

The South African Telecoms Innovation System and the Diffusion of Broadband

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1 Introduction

1.1 The Importance of Broadband in Developing Countries³

An important priority in all countries is widespread access to the means of communication. In most countries so-called universal access is the goal, although in developing countries the reality is that sections of the population, sometimes significant proportions of the total population, are unable to get such access.

Until around the mid-1990s 'access' referred primarily to fixed telephony (the 'plain old telephone' service, POTS). However, from this time new communications services made their appearance, particularly mobile communications and the Internet. These new services, and particularly the Internet, added important information functionalities to the pure communications capability. From a policy point of view they also raised questions about the meaning of 'access' and whether this should be conceived as including mobile and Internet access. The use of both mobile phones and the Internet as tools of development enhanced the urgency of these questions.

The advent of broadband Internet in the first few years of the new millennium added further fuel to the debate. Not only is broadband the fastest growing telecoms services in the rich countries, it is also rapidly becoming an innovation platform for a rapidly growing range of additional services. Of these the most dramatic so far has been voice-over-the-Internet (VoIP). This service enables users to speak, often for free, over the Internet. At the same time VoIP is also rapidly undermining the crucial fixed telephony revenues of the incumbent telecoms companies and some of their competitors, forcing important restructuring.

Most developing countries are giving increasing prominence to ways of expanding broadband subscription in their countries, primarily in the wealthier parts of the urban areas. However, questions do need to be asked regarding when 'old' narrowband dialup services will suffice and when circumstances do require broadband. For many homes and small businesses, wanting only to use e-mail (still the most popular service over the Internet) and access ordinary web sites (that are not video-rich), narrowband dialup may suffice. In this connection it is worth bearing in mind that most users of broadband, in both rich and poorer countries, still use broadband for much the same things that they used dialup for (i.e. for e-mail and accessing web sites). In short, in this as in other areas, it is important to pay close attention to the demand side and to the co-evolution of demand.

Having said this, however, it is clear that broadband does create new opportunities that have potentially important implications in developing

³ For further details on broadband globally see M. Fransman, ed, (2006) *Global Broadband Battles: Why the US and Europe Lag while Asia Leads*, Stanford University Press.

countries. More specifically, since broadband enables visually-rich video content, applications and services, and since the natural human way of communicating is visual and aural, this medium opens up the possibility of new development-related usages.

1.2 The Importance of Telecoms Innovation Systems

Following the concept of 'innovation systems' developed in the literature on innovation (see the standard references to the usual suspects), it is productive to develop a conceptualisation of a 'national telecoms innovation system'. Reduced to its bare essentials, such a system involves the following players⁴:

- *The providers of telecoms services* (including the incumbent telecoms provider, its competitors, and other providers – such as Internet Service Providers).
- *The providers of telecoms equipment* (including both the manufacturers and the suppliers of this equipment, both network equipment and customer equipment).
- *Related ICT providers* (including computer hardware and software companies, Internet portals such as Yahoo, and search engines, such as Google).
- *Finance providers* (including banks and stock markets).
- *Regulators and government policy-makers* (see later for a discussion of regulation. This includes also the legal framework within which the system operates).
- *Categories of users* (including the digital rich, the digital poor, large companies, small and medium companies, government, and other users).

1.3 The Role of Regulation

Regulation plays a particularly important role in the national telecoms innovation system (NTIS), more important than that in many other sectoral systems of innovation. The reason is simple.

⁴ An analysis of the role of these players can be integrated into a 'layer model' of the Telecoms and Information Industries. See Fransman, M (2002) Mapping the Evolving Telecoms Industry: The uses and shortcomings of the layer model, *Telecommunications Policy*, Vol 26, Nos 9/10, October/November 2002.

One of the major characteristics of NTIS is that it is characterised by very high fixed costs coupled with very low marginal costs. Typically, the fixed costs are incurred in investing in telecoms networks. High fixed costs, in turn, often imply significant economies of scale, which in turn might imply that only a few, or in the extreme case only one, competitors are likely to survive.

Added to this are the problems of low marginal costs. (The addition to total cost (i.e. the marginal cost) of an extra voice call may be fairly close to zero. More contemporarily, once you have already purchased your broadband connection, the marginal cost of a VoIP call is zero. Under conditions of strong competition, such as is rapidly emerging in the VoIP market, the price will tend towards the marginal cost.) The problem, however, is that with low prices – and therefore low revenues – some telecoms network operators are likely to have difficulties recouping their investment costs in their networks. The logical outcome is oligopoly, or perhaps even monopoly. It is hardly surprising, therefore, that regulation plays a key role in this innovation system, or more generally in sectoral innovation systems characterised by very high fixed costs and very low marginal costs.

