieved from www.ccs.neu.edu: www.ccs.neu.edu/course/is4800sp12/resources/qualmethods.pd

FIBRECO. (2014, May 30). *FIBRECO Homepage*. Retrieved from www.fibreco.co.za: http://fibreco.co.za/network/map.aspx

Fin24. (2014, May 19). *Vodacom to acquire 100% of Neotel.* Retrieved from www.fin24.com: http://www.fin24.com/Companies/ICT/Vodacom-to-acquire-100-of-Neotel-20140519

Fisher, H. (2008). Hosting the FIFA 2010 Soccer World Cup: The South African Service Delivery Dilemma. *2008 CAPAM Biennial Conference* (pp. 1-12). Ottawa: CAPAM.

Fransman, M. (2010). *The New ICT Ecosystem.* Cambridge: Cambridge.

Fransman, M. (2010). *The New ICT Ecosystem: Implications for Policy and Regulation.* Cambridge: Cambridge University Press.

Froyen, R. (2002). *Macroeconomic Theories and Policies, Seventh Edition.* University of North Carolina: Prentice-Hall Intetnational Inc.

Futter, R. (2011). *Telecoms Infrastructure Spend: What are the risks and opportunities to Telecoms Investment in Africa.* Retrieved from www.crescoprojectfinance.co.za: www.crescoprojectfinance.co.za/.../Telecoms_Infrastructure_Spend_in_...

Garcia-Murillo, M., & Pick, J. (2004). Interconnection and Regulation: Explaining Dominance by the Incumbent in Mexico. *Communications & Strategies, no.53 1st Quarter*, 17-52.

Gauteng. (2012). *Gauteng ICT Development Strategy.* Johannesburg: Gauteng.

Gauteng Province. (30 March 2013). Speech By Mr. Mandla Nkomfe, Gauteng Mec For Finance. *2013/2014 Budget Vote Of The Gauteng Department Of Finance* (pp. 1-6). Johannesburg: Gauteng Province.

Gauteng Province Procincial Treasury. (2012). *Infrastructure Development in South Africa and Gauteng: Quaterly Bulletin.* Gauteng Province.

Genesis. (Unspecified). *Broadband Networks: Financing and Investment Strategy in Broadband- the African Experience.* Geneva: ITU EYE Country Reports.

Gillwald, A. (2003). *National Convergence Policy in a Globalised World: Preparing South Africa for Next Generaion Networks, Services and Regulation.* Johannesburg: LINK Centre.

Gillwald, A. (2005). Good intentions, poor outcomes: Telecommunications reform in South Africa. *Telecommunications Policy*, 469-491.

Gillwald, A. (2005). Good Intentions, poor outcomes: Telecommunications reform in South Africa. *Telecommunications Policy 29*, 469-491.

Gillwald, A. (2009). Good Intentions, poor outcomes: SA telecoms in Review. *i-week* (pp. 1-36). Johannesburg: ResearchICTafrica.

Girard, B. (2005). *Internet, Radio and Network Extension.* Lingby: Infodev.

Goldstuck, A. (2012). *Internet Matters: A quiet engine of the South African economy.* Johannesburg: World Wide Worx.

Goldstuck, A. (2014). *South Africa Social Media Landscape .* Johannesburg: Wordwideworx.

Gramlich, E. (1994). Infrastructure Investment: A Review Essay. *Journal of Economic Literature , Vol,XXXII*, 1176-1196.

Grant Thorton. (2012). *Emerging Market Opportunities Index: High Growth Economies.* Johannesburg: Grant Thorton.

Grimsey, D., & Lewis, M. (2002). Evaluating the Risks of public private partnerships for infrastructure projects. *International Journl of Project Management 20*, 107-118.

Hawthorne, R. (2013). Draft Findings: Telecommunications Review. *Presentaions at the University of Johannesburg* (pp. 1-41). Johannesburg: University of Johannesburg.

Hawthorne, R., Bonakele, T., Cull, D., & Lewis, C. (2014). *Review of economic regulation of the telecomunications sector.* Johannesburg: University of Johannesburg Centre for Competition, Regulation and Economic Development.

Heil, O., & Helsen, K. (2001). Toward an understanding of price wars: Their nature and how they develop. *International Journal of Reasearch in Marketing*, 83-98.

Henisz, W., Zelner, B., & Guillen, M. (2005). The Worldwide Diffussion of Market-Oriented Infrastructure Reform, 1977-199. *American Sociological Review, Vol.70, No.6*, 871-897.

Heritier, A. (2001). Market integration and social cohesion: the politis of European regulation. *Journal of European Public Policy , 8(5)*, 825-852.

Hess, H. (2013). International Analysts Day. *American Tower-International Analyst Day* (p. 83). New York: ATC.

Hodge, J. (2000). *Liberalising Communication Services in South Africa.* Retrieved from www.siteresources.worldban.org: siteresources.worldbank.org/INTRANETTRADE/.../SAfrTelecom.pdf

Holcombe, R. (1997). A theory of the Theory of Public Goods. *Review of the Austrian Economy*, 1-22.

Honing, D. (2012, March 01). *More Wireless Broadband is What Consumers Want, US needs to Close Digital Divide*. Retrieved from www.huffingtonpost.com: http://www.huffingtonpost.com/david-honig/more-wireless-broadband-i_b_1161068.html

Hovenkamp, H. (2010). The Law of Vertical Integration and the Business Firm: 1880-1963. *Iowa Law Review*, 863-918.