Enter the regulator. Primed by economic theory, regulators see their task in regulating telecoms sectors as one of encouraging competition wherever possible while, in those areas where competition is not possible, designing regulations that as far as possible mimic the market. (One example, is LRIC (long run incremental cost) access pricing, i.e. calculating the price that competitors to the incumbent have to pay in order to get access to the incumbent's network on the basis of the long run incremental cost.)

1.4 The Political Economy of Regulation

However, the corollary of high-profile regulation is that what is called the political economy of regulation becomes crucial.⁵ The political economy of regulation refers to the institutions on which regulation is based (including the institutions of the regulator as well as the legal institutions with which those affected by regulation may become involved) as well as the political processes that determine who will have the power to make the regulations as well as the kind of regulations they will want to make.

Not surprisingly, the political economy of regulation has a major impact not only on the functioning and performance of a NTIS, but also on the comparative global performance of different NTISs. Indeed, a recent study, *Global Broadband Battles: Why the US and Europe Lag while Asia Leads*⁶, shows that global broadband performance is significantly influenced by different national regulatory institutions and their political

⁵ M. Fransman, ed, (2006) *Global Broadband Battles: Why the US and Europe Lag while Asia Leads*, Stanford University Press.

⁶ Ibid.

processes of regulation.

1.5 The Role of Competition in NTIS

Two key regulatory questions in any NTIS are the following: What role can competition play in the NTIS (given its particular circumstances)? What role should competition play? (It should be kept in mind that there are different degrees of competition possible. For example, two network operators may compete on the basis of their own fully-owned networks. However, regulation may require that a dominant operator give access to its own network to its competitors at regulated prices. The latter occurs in the case of so-called local loop unbundling, where the competitor gets access to the incumbent's customers through the incumbent's local loop. This regulation has been particularly important in Japan where it has resulted in both the incumbent and its main competitor getting about one third of the broadband market each.)

1.6 Competition and the Political Economy of Regulation

The problem with the introduction of competition is that it redistributes profits, for example from a dominant incumbent to new entrants whose entry has been facilitated by regulation. It is here that the political economy of regulation becomes important. The reason, simply, is that the corporate players in NTIS are also political players. Not only do they compete in telecoms markets; they also compete in the national (and perhaps regional) political process. As political beings, corporate players also play their political cards.

This is clear, for example, in the US where the FCC (the national regulator) and its party-politically appointed commissioners have had to make decisions about next-generation networks affecting the future fortunes of local and long-distance telecoms companies, of cable TV companies, and of a series of actual and potential new entrants. Different political processes have been at work in Germany, where the incumbent until recently has managed to retain almost 90 percent of the national broadband market. It follows from the present discussion that political-economy lies at the heart of NTIS.⁷

⁷ Indeed, it may be suggested that one of the major weaknesses of most discussions of national innovation systems is that they tend to ignore, or significantly underplay, the importance of political processes.

2 The diffusion of broadband in South Africa

The sections that follow are devoted to a case study of the development of broadband in South Africa. A major feature of this development is the poor performance of South Africa in broadband compared to other developing countries. The study links this performance to the weakness of competition in relation to the incumbent in a situation where the regulator's remit and capacity are significantly constrained.

The dominant economic paradigm that defines the early 21st century is that of the knowledge based economy. This is characterized by deepening use of information and communication technology (ICT), intense technological innovation, globalization, and widening diversity in demand from ever more sophisticated customers. In the knowledge-based economy, countries that have an entrenched use of ICT will be more likely to achieve higher growth than those that do not. High-speed 'broadband' telecommunication connectivity is at the heart of knowledge-based economy. The availability of broadband and the extent of its use within an economy plays an important role in promoting economic growth and improving living standards through engagement in the knowledge economy

Globally, the market for broadband is expanding. In 2004 most countries experienced an increase in broadband subscriptions, with growth has being particularly strong in parts of Europe. This expansion of broadband networks has brought with it a host of new services, including voice over IP (VOIP) telephony and the delivery of video over broadband. Recent highlights include:

- The number of broadband subscribers reached 118 million by the end of 2004, adding 34.1 million broadband subscribers during the year.
- Within OECD countries, the average broadband penetration rate reached 10.2 subscribers per 100 inhabitants in 2004, up from 7.3 subscribers per 100 inhabitants in December 2003. Korea (19.1 subscribers per 100) and the Netherlands (19 per 100) lead the pack. The stellar performance of the Korean Broadband industry in recent years has led some countries to benchmark Korea as their development model⁸.

South Africa is very much a laggard in its adoption and use of broadband. The penetration level is only 0.2 per 100 inhabitants. In this paper, we examine the current status of broadband connectivity in South Africa, attempt a diagnosis of the reasons for its low level of penetration, and assess likely future developments. In doing so we particularly focus on the mechanisms, structures and policies that are limiting the growth of broadband in South Africa. We also attempt to outline the steps needed to remedy the situation.

For the purposes of this study, we define broadband as being

⁸ According to the statistics released by the Organisation for Economic Co-operation and Development (OECD), OECD Broadband Statistics, December 2004, <http://www.oecd.org/>

telecommunications network connectivity with a speed greater than 128Kbs. Many would consider this speed to be low and to barely constitute broadband at all; this bit rate is low by international standards, but this is lower threshold speed above which connectivity is currently considered to be 'broadband' in the South African market.

2.1 The legislative and institutional situation

2.1.1 Recent history

In South Africa, the incumbent public switched telecommunication service (PSTS) operator is Telkom SA Limited (www.telkom.co.za). Telkom was previously part of the South African Post Office and was exclusively owned by the state. It is now an independent company listed on the Johannesburg and New York stock exchanges, though the South African government is still a significant shareholder. Until very recently, Telkom has been the only legal provider of voice and wholesale Internet communication in South Africa. Legislation protected Telkom from any form of competition when it was part of the Post Office, and this was continued through Telkom's commercialisation and then partial privatization by the new post-apartheid government in 1995.

When foreign strategic equity partners - Southwest Bell Corporation (SBC) and Malaysia Telecom - purchased a 30% stake in Telkom in 1995, they secured a commitment from the South African Government that they would enjoy a period of protection from any substantive competition. This was justified by the obligation placed on Telkom by government to expand landlines to previously unserved rural communities throughout South Africa⁹. This occurred at a time when global telecommunication markets were rapidly liberalising. While there were other licensed Telecommunication Service Providers who could sell services to end users, such as Value added Network Services (VANS), these providers were compelled by the legislation to buy wholesale services from Telkom, as they could not invest in and own their own network infrastructure. (This prohibition on self-provisioning remains in force.) Further, they could not offer voice services even over the rented Telkom infrastructure. It was intended that this exclusivity period would terminate in 2001. However, bureaucratic bungling and internal political pressure to achieve a higher share price at the Telkom Initial Public Offering (IPO) resulted in an effective extension of the monopoly period for a further 4 years.

In 2004 SBC and Malaysia Telecom sold their equity stake in Telkom and removed their operational personnel. They did this for a variety of reasons, including the impending competition anticipated from a Second Network Operator (SNO), pending liberalization, and the proposed advent of a new licensing regime in the form horizontal licensing (whereby the network and the services run on it are licensed separately) rather than the current vertical integration model (which licenses Telkom to own the physical network as well as provide services across it). Moreover, SBC and Malaysia Telecom were able to reap a considerable financial return on the

⁹ Telkom did by and large stand by this commitment, though the number of lines actually in use later fell due to default by customers unable to afford the charges.

Telkom IPO of Telkom on the New York Stock exchange [Gush, G. & Ginsberg, J.,2003].

The situation in fact did not change until February 2005, when growing internal pressures forced the Minister of Communications to set out regulations for increased liberalisation [Department of Communications, 2004]. The main effect of this legislation has been to remove the restriction on VoIP and afford private telecommunication networks (PTNs) and Value Added Network Services (VANS) more leeway in addressing niches in the communications market. However, simultaneously, the Minister has looked to limit competition in order to protect the license and marketability of a Second Network Operator (SNO). As a result, the effect of the liberalisation has, thus far, been negligible.

The broadband market in South Africa is largely reflective of this historical monopoly situation. The introduction of competitors in the broadband market, although not on an equal footing with Telkom, and increasing competition in the voice market in the form of long distance callback services, least cost routing (LCR) and voice over internet protocol (VOIP) services, has resulted in a market that is slowly evolving. However, the new players have made only a very small dent in the prevailing market structure.

2.1.2 Regulatory authorities and policy

The regulator of the telecommunications and the broadcasting sectors in South Africa is the Independent Communications Authority of South Africa (ICASA). ICASA was established in July 2000 in terms of the Independent Communications Authority of South Africa Act. It took over the functions of two previous regulators, the South African Telecommunications Regulatory Authority (SATRA) and the Independent Broadcasting Authority (IBA). The two organisations were merged into ICASA.

ICASA has often been accused of being 'soft on Telkom' and protecting its monopoly. The reality is that the regulator is in a very weak position with respect to promoting liberalisation and preventing anti-competitive behaviour; its ability to act is proscribed by the Telecommunications Act No. 103 of 1996, which serves to protect the monopoly position of Telkom. Furthermore, ICASA has limited resources and personnel and depends on Government for funding. Finally, government has not been averse to interfering with the regulator – a previous head of the organisation was sidelined and removed for acting too independently of government.

As a result, the effect of legislation and regulation has been to severely restrict the growth of broadband access. Of particular import was the regulator's role under the above Act, which has effectively required it to protect the Telkom monopoly. More than any other factor, this has retarded the development of competition. The lack of competition has, in turn, retarded the development of broadband in South Africa.