Husserl, E. (1913). *Ideas: General Introduction to Pure Phenomenology .* London: Collier, MacMillan.

Hutton, D. (2011, September 30). *Mobile Phones Dominate in South Africa*. Retrieved from www.nielsen.com: http://www.nielsen.com/us/en/newswire/2011/mobile-phones-dominate-in-south-africa.html

ICASA. (2007). *Notice of Intention to Define Relevant Wholesale Call Termination Markets in Terms of Section 67(4) of the Electronic Communications Act 36 of 2005.* Cape Town: Government Printers.

ICASA. (2013). *Broadband Value Chain Request for Information (RFI).* ICASA.

ICASA. (2013). Cost to Communicate. *Select Committee on Labour and Public Enterprises.* Cape Town: SA Parliament.

ICASA. (2013). *Explanatory Note to Accompany the Draft "Bitstream and Shared/Full Loop Access Regulation.* Johannesburg: ICASA.

ICASA. (2014, Marcg 21). *Broadband Value Chain Analysis*. Retrieved from www.icasa.org: https://www.icasa.org.za/LegislationRegulations/MarketsCompetition/MarketsCompetitionAnalysis/CosttoCommunicateProgramme/BroadbandValueChainAnalysis/tabid/744/Default.aspx

ICASA. (2014, May 23). *ICASA comments on potential mergers and aquisitions.* Retrieved from www.icasa.org.za: https://www.icasa.org.za/AboutUs/ICASANews/tabid/630/post/Comments_On_Mergers_And_Acquisitions/Default.aspx

ICASA. (2014, March 12). *ICASA launches public inquiry into the state of competition in the ICT sector.* Retrieved from www.icasa.org.za: https://www.icasa.org.za/AboutUs/ICASANews/tabid/630/post/Inquiry_Into_State_Of_Competition_In_The_ICT/Default.aspx

ICASA. (2014, July 11). *Local loop unbundling*. Retrieved from www.icasa.org.za: https://www.icasa.org.za/LegislationRegulations/RegulationsUnderway/LocalLoopUnbundlingLLU/tabid/540/Default.aspx

ICASA. (2014, June 03). *www.icasa.co.za.* Retrieved from ICASA comments on mergers and acquisitions of telecom operators: https://www.icasa.org.za/AboutUs/ICASANews/tabid/630/post/Comments_On_Mergers_And_Acquisitions/Default.aspx

Inderst, G., & Della Croce, R. (2013). *Pension Fund Iinvestment in Infrasructure- A comparison between Australia and Canada, OECD Working Papers on Finance, Insuarance and Private Pensions.* OECD.

Infraco, B. (2009). *Annual Report.* Johannesburg: Broadband Infraco.

Internet Society. (2014). *Internet Society Global Internet Report.* Internet Society.

InvestingAnswers. (2014, April 29). *Headline Earnings Definition*. Retrieved from www.investinganswers.com: http://www.investinganswers.com/financial-dictionary/financial-statement-analysis/headline-earnings-529

Investopedia. (2014). *EBITDA*. Retrieved from www.investopedia.com: http://www.investopedia.com/terms/e/ebitda.asp

ISPA. (2013). *ISPA Recognition*. Retrieved from www.ispa.org.za: http://ispa.org.za/about-ispa/

ITNewsAfrica. (2014, February 17). *Dark Fibre Africa aquires Conduct.* Retrieved from www.itnewsafrica.co.za: http://www.itnewsafrica.com/2014/02/dark-fibre-africa-acquires-conduct/

ITU. (2006). Ruling the New and Emerging Markets in the Telecommunications Sector. *What rules for IP-enabled NGNs* (pp. 15-45). Geneva: ITU.

ITU. (2009). *Report to the Bangladesh Telecommunications Regulatory Commission (BRTC) On Significant Market Power.* Geneva: ITU.

ITU. (2013). *Competition and regulation in a converged broadband world.* Geneva: ITU.

ITU. (2013). *Measuring the Information Society.* Geneva: ITU.

ITU. (2013). WTPF Strategic Dialogue. *World Telecommunications/ICT Policy Forum* (p. 4). Geneva: ITU.

ITWeb. (2001, January 24). *Facilities-based competition will ensure economic growth and development*. Retrieved from www.itweb.co.za: http://www.itweb.co.za/index.php?option=com_content&view=article&id=98930

ITWeb. (2013, July 16). *Dubai's Oger Telecom injects $350m in Cell C*. Retrieved from www.itweb.co.za: http://www.itwebafrica.com/telecommunications/325-south-africa/231320-dubais-oger-telecom-injects-350mn-in-cell-c

Kaplow, L. (2013). *Market Definition, Discussion Paper No.745.* Cambridge: Harvard Law School.

Katz, R. (2011). *Broadband Business Models to meet deployment targets.* Geneva: ITU.

Kelly, T., & Rossotto, C. (2012). *Broadband Strategies Handbook.* Washington, D.C: The World Bank.

Khalil, A. (2013, November 19). *Hariri's Saudi Oger Empire for Sale*. Retrieved from www.emglsh.al-akhbar.com: http://english.al-akhbar.com/node/17646

Kirkpatrick, C., Parker, D., & Zhang, Y. (2006). Foreign direct investment in infrastructure in developing countries: does regulation make a difference. *Transnational Corporations , Vol.15*, 144-171.

Koboldt, C. (2012). *Competition and Regulation in a Converged World.* Geneva: ITU.

Kwak, Y., Chih, Y., & Ibbs, C. (2009). Towards a Comprehensive Understanding of Public Private Partnerships for Infrastructure Development. *Carlifornia Management Review*, 54-78.

Laffont, J., & Tirole, J. (1991). The Politics of Government Decision-Making: A theory of regulatory Capture. *The Quaterly Journal of Economics*, 1089-1127.

Lamprecht, M. (2011). *MTN Technology Overview.* MTN.

Lester, S. (1999, December 20). *An Introduction To Phenomenological Research.* Retrieved from www.sld.demon.uk: www.sld.demon.co.uk/resmethy.pdf

Mahan, A., & Melody, W. (2005). *Stimulating Investment in Network Development : Roles for Regulators.* Lyngy,Denmark: infoDev.

Mahlong, A. (2011, November 07). *R36 million broadband project launched*. Retrieved from www.saitnews.co.za: http://saitnews.co.za/broadband/million-broadband-project-launched/

Mail & Guardian. (2014, April 14). *Vodacom and MTN pay R2.26 billion to take over Nashua Mobile customers.* Retrieved from www.mg.co.za: http://mg.co.za/article/2014-04-14-vodacom-and-mtn-to-pay-r226-billion-to-take-over-nashua-mobile-customers

Marvasti, A. (2004). *Qualitative Research in Sociology.* London: SAGE.

Mavuso, M. (2012). *Public Hearings on Cost of Communications.* Telkom.

Mawson, N. (2013, February 27). *Broadband Funding on Hold*. Retrieved from www.itweb.co.za: http://www.itweb.co.za/?id=62072:Broadband-funding-on-hold

Maxwell, J. (2008, July 07). *Designing A Qualitative Study*. Retrieved from www.coursesite.uhcl.edu: coursesite.uhcl.edu/HSH/PeresSc/Classes/.../Ch7_qualitativeResearch.pdf

McChesney, R., & Schiller, D. (2003). *The Political Economy of International Communications: Foundations for the Emerging Global Debate about Media Ownership and Regulation, Programme Paper Number 11.* United Nations Research Institute for Social Development.

McKinsey . (2012). *A "New Deal": Driving investment in Europe's telecoms infrastructure.* McKinsey.

McLeod, D. (2013, September 13). *Telkom CEO vows to fight ünfair"LLU*. Retrieved from www.techcentral.co.za: http://www.techcentral.co.za/telkom-ceo-vows-to-fight-unfair-llu/43914/

Melody, W. (2005). *Regulation and Network Investment: A framework for analysis.* Lyngby: Infodev.

Minow, M. (2003). Public and Private Partnerships: Accounting for the New Religion. *Harvard Law Review*, 1229-1270.

MN0-R1. (2014, 03 22). Wireless Broadband Engineer. (Author, Interviewer)

MNO-R2. (2014, 03 06). Head of Regulatory Affairs. (Author, Interviewer)

Mobile Telephone Networks(Pty) Ltd (Applicant) vs The Chairperson of the Independent Communications Authority of South Africa and 30 Others(Respondents), No.2014/046999 (In the High Court of South Africa (Gauteng Local Division, Johannesburg) March 31, 2014).

Mochiko, T. (2013, July 16). *Cell C gets funding boost from Oger Telecom, banks*. Retrieved from www.bdlive.co.za: http://www.bdlive.co.za/business/technology/2013/07/16/cell-c-gets-funding-boost-from-oger-telecom-banks

Mochiko, T. (2013, August 15). *Cell C Plans R200m network expansion in Gauteng*. Retrieved from www.bdlive.co.za: http://www.bdlive.co.za/business/technology/2013/08/22/cell-c-plans-r200m-network-expansion-in-gauteng

Mochiko, T. (2014, January 29). *ICASA releases final regulations on mobile*. Retrieved from www.bdlive.com: http://www.bdlive.co.za/business/technology/2014/01/29/icasa-releases-final-regulations-on-mobile-termination-rates

Mohr, P., & Fourie, L. (2004). *Economics for South African Students.* Pretoria: Van Schaik.

Moneyweb. (2008, August 29). *Court: Competitors Allowed to bypass Telkom*. Retrieved from www.moneyweb.co.za: http://www.moneyweb.co.za/moneyweb-technology-news/court-competitors-allowed-to-bypass-telkom

Morokolo, E. (2014, May 13). *Cell C to increase nework sites*. Retrieved from www.saitnews.co.za: http://saitnews.co.za/broadband/increase-network-sites/

Morokolo, E. (2014, April 15). *City of Tshwane to Roll Out 600 hotspots*. Retrieved from www.saitnews.co.za: http://saitnews.co.za/broadband/tshwane-hotspots/

Mossberger, K. (2008). Digital Citizenship. *The Internet, Society and Participation.* Chicago: MIT Press.

Moteff, J., & Parfomak, P. (2004). *CRS Report for Congress: Critical Infrastructure and Key Assets, Definition and Identification.* Washington: Congessional Research Services.

MTN. (2008). *Digital inclusion for all in South Africa*. Retrieved from www.mtn.com: https://www.mtn.com/.../Digital%20inclusion%20for%20all%20in%20So

MTN. (2010). *MTN Group Ltd Integrated Report.* Johannesburg: MTN.