However, emboldened by legislative changes (see below) and seemingly with a new mandate to play a more decisive role, ICASA has recently been more strident in tackling the significant market power of Telkom, including addressing the pricing and the structure of the ADSL market [Government

Gazette, 2005].

2.2 Recent legislative changes

In September 2004 the Minister of Communications, Ivy Matsepe-Casaburri, announced a number of legislative changes that limit Telkom's monopoly, essentially by legalizing the use of VOIP, , expanding the scope of activity of private telecommunication networks (PTNs) and also giving VANS providers added scope. However it does not significantly change the competitive landscape for broadband, as the ability of VANS providers to provision their own infrastructure is still restricted, and it does not address the critical issue of access to the last mile infrastructure.

The greatest weakness of the regulatory announcement is, however, the fact that it fails to address monopolistic practices in the access to international bandwidth. This substantially decreases the potential impact of the announcement with regard to broadband penetration.

These regulatory changes are therefore not likely to be associated with a substantial decrease in the costs of bandwidth or a substantial growth in the broadband market.

2.3 The Convergence Bill

In the first quarter of 2005, the Department of Communications introduced the Convergence Bill to Parliament, with the intention of having the Bill passed in the current sitting (which ends this year, 2005).

The intention of the proposed bill is: "To promote convergence in the broadcasting, broadcasting signal distribution and telecommunications sectors and to provide the legal framework for convergence of these sectors; to make new provision for the regulation of communications and network services; to provide for the granting of new licenses and for new social obligations; to provide for the control of the radio frequency spectrum; to provide for the continued existence of the Universal Service Agency; and to provide for matters incidental thereto."

The bill is essentially a move from licensing in a vertically integrated manner to licensing activities in a horizontal manner (e.g. Telkom would require licenses for each layer of its business - infrastructure, network services, value-added services and content provision - rather than operating under the single, vertically integrated license that it currently holds). The underlying rationale for the Convergence Bill is that, as technology leads to increasing practical convergence between voice, data, and broadcasting, then it becomes necessary to integrate the existing regulatory regimes into a single act.

The Bill does little to promote competition in the communications arena, promote the use of Information and Communications Technology (ICT) for socio-economic development, or address the critical aspect of Universal Access for local communities¹⁰. The failure of the Convergence Bill to deal with Telkom's monopoly over last mile access and international connectivity is likely to defeat the Bill's stated aim of significantly

¹⁰ Proceeding of the Colloquium on the cost of telecommunication services, 14 July 2005, Gallagher Estate, Department of Communications

increasing public access to the Internet.

3 Market structure

3.1 Size of the market and market share

The current broadband players are:

Telkom is South Africa's partially state-owned telecommunications monopoly is a listed company on the New York Stock Exchange. Telkom dominates the local broadband market through a variety of mechanisms, including monopoly rights to provide last mile infrastructure and exclusivity with majority ownership and control of the only undersea cable connecting South Africa to global networks. Telkom has been marketing its ADSL services since August 2002. It has had only limited success. This is due mainly to the high prices that it charges, and service restrictions such as bandwidth traffic caps placed on the majority of ADSL products. Telkom has started Wimax wireless trials and intend to offer this as a complimentary service to ADSL.

Sentech is also a state-owned company. Originally the television and radio signal broadcaster for the State, Sentech was originally only involved in terrestrial and satellite signal broadcasting. In 2000, Sentech acquired a satellite based Internet service provider called Infosat. Sentech was granted a multimedia license in 2002 by ICASA. It currently offers a broadband wireless suite of products called 'MyWireless'. Sentech also markets VSTAR, a two way satellite service aimed at larger enterprises, not priced for home or small business users.

Largely as a result of logistical and technical problems, Sentech has fallen short of its envisioned targets for the network.

IBurst is a product of Wireless Broadband Services (WBS). It is a recent addition to the wireless broadband market. It offers a service up to 1Mbps, and is currently still in beta phase. It is in the market at similar pricing to the lower-end MyWireless service. It currently has only a very small market share.

Vodacom is the largest mobile operator (by subscriber numbers) in South Africa. It is 50% owned by Telkom. Vodacom has been the first to offer 3G services in the country, through its Vodacom3G product. Initial uptake of the new offering has been slow. However, expected price revisions and the introduction of more favourable packages may accelerate adoption.

MTN is the second-largest mobile operator (by subscriber numbers) in South Africa. It also recently offered 3G services to the market, in response to and at rates comparable with the Vodacom 3G packages.

Uninet and **Wireless-Online** are two of the numerous area-specific wireless Internet service providers ('Wisps'). Wisps make up only a tiny portion of the broadband market. There is some debate as to whether these WISPS do indeed offer genuine broadband connectivity.

These various broadband providers compete for the same customers, albeit with differing products. Providers are reluctant to part with commercial information. What follows is best effort estimate based on data garnered from Telkom (www.telkom.co.za), the websites for the

ADSL and broadband user community (www.myadsl.co.za and www.mybroadband.co.za) and reports on subscriber numbers from press releases made on ITWeb (www.itweb.co.za).