MTN. (2012, September 27). *MTN: LTE in three cities , more 3G coverage and other stuff that R7billion can buy you*. Retrieved from www.thetechieguy.files.wordpress.com: http://thetechieguy.files.wordpress.com/2012/09/image53.png

MTN. (2013). *MTN'S RESPONSE TO THE ICASA DRAFT CALL TERMINATION REGULATION AS PUBLISHED IN GOVERNMENT GAZETTE NO 36919 DATED 11 OCTOBER 201.* Johannesburg: ICASA.

MTN Group. (2011). *Annual Results.* MTN.

MTN Group. (2013). *Annual Results.* MTN.

MTN Group Ltd. (2012). *Integrated Annual Report.* Johannesburg: MTN.

Mtshali, N., & Ndaba, B. (2014, February 11). *R1.5bn for cheaper internet access*. Retrieved from www.iol.co.za: http://www.iol.co.za/scitech/technology/telecoms/r1-5bn-for-cheaper-internet-access-1.1645111#.U9Et5UkaJMs

Mudzuli, K. (2013, November 27). *More wi-fi spots go live in Tshwane*. Retrieved from www.iol.co.za: http://www.iol.co.za/scitech/technology/telecoms/more-wi-fi-spots-go-live-in-tshwane-1.1613043

Muller, R. (2008, 04 08). *Seven years on, Cell C makes an operating profit*. Retrieved from www.mybroadband.co.za: http://mybroadband.co.za/news/cellular/3515-seven-years-on-cell-c-makes-an-operating-profit.html

Muller, R. (2009, December 09). *Cell C's broadband plans*. Retrieved from www.broadband.co.za: http://mybroadband.co.za/news/broadband/10787-cell-c-s-broadband-plans.html

Muller, R. (2014, July 11). *Don't fall for ICASA's changing LLU story*. Retrieved from www.mybroadband.co.za: http://mybroadband.co.za/news/telecoms/105347-dont-fall-for-icasas-changing-llu-story.html

Muller, R. (2014, April 21). *This is why we need competition*. Retrieved from www.mybroadband.co.za: http://mybroadband.co.za/news/telecoms/100748-this-is-why-we-need-competition.html

Mungadze, S. (2014, June 03). *MTN to take control of Afrihost.* Retrieved from www.bdlive.co.za: http://www.bdlive.co.za/business/technology/2014/06/03/mtn-to-take-control-of-afrihost

MyBroadband. (2012, September 04). *Enough international bandwith for now*. Retrieved from www.mybroadband.co.za: http://mybroadband.co.za/news/telecoms/58755-enough-international-bandwidth-for-now-telkom-ceo.html

MyBroadband. (2012, November 21). *Prepaid Mobile Comprison*. Retrieved from www.mybroadband.co.za: http://mybroadband.co.za/news/broadband/65110-prepaid-mobile-data-price-comparison.html

Mybroadband. (2013, April 15). *Cell C Network Problems and Update*. Retrieved from www.mybroadband.co.za: http://mybroadband.co.za/news/cellular/74533-cell-c-network-problems-and-growth-update.html

Mybroadband. (2014, January 11). *ANC promises better broadband, free Wi-Fi and cheaper communications*. Retrieved from www.mybroadband.co.za: http://mybroadband.co.za/news/government/94717-anc-promises-better-broadband-free-wi-fi-and-cheaper-communications.html

MyBroadband. (2014, February 26). *More Money in SA for Broadband Support*. Retrieved from www.mybroadband.co.za: http://mybroadband.co.za/news/government/97639-more-money-in-sa-budget-for-broadband-support.html

Mybroadband. (2014, April 09). *Most popular smartphones in South Africa*. Retrieved from www.mybroadband.co.za: http://mybroadband.co.za/news/smartphones/100280-most-popular-smartphones-in-south-africa.html

MyBroadband. (2014, February 12). *This is what South Africa's internet actually looks like*. Retrieved from www.mybroadband.co.za: http://mybroadband.co.za/news/internet/98178-this-is-what-south-africas-internet-actually-looks-like.html

Myers, M. (1997). Qualitative Research in Information Systems. *MIS Quaterly*, 241-242.

National Treasury. (2014, March 04). *2013 Budget Review*. Retrieved from www.treasury.gov.za: www.treasury.gov.za/documents/national%20budget/.../chapter%207.pd

Navas-Sabater, J., Dymond, A., & Juntumen, N. (2002). *Telecommunications and Information Services to the Poor.* Wahigtom, DC: World Bank.

Neotel. (2013, August 22). *Neotel innovates and launches NeoBroadband powered by LTE*. Retrieved from www.itweb.co.za: http://www.itweb.co.za/index.php?option=com_content&view=article&id=66758

Neotel. (2013, November 22). *Profile*. Retrieved from www.itweb.co.za: http://www.itweb.co.za/office/neotel/profile.htm

Neuman, W. (2011). *Social Research Methods: Qualitative and Quantitative Approaches, 6th Edition.* Boston: Pearson.

Noam, E. (2006). Fundamental instability: Why telecom is becoming a cyclical and oligopolistic industry. *Information Economics and Policy 18*, 272-284.

Noetel. (2014, February 25). *Neotel: Your Key to Faster Speeds*. Retrieved from www.neotel.co.za: http://www.neotel.co.za/wps/portal/!ut/p/c4/04_SB8K8xLLM9MSSzPy8xBz9CP0os3gjJ1cnczcPIwMLUzM3A0cTIx8Tr8AAQwMDA_2CbEdFAMmXpkc!/?WCM_GLOBAL_CONTEXT=

OECD. (2003). *Competition Law and Policy in South Africa.* Paris: OECD.

OECD. (2008). *Convergence and Next Generation Networks.* Seoul: OECD.

OECD. (2013). *OECD Economic Surveys: South Africa 2013.* OECD.

Onakoya, B., Tella, A., & Osoba, M. (2012). Investment in Telecommunicatins Infrastructure and Economic Growth in Nigeria: A Multivariate Approach. *British Journal of Economics, Management and Trade 2(4)*, 309-326.

Otter, A. (2009, March 25). *R1 billion Joburg Broadband Project to Start Soon*. Retrieved from www.mybroadband.co.za: http://mybroadband.co.za/news/broadband/7450-r1-billion-joburg-broadband-project-to-start-soon.html

Oxford Martin Commission. (2013). *Now for the Long Term: The Report of the Oxford Martin Commission for Future Generations.* London: University of Oxford.

Parliamentary Monitoring Group. (2009, July 08). *Department of Communications & PNC on ISAD: Strategic Plan 2009/12.* Retrieved from www.pmg.za: http://www.pmg.org.za/report/20090709-department-communications-presidential-national-commission-informatio

Patton. (1990). *Qualitative Evaluation and Research Methods.* Beverly Hills CA: Sage. Retrieved from egacy.oise.utoronto.ca/research/field-centres/ross/.../Patton1990.pdf

Patton, M. (2003). *Qualitative Evaluation Checklist.* Chicago: Evaluation Checklists Projects.

Perry, S. (2008, August 20). *eThekwini takes municipal broadband lead*. Retrieved from www.moneyweb.co.za: http://www.moneyweb.co.za/moneyweb-technology-news/ethekwini-takes-municipal-broadband-lead

Picot, A., & Wernick, C. (2007). The Role of Government in Broadband Access. *Telecommunications Policy*, 660-674.

Poddar, N. (2014, January 29). *Tata Group to exit telecoms business completely*. Retrieved from www.economictimes.indiatimes.com: http://economictimes.indiatimes.com/news/news-by-industry/telecom/tata-group-to-exit-telecom-business-completely-sources/articleshow/29547301.cms

Potgieter, P. (2010). Media Concentration in South Africa. *Unspecified* (pp. 1-19). New York: UNISA. Retrieved from http://www.potgieter.org/doku.php?id=telecom

Reilly, F., & Brown, K. (2006). *Investment Analysis and Portfolio Management,Eight Edition.* Mason, Ohio: Thomson Higher Education.

REMGRO. (2010). *Annual Results .* Johannesburg: REMGRO.

REMGRO. (2011). *Annual Results .* Johannesburg: REMGRO.

REMGRO. (2012). *Annual Results .* Johannesburg: REMGRO.

REMGRO. (2013). *Annual Results.* Johannesburg: REMGRO.

REMGRO Ltd. (2014, February 22). *Corporate Profile*. Retrieved from www.remgro.com: http://www.remgro.com/english/group_investments/infrastructure.asp

Reynolds, T. (2009). *Telecommuncations Investments as a economic stimulus.* OECD.

Reynolds, T. (2009). *The role of communication infrastructure investment in economic recovery (DSTI/ICCP/CISP(2009)1/FINAL).* OECD.

Rhoades, S. (1983). *The Herfindahl-Hirschman Index.* Washington, D.C.: Federal Resrerve Bulletin.

Rindova, V., & Kotha, S. (2001). Continuos "morphing": Competing through dynamic capabilities, form and function. *Academy of Management Journal, 44 (6)*, 1263-1280.

Riordan, M. (1990). *"What is Vertical Integration"?The Firm as Nexus of Treaties, edited by Aoki, Gustafsson and Williamson.* New York: Sage Publications.

Riordan, M. (2005). *Competitive Effects of Vertical Integration, Discussion Paper No.:0506-11.* New York: Columbia University.

Roane, B. (2014, March 05). *Gauteng rolls out R510m broadband plan*. Retrieved from www.iol.co.za: http://www.iol.co.za/scitech/technology/telecoms/r1-5bn-for-cheaper-internet-access-1.1645111#.U9Et5UkaJMs

Roetter, M. (2014, June 23). *Wholesale Services: Telecommunications.* Retrieved from www.bmi-t.co.za: http://www.bmi-t.co.za/content/wholesale-services-telecommunications

Roller, L., & Waverman, L. (1996). *Telecommunications Infrastructure and economic development: a simultaneous approach.* Berlin: WZB Berlin Social Science Center.

Rowlands, B. (2005). Grounded in Practice: Using Interpretive Research to Build Theory. *The Electronic Journal of Business Research Methodology Volume 3 Issue 1*, pp 81-92.

RR-1. (2014, 02 26). ICASA Compliance Division. (Author, Interviewer)

RSA. (1996). *Act 103 of 1996: Telecommunications Act, 1996.* Pretoria: Government Printers.

RSA. (1996). *White Paper on Telecomunications.* Pretoria: Government Printers.

RSA. (1998). *Competitions Act 1998.* Pretoria: Government Printers.

RSA. (2000). *Promotion of Administrative Justice Act 3 of 2000.* Pretoria: Government Printers.

RSA. (2009). *Electronic Communications Act 36 of 2005.* Pretoria: Department of Communications .

RSA. (2010). *National Broadband Policy .* Pretoria: Government Printer.