Table 1: Estimates of market share per provider¹¹

Service	Customers	Market share
Telkom ADSL	> 67,000	~85%
Sentech MyWireless	> 4,000	~6%
WBS iBurst	> 2,500	~4%
Vodacom3G	> 1000	~2%
Small Wireless ISP's:	< 2000	~3%

Telkom's dominance is evident. Telkom has a large head start on the second network operator and will most likely dominate the local broadband market for the foreseeable future. Broadband Satellite access is available throughout South Africa. Sentech and Orbicom are the two main providers of satellite access. These products are not intended to replace Internet connections for home users and are targeted at larger businesses.

Although the various players compete for the same customer, their product offerings are often not directly comparable. Competition is often technology specific, and at various levels of the network. Using the data garnered from the various sources used in compiling Table 1, we have estimated the market share of the players in the different network categories for traffic generated within South Africa.

Table 2: Existing market structure: Dominant Network dynamics

Portion of Network	Wholesale	Estimated Market share per category	Retailer/reseller
International connectivity	Telkom (undersea Cable and satellite) Other/Satellite	95% 5%	Telkom, VANS e.g. UUNET, Internet Solutions
Long distance within SA	Telkom, PTNs such as Eritel and Transtel	90% 10%	Telkom, VANS VANS
Local loop-wireline	Telkom Other	98% 2%	Telkom
Local loop wireless	Sentech (MyWireless), WBS (iBurst) Other	60% 30% 10%	Sentech WBS VANS/WISPs

¹¹ As of May 2005. Vodacom recently reported increases in 3G subscribers

Portion of Network	Wholesale	Estimated Market share per category	Retailer/reseller
Cellular 3G	Vodacom MTN	90% 10%	Vodacom Service Provider, other Cellular Service Providers

The size of the *potential* broadband market is difficult to estimate. A good indicator of the market potential is the size of the consumer Internet market i.e. the number of people with access to Internet facilities. This has been estimated as being between 4.0 and 4.5 million people (roughly 10% of the South African population), about half of whom have access through an office or other work facility [Goldstuck 2005].

There are estimated to be approximately 800,000 dial-up residential Internet accounts (i.e. 800 000 households) with Internet access [BMI-T 2004]. If one assumes no market growth, then the potential broadband home user market is 800 000. In most other markets dial-up has been phased out and replaced by broadband connectivity.

The breakdown between business and consumer usage of broadband is not available. This is partially because many small and medium enterprises (SMEs) make use of the more affordable consumer broadband connections.

A further unknown factor in our estimates is cellular broadband e.g. 3G. Currently there are more than 20 million cell-phone users in South Africa; roughly 10% (2 million) of these being high value contract subscribers [Smit 2005:p2-5] (the rest are pre-paid). These contract subscribers represent the initial potential market for cellular broadband.

We therefore estimate that within a five to ten year period, a market with potentially 600 000 to 1 000 000 broadband connections on ADSL and fixed wireless is possible. We estimate that cellular broadband may add a million broadband users, taking the total number of broadband subscribers up to 2 million. There may be some double counting in this estimate as we anticipate some 3G users to also have either wire-line or fixed wireless broadband access, although this would be countered by the number of connections that are shared amongst numerous users.

Table 3: Estimates of Broadband Potential by access technology

Access	Main Providers	Potential Number of subscribers	Comment
ADSL (Business and Consumer)	Telkom, SNO	400,000 – 550,000	ADSL can have multiple end-users when used in conjunction with a wired or wireless network. <i>Assumption:</i>

Access	Main Providers	Potential Number of subscribers	Comment
			costs of ADSL drops and 40-60% of dial-up users migrate
Fixed Wireless	Sentech, IBurst	200,000 – 250,000	Fixed-wireless can have multiple end-users when used in conjunction with a wired or wireless network. Assumption: Fixed wireless costs drop and broadband demand grows
3G	Vodacom, MTN, Cell-C	1,000,000	Individual, mainly contract subscribers. Assumption: all new contract phones will be 3G enabled, costs drop

3.2 Demand Side: price and speed

Internet dial-up services are priced competitively by international standards, with prices ranging from around R89 to R149 per month. But this excludes the cost of the local phone calls, which is charged separately. Further, in South Africa local call rates are relatively high in international terms, and increasing faster than inflation: the cost of a three-minute local call has increased by an average of over 25% every year from 1997 to 2003. When these additional costs are factored in, the cost of Internet access is particularly unaffordable to most people. Unlike more mature and more liberalized markets, South Africa has not introduced a FRIACO-type regime for dial-up Internet access. FRIACO (flat rate Internet access call origination, a scheme originally introduced by Oftel in the UK but now used in most countries), regulates the cost of interconnection to incumbent Telco local networks in such a way that ISPs are able to offer flat-rate Internet access without any dial-up charges. Hence, while the overall cost of using the Internet has progressively *fallen* in most countries, in South Africa it has *risen*. Moreover, the proportion of Internet charges accounted for by the phone charge, as opposed to the ISP charge (assuming constant use) has also risen sharply. As an illustration, where a user spends two hours per week on the Internet, the total cost per month, including ISP charge is currently about R300 (assuming equal time on line at peak-rate and off-peak times)[SA Foundation 2005:p18-24, IOZ 2005].

As a consequence, it is highly likely that South African residential users do not spend nearly as much time online as those in more liberal markets. This severely retards the benefits to the consumer as well as the development of ancillary markets such as online advertising, e-commerce

and digital content.

Future broadband uptake, whether business or residential, will depend heavily on Internet costs. Although the high cost of local calls is one factor discouraging the spread of the Internet among consumers, it is not the only factor. A further hurdle to Internet usage in middle and low-income countries is the high cost of PCs, as well as their relative complexity. The Yankee Group believes that only around 60 percent of households in Europe will ever access the Internet using current-generation PCs, because of their cost and complexity. In South Africa, only about 20 percent of households own an Internet-ready PC [Goldstuck 2005]; given general income levels the total potential market, is probably no higher than 30-40 percent of households (given the falling prices of PCs and a push to grow the Black middle class in SA) even if a more favorable flat-rate Internet service were introduced.

The vast majority of broadband users in SA use their connections primarily for e-mail and browsing, plus occasional file downloads. The rest use their connections for movie/music downloads, online gaming and VOIP.

3.3 Content

News and online services are well established in South Africa. There have been rumors to the effect that Telkom is currently in talks with MNET, a media company that provides terrestrial and satellite digital broadcasting, to deliver TV over ADSL [Southwood 2005]. However, there are currently no websites delivering true broadband content in South Africa. This is again a consequence of the high price of bandwidth coupled with limited market of broadband users. This break on the creation and consumption of local content has diverse economic, social and developmental consequences of its own.

3.3.1 Lower voice costs

Relatively high calling costs in South Africa combined with the availability of Internet based calling systems such as Skype and Net2phone, have led to the emergence of a local clique of users of broadband as a mechanism to reduce calling costs, especially for overseas calls. As the technology for calling over the Internet has improved and the number of global users has risen, there has been a rise in the use of the Internet for voice calls in South Africa. Although it is a niche application of broadband, and there is little evidence to suggest that it is currently a primary driver for broadband adoption, it is likely to become a more important competitive factor as prices drop. In effect, the current high broadband pricing prevents erosion of voice revenue because it prevents the consumer voice market from moving to VOIP usage, which is facilitated by cheap broadband access. This suggests that Telkom is predicating its broadband pricing strategy as a means to preserve its fixed-line voice revenue stream.

3.4 Business needs

From a business point of view broadband can be a major cost saver, as moving from dial-up or Diginet allows various kinds of savings. Even

though ADSL is highly priced, businesses increasingly require 24/7 connectivity and thus choose ADSL as the cost-effective option. Moving from a per-minute dialup charge to an 'affordable' ADSL connection offers some cost savings and the benefit of being online permanently. Telkom seem to be protecting their Diginet revenue by pricing ADSL at a premium, as well as by imposing the 3GB cap. However, larger companies with mission-critical applications will almost certainly remain with their Diginet lines as they offer bandwidth in increments at guaranteed speeds, albeit at a hefty premium.

Some of the most attractive reasons to get a broadband connection are the ability to work from home, publishing and accessing media, services and applications as well as the social sharing possible in community based activities. In South Africa this potential of broadband has yet to be realized. Undoubtedly VOIP will become a factor in the decision to get broadband, particularly with the high costs of calls from the Telkom network. VOIP offers businesses major call savings and as such makes ADSL an attractive option.

3.5 Mobility

Although the main competitors to DSL are wireless services, this is not a result of a requirement for mobility. Wireless access has arisen as the main competitive technology because it is currently the only viable means of competing with Telkom's DSL; as already noted this is because of the legislative restrictions and the prohibitive cost of attempting to duplicate the infrastructure necessary to offer wireline broadband to the existing national base of Telkom customers.

Consequently, broadband wireless access is being used in a fixed wireless mode i.e. the access point is physically fixed although the connectivity is wireless – as against a mobile access point e.g. a cell phone. The advent of 3G may possibly to change this mode of operation in that the 'modem' could be a 3G-enabled phone. Indeed Vodacom, the first to market with 3G, has indicated that the 3G modem card market is limited (mainly laptop users) and that fixed phones and 'set-top boxes' with embedded GSM cards (effectively GSM modems) are their main strategies for market penetration¹².

Hotspots and wireless broadband zones (which provide Internet access in a localized area) are not very popular in South Africa due to a limited number of 'road warriors'(highly mobile business users).