RSA. (2012). *2010 FIFA World Cup Country Report.* Pretoria: Department of Sports and Recreation.

RSA. (2012). *National Development Plan.* Pretoria: Government Printers.

RSA. (2013). *Act No.4 of 2013: Protection of Personal Information Act, 2013.* Cape Town: Government Printers.

RSA. (2013). *Draft National Broadband Policy.* Pretoria: Government Printers.

RSA. (2013). *Government Gazette No.953: South Africa Connect, Creating Opportunities, Ensuring Industry.* Pretoria: Government Printers.

RSA. (2013, February 19). *Key Issues- National Development Plan 2030*. Retrieved from www.gov.za: http://www.gov.za/issues/national-development-plan/

SAGE Publications. (2013, 01 28). *Chapter 10: Qualitative Data Analysis.* Retrieved from www.sagepub.com: www.sagepub.com/upm-data/43454_10.pdf

Sallet, J. (2013). The Creation of Value : The Value Circle and Evolving Market Structures, L.11. *J on Telecomm. & High Tech*, 185.

Samuelson, P. (1954). *The Pure Theory of Public Expenditure*. Retrieved from www.ses.unam.mx: www.ses.unam.mx/docencia/2007II/Lecturas/Mod3_Samuelson.pdf

SAR-1. (2014, 02 16). Sector Analyst. (Author, Interviewer)

SAR-2. (2014, 03 14). Sector Analyst. (Author, Interviewer)

SARB. (2014, May 19). *Selected Historical Rates*. Retrieved from www.resbank.co.za: https://wwwrs.resbank.co.za/webindicators/ExchangeRateDetail.aspx?DataItem=EXCX135D

Saudi Oger. (2014, April 6). *Cell C (South Africa)*. Retrieved from www.saudioger.com: http://www.saudioger.com/cellc.html

SEACOM. (2014, June 10). *Time to turn Aafrica's fallow fibre into a productive and profitable asset.* Retrieved from www.seacom.mu: http://seacom.mu/time-to-turn-africas-fallow-fibre-into-a-productive-and-profitable-asset/

Shwarz, A. (2007). Wholesale market definition in telecommunications: The issue of broadband access. *Telecommunications Policy 31(5)*, 251-264.

South Africa.info. (2013, April 12). *South Africa has big role to play in BRICS: O'Neill*. Retrieved from www.southafrica.info.gov: http://www.southafrica.info/global/brics/oneill-120413.htm#.UouGW0kaLug

South African Broadband. (2012). *Provincial Broadband Province of Gauteng*. Retrieved from www,broadbandstats.co.za: http://www.broadbandstats.co.za/province/Gauteng

South African Broadband. (2014). *Broadband exchange statistics by Province*. Retrieved from www.broadbandstats.co.za: http://www.broadbandstats.co.za/province/

Spillane, C. (2013, December 17). *Vodacom to boost investment by over R2bn*. Retrieved from www.moneyweb.co.za: http://www.moneyweb.co.za/moneyweb-technology-news/vodacom-to-boost-investment-by-over-r2bn

Srivastava, P., & Hopwood, N. (2009). A Practical Interative Framework for Qualitative Data Aanalysis. *International Journal of Qualitative Methods*, 76-84.

SR-NGO. (2014, March 23). NGO Coordinator. (Author, Interviewer)

Steyn, L. (2013, April 27). *LTE Spectrum mess in South Africa*. Retrieved from www.mybroadband.co.za: http://mybroadband.co.za/news/cellular/76674-lte-spectrum-mess-in-south-africa.html

Stork, C., & Gillwad, A. (2012). Mobile Wholesale and retail price interplay: The somewhat contrary case of South Africa in Africa. *19th Biennial Conference 2012: Moving Forward with Future Technologies: Opening a Platform for All* (pp. 1-21). Bangkok, Thailand: Econstor.

Strauss, A., & Corbin, J. (1998). *Basics of Qualitative Research: Techniques and procedures of developing grounded theory 0803959397.* London: SAGE.

Sutherland, E. (2014). Governance of Telecommunications: Two decades of reform in South Africa. *1994-2014- 20 Years of South African Democracy* (pp. 1-21). Oxford: LINK Centre.

Tata Communications. (2011, October 14). *Tata Communications reinforces its committment to the emerging markets with a further increase in Neotel shareholdings*. Retrieved from www.tatacmmunications.com: http://www.tatacommunications.com/article/tata-communications-reinforces-its-commitment-emerging-markets-further-increase-neotel

Tata Communications. (2014, March 05). *Investors Reports*. Retrieved from www.tatacommuications.com: http://www.tatacommunications.com/investor-relations/investor-reports

TechCentral. (2009, December 09). *Cell C to spend billions on 3G network*. Retrieved from www.techcentral.co.za: http://www.techcentral.co.za/cell-c-to-spend-billions-on-3g-network-2/11796/

Techcentral. (2014, July 01). *Cwele to have oversight of Infraco*. Retrieved from www.techcentral.co.za: http://www.techcentral.co.za/cwele-to-have-oversight-of-infraco/49231/

Techcentral. (2014, July 01). *Vox seeks a big daddy*. Retrieved from www.techcentral.co.za: www.techcentral.co.za/vox-seeks-a-big-daddy/49238/

Technomyblog. (2014). *Time Value of Money, Real Options & Risk in Technology Investment Decisions*. Retrieved from www.technomyblog.com: http://techneconomyblog.com/tag/real-options/

Telecoms.com. (2011, June 14). *Neotel becomes Tata subsidiary*. Retrieved from www.telecoms.com: http://www.telecoms.com/29074/neotel-becomes-tata-communications-subsidiary/

TeleGeography. (2014, May 2014). *Cell C to invest ZAR2.3bn in network upgrade.* Retrieved from www.telegeography.com: http://www.telegeography.com/products/commsupdate/articles/2014/05/14/cell-c-to-invest-zar2-3bn-in-network-upgrade/

Teljeur, E., Gillwald, A., Steyn, G., & Storer, D. (2003). *Regulatory Frameworks: Impact and Efficacy.* Cape Town: Support to Restructuring of Public Enterprises in South Africa.