3.6 Limited competition

As outlined above, there has been no true competition in the South African market for broadband products. Competition is currently limited by three main factors:

- Monopoly behaviour over the international connection, including anti-competitive pricing

¹² The number of 3G broadband users is difficult to pinpoint as the cellular operators typically quote the number of users who have 3G phones, rather than those who actually use it in broadband mode. A breakdown of the usage of 3G phones was not available.

- The effective prevention of facilities based competition
- The entrenched position of the dominant player, Telkom. This has led to very high prices for broadband connectivity (see below).

The vast majority of potential consumers in the country cannot afford an Internet connection, let alone broadband connectivity. As a direct consequence, South Africa is lagging significantly, both in terms of general Internet penetration and specifically in Broadband penetration.

Government initially intended to bring about competition for Telkom through the licensing of a Second Network Operator (SNO), and this was to come into effect as soon as Telkom's legislated protection period ended in 2001. However, a drawn out process by the Department of Communications, combined with a downturn in the global telecommunications market in 2001-2002 resulted in no significant global telecommunications company expressing interest in being a strategic equity partner for the SNO. This changed only in 2005 when VSNL of India became the strategic equity partner.

The SNO is poised to provide competition to Telkom in voice calls and Internet access. Price decreases are however likely to be limited to the corporate market rather than the home market. This is because the SNO has to rely on Telkom's network while it rolls out its own infrastructure, and has therefore pay Telkom wholesale prices. If the SNO were to use Telkom's last mile infrastructure it would not be able to offer competitive services. Access to the SAT-3 cable will also be very important if the SNO is to be competitive with Telkom's offerings. Until now only Telkom has had access to the cable for outgoing traffic, which is vastly under-utilised. Government seems to be keen to open up access to the cable to other providers, but as yet there is no resolution on this issue.

It is therefore very likely that Telkom will dominate both the voice and Internet telecommunications market for a number of years [Hodge 2003]. They have had the advantage of being the monopoly in South Africa. Telkom has had a very long period to build up their reserves and prepare for the advent of an SNO. Certainly the price of Telkom shares have risen dramatically since its IPO in response to high levels of profit and the expectation that this will continue.

After many false starts, the SNO should start business by the end of 2005, with VSNL of India as its strategic partner. The high cost of deploying a wireline network for consumers' means that the SNO is more likely to utilise wireless technologies for its local loop. The use of wireless technologies could circumvent Telkom's stranglehold to the wireline last mile, as well as allow for Internet accessibility where wireline infrastructure is not feasible. The likely SNO strategy will be to:

- Focus primarily on the wholesale market, supplying backbone, interconnection and backhaul to network resellers such as VANS providers and fixed wireless access providers (Sentech and iBurst)
- Directly address the corporate and business market- competing with VANS providers
- Provide home-user and end-user connectivity together with partners such as the VANS and the Fixed Wireless Access providers

3.7 The mobile operators

The entry of the mobile operators in the broadband market has interesting ramifications as it raises the level of competition considerably. Also, it changes the dynamics of broadband access as the cost of the device and the service offering is different from that offered by Telkom. We also anticipate competition between mobile operators, which will also drive down costs and increase broadband penetration.

4 Supply side

4.1 Range of technologies

A wide range of technologies is available in the country. In most instances, the service provider using a particular technology will have exclusive product coverage in that technology i.e. competitors in this space tend to compete as much in technologies as in service and price offerings. The Yankee Group did an analysis of existing and potential technologies for broadband penetration in South Africa in 2003 [Yankee 2003]. We have expanded and extended their analysis with more recent data and new offerings that were not available at the time of that report.

Table 4: Potential of broadband technologies for SA market

Technology	Significance relative to international experience (Higher/Lower/Same)	Commentary
DSL	Same	Although DSL has got off to a slow start, Telkom's dominance of the market means that it will be at least as significant as it is in other countries. The major uncertainties are whether wireless and other alternative technologies find a foothold, and whether Telkom chooses to cut the current high price.
Cable modem	Much Lower	There is no likelihood that cable TV will be at all significant in South Africa as there is no installed base and the cost of infrastructure is prohibitive. Sentech's plans for digital terrestrial broadcasting may include broadband capabilities
FTTH	Lower	FTTH (fibre to the home) could play a part in a few affluent districts if the facilities market is deregulated and independent metro networks are created, but the cost of infrastructure for SA give wireless a considerable edge. Some private housing and business park estates offer FTTH as a