Telkom . (2011). *Annual Report .* Telkom.

Telkom. (2010). *Annual Results.* Pretoria: Telkom.

Telkom. (2012). *Annual Report.* Telkom.

Telkom. (2013). *Annual Report .* Telkom.

Telkom. (2013, November 8). *Interim Results 2014*. Retrieved from www.telkom.co.z: https://secure1.telkom.co.za/ir/financial/interim...2014/overview.html

Telkom. (2013). *SA SOC Limited Group Annual Results.* Pretoria: Telkom.

Telkom. (2014, March 07). *Telkom and MTN annunce signing of heads of agreement*. Retrieved from www.telkom.co.z: http://www.telkom.co.za/about_us/mediacentre/press_release/articles/2014/article_1242.html

Telkom-BCX. (2014, May 22). *www.telkom.co.za.* Retrieved from www.telkom.co.za: www.telkom.co.za/apps_static/ir/pdf/news/pdf/sensarticle_401.pdf

Theron, N., & Boshoff, N. (2010). *Vertical Integration in South African Telecoms.* Stellenbosch: University of Stellenbosch.

Thornton, L. (2008, September 01). *High Court Ruling Paves the Way for Competition from Alternative Communication Providers in South Africa.* Retrieved from www.thorton.co.za: thornton.co.za/resources/lti-bna-altech%20court%20ruling.pdf

Thorton, L. (2008, September 01). *High Court Ruling Paves the Way for Competition from Alternative Communication Providers in South Africa.* Retrieved from www.thorton.co.za: thornton.co.za/resources/lti-bna-altech%20court%20ruling.pdf

Tshwane, C. o. (2012/13). *Service and Delivery Budget Implementation Plan.* Pretoria: City of Tshwane.

Tubbs, B. (2014, January 30). *New mobile fees: good news, bad news*. Retrieved from www.itweb.co.za: http://www.itweb.co.za/index.php?option=com_content&view=article&id=70480

UN Habitat. (2011). *Infrastructure for Economic Development and Poverty Reduction in Africa.* Nairobi: United Nations Human Settlement Programme.

UniNet. (2006). *Knysna Open Access Network Case Study.* Cape Town: UniNet Communications.

UniNet. (2006, June 22). *UniFi Knysna Project.* Retrieved from www.pmg.org.za: www.pmg.org.za/docs/2006/060609knysna.pp

Van Onselen, G. (2012, April 23). *The ANC's all-time top 10 most disturbing quotes: What it really thinks*. Retrieved from www.inside-politics.org: http://inside-politics.org/2012/04/23/the-ancs-all-time-top-10-most-disturbing-quotes/

Vodacom . (2012). *Annual Results.* Vodacom.

Vodacom. (2011). *Annual Results.* Vodacom.

Vodacom. (2013). *Annual Results.* Vodacom.

Vodacom. (2013). *Annual Results.* Vodacom.

Vodacom. (2013). *Technology Report.* Vodacom.

Vodacom. (2013, September 13). *VPN Services-Product Training- Enterprise Business Unit, Network Services.* Retrieved from www.vodacom.co.za: www.vodacom.co.za/cs/.../documents/document/pocm01-584684.pdf

Vodacom. (2014). *Vodacom's written submission in response to the Authority's invitation for comments on the Draft Call Termination Regulations [General Notice 1018, Government Gazette 36919 of 11 October 2013.* Johannesburg: ICASA.

Vogelsang, I. (2010). Incentive Regulation, Investments and Technological Change. *Regulation: Political Economy, Measurement and Effects on Performance* (p. 39). Munich: Boston University.

Volgesang, I. (2003, March 20). Price Regulation of Access to Telecommunications. *Journal of Economic Literature*, 830-862. Retrieved from www.warrington.ufl.edu: warrington.ufl.edu/.../Vogelsang%20on%20Interconnection%20Pricing

Wall Street Journal. (2013, November 2013). *Sub-Saharan Africa's mobile phone growth faces challenges*. Retrieved from www.online.wsj.com: http://online.wsj.com/news/articles/SB10001424052702303914304579191500020741652

Wallsten, S. (2001). *Telecommnication Privatisation in Developing Countries: The real effects of exlusivity periods.* Washington, D.C.: Word Bank.

Waverman, L., Meschi, M., Reiller, B., & Dasgupta, K. (2007). Access Regulation and Infrastructure Investment. *LEGG Investment and Regulation*, 1-70.

Wellenius, B. (2000, March). Extending Telecommunications beyong the Market: Towards universal service in competitive markets. *Public Policy for the Privae Sector*, pp. 1-12.

wikipedia. (2014). *Herfindahl indez.* Retrieved from www.wikipedia.org: http://en.wikipedia.org/wiki/Herfindahl_index

Word Wide Worx. (2012). *Internet Access in South Africa : Executive Summary.* Johannesburg: World Wide Worx.

World Bank. (1995). *Bureaucrats in Business: The Economics and Politics of Government Ownership.* Washington DC: Oxford University Press and World Bank.

World Bank. (2013, December). *Private Participation in Infrastructure Database*. Retrieved from www.worldbank.org: http://ppi.worldbank.org/explore/ppi_exploreCountry.aspx?countryId=40

Wright, C., Kuun, C., Mahalima, Z., & Daniel, G. (2006). *SANReN: History, Progress, Future.* Retrieved from www.erina4africa.eu: www.erina4africa.eu/events/malawi/ppt/SANReN.pdf

Yoshino, N., & Nakahigashi, M. (2000). *The Role of Infrastructure in Economic Development.* Keio University: Centre of Excellence (Ministry of Education).

Zwane, T. (2014, May 18). *Cell C leads price war*. Retrieved from www.citypress.co.za: http://www.citypress.co.za/business/cell-c-leads-price-war/

APPENDIX "A"

INTERVIEW GUIDE

MA (ICT) POLICY AND REGULATION: QUALITATIVE RESEARCH

Title: *Investment in Broadband Infrastructure and the Emerging Market Structure in South Africa*

Name: Milingoni Lloyd Nedohe, Student No. 0114561a

Supervisor: Luci Abrahams, LINK Centre, University of the Witwatersrand

Request: You are invited to participate in this study by responding to a limited number of questions for the purposes of a Masters research. You have been selected as a key informant because of your institutional knowledge of Telecoms in South Africa. The interviewer would like to conduct a one-on-one interview, which should take a maximum of one hour. Please read the following outline in order to consider your participation. An informed consent form is attached for your signature.

Overview of the study: The subject of investment in broadband infrastructure, both fixed and mobile is a growing area of interest to scholars and practitioners in African, Americas and Asian societies. For the purposes of this research, the concept "broadband investment" refers to sunk costs in fibre optic cables and radio access networks (RANS), which have fast-tracked the uptake of broadband in the commercial hubs of the country exponentially, though still falling short of universal access targets.

The objectives of this research were to investigate and analyse capital expenditure trends (private and public investment) in broadband infrastructure post the Altech ruling, and how these quests for self-provisioning and operational efficiencies have influenced the emerging market structure. In particular the objectives were to discover the nature and levels of competitive leverage (network externalities) and demand derived from the investment, and the prevailing policy and regulatory trends in the period 2009-2013.

This is a qualitative study, where the interviewer is interested in the ideas and reflections of the respondents with respect to investment patterns in broadband infrastructure and how

these impact the market structure in South Africa, and how the proposed broadband policy could contribute to the strategy of network investments in the fibre (middle and last mile) capacities, as reflected in the guiding questions below. The researcher is not interested in any quantitative data.

Deciding to participate: Participation is entirely voluntary. You are free to withdraw at any stage without giving a reason. There are no risks to participation. The study may have several beneficial outcomes, as the researcher publishes and contributes to the public discourse on universities, in South Africa and internationally.

Anonymity and confidentiality: Any limited personal information collected about you will be kept confidential. Names will not be listed in the published report, unless specifically agreed to. Please note that it may be possible to identify the interviewee where reference is made to a particular area of research or research administration, but this will be implicit rather than explicit in the report. The anonymised data generated in the course of the research will be kept securely in paper or electronic format for a period of five years after completion of the study.

Title: *Investment In Broadband Infrastructure And The Emerging Market Structure In South Africa*

Please initial box

1. I confirm that I have read and understand the information sheet for the above study and have had the opportunity to ask questions. ☐
2. I understand that my participation is voluntary and that I am free to withdraw at any time without giving a reason. ☐
3. I understand that the researcher will not identify me by name in any reports using information obtained from this interview and that the views I express will remain confidential; or ☐
4. I agree to my name being listed as a participant in this study in the annexure to the report. ☐
5. I agree to the interview being audio recorded. ☐
6. I agree to the use of anonymised quotes in the dissertation. ☐
7. I agree that data gathered from me in this study may be stored (after it has been anonymised) and may be used for future research. ☐

Name of Research Participant Date Signature

Name of Researcher Date Signature

Designation and institutional component of Key Informant:

Date and Time of Interview:

Please note that these are guiding questions. The researcher is interested in noting and understanding the impact of policy and regulation on investment in broadband infrastructure in South Africa.

Section 1 General Background

Q1 Please share your story of the evolution of the telecoms industry in South Africa in the past 5 years– the technology transitions, industry successes and failures from an investment and market perspective.

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Section 2 Perspective on Policy and Regulation

Q2 What are the areas where investment has been affected by the policy and regulatory regime in South Africa?

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Interview Guide: Key Informants

1. What are the major provisions of the draft broadband policy regarding investment?

2. The entire market appears to have been on a march towards self-provisioning, how will this impact the market competitiveness down the line?

3. Delivery of broadband, a critical social service, is now in the hands of the private sector; what is the minimum role Government should play in supporting this trend?

4. The issue of access regulation and difficulty to enforce appears to be the future space for disputes; how should the regulator intervene to ensure effective competition on the broadband networks

5.With all these investments made, how will pricing affect market uptake, noting that operators have to recover their ROI, and how will the state ensure broadband supply and demand are covered in the rural areas of SA?

Name: _____ Date: _____

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