Technology	Significance relative to international experience (Higher/Lower/Same)	Commentary
		value add.
Satellite	Same	Satellite connectivity is insignificant as a broadband residential technology today. The lack of an obvious backchannel combined with the high cost of ownership for satellite service suggests that it will not have much impact in residential markets.
Powerline	Higher	Given the relative state of development, and uncertainty about the local electricity infrastructure, the significance of Powerline is hard to judge. However, it could become very significant if the current uncertainties over the SNO and ownership of municipal electricity networks are resolved, given the relative penetration of fixed line networks and electricity networks.
Broadband fixed wireless	Higher	Broadband fixed wireless is likely to play a significant part in the development of South African broadband. Both Sentech and the SNO are likely to use broadband fixed wireless access, and the technology could get a further boost from standards such as wimax (802.16)
3G (mobile broadband)	Higher	Initially likely to be for mobile computing users - could become a viable alternative to fixed wireless and fixed line access if the pricing is right. Extensive penetration of mobile telephony may enable faster penetration than fixed broadband technologies. Vodacom have effectively adopted Vodafone's 3G strategy and their service offerings. Other networks have promised 3G offerings and competition may drive down the current high pricing. There is a high dependency on suitable devices and pricing plans as the high end of the mobile market is driven by subsidised handsets. The presence of strong competition in this sector is likely to be a key driving force
Carrier Class Ethernet	Lower	No current activity

Technology	Significance relative to international experience (Higher/Lower/Same)	Commentary
WiFi	Higher	Scattered activity mainly in hotspots although several start-ups such as Uninet are offering WiFi services to end users, it remains to be seen if this will emerge as a true broadband technology in South Africa. WiFi access and hotspots are available, but have not taken off in South Africa due to the limitations on the availability and use of mobile devices (typically laptops). WiFi is being used in some instances as a fixed wireless access technology, generally in the unlicensed band (ISM).
Wimax	Higher	Several Operators have been trialing Wimax as a fixed wireless solution, including Telkom, Vodacom, and WBS. The State IT Agency (SITA) recently put out a tender for a Wimax compliant network on behalf of local and provincial governments. High chance to become the standard for broadband wireless access.

Source: Based on work by The Yankee Group, 2003

4.2 Broadband product Pricing

ADSL was the first broadband product available. The initial uptake has been rather slow, due to the price and bandwidth limitations. The ADSL subscriber base has grown to over 60,000 in a matter of 32 months, an average of 1,875 signups a month¹³. Tariffs remained at the same level for over 2 years. Telkom recently reduced their ADSL prices in response to increasing competition and widespread complaints on affordability¹⁴.

ADSL services have all been subject to various mechanisms to limit use (justified by Telkom as “preventing abuse”), such as port prioritisation, and disabling or limiting peer to peer networking (P2P). Of most import has been the implementation of a cap on the amount of bandwidth use and cutting off service once this cap has been reached. Telkom claims these mechanisms are in place to protect the majority of users from ‘heavy downloaders’. Currently, the only way to get open or unshaped broadband in South Africa is to either purchase a Diginet connection or an ‘Unshaped’ ADSL service (i.e. an uncapped and unrestricted service) at a premium price.

¹³ www.myadsl.co.za and Telkom press releases

¹⁴ Current pricing at www.telkom.co.za/dsl

In response to pressure to improve their offerings and make new services available, Telkom have introduced new ADSL services to the market – mainly by dropping the bandwidth of the ADSL product offering.

Table 5: Comparison of broadband pricing¹⁵

Company	Offering ¹⁶	Price (May 2005)	Price (Sept 2005)	Conditions
Telkom	HomeDSL 512 HomeDSL 384 HomeDSL192	R930 R786 R666	R819 R701 R612	Modem extra, Installation extra, assume 3Gig, includes ISP fees (R250)
Sentech	MyWireless 512 MyWireless 256 MyWireless 128	R1,549 R749 R649	R1,349 R699 R499	Modem extra
WBS	iBurst 1Mb	R599	R599	Modem extra, installation extra. Assume 3Gig

Remember that the wholesale ADSL market is entirely dominated by Telkom, the sole provider of wholesale accounts i.e. all ADSL accounts are effectively Telkom accounts – any other ADSL products in the market are merely being resold by service providers. More than 90% of the revenue generated from the sale of an ADSL line to a consumer currently accrues to Telkom (see Table 6). Limited margins provide no real commercial incentive for resellers to offer the product. More importantly, the fixed pricing and commission structure means that resellers cannot discount the wholesale price in order to gain market share. The retail section of Telkom can offer ADSL products even though the margins are slim, because their profitability is built into the wholesale pricing structure attributing to Telkom as a whole. No other providers can compete because they are hostage to the high wholesaling pricing structure on which they are dependent. This is clear-cut case of anti-competitive pricing.

Table 6: Breakdown of typical ADSL costs showing the value accruing to Telkom

3Gb Home DSL512	Cost (Rand)	Percentage
ISP Share(average)	R50	5%
Telkom Phone Line Rental	R87	9%

¹⁵ Data obtained from individual company websites

Telkom ADSL Wholesale	R190	21%
Telkom ADSL Line Rental	R599	65%
Value accruing to Telkom	R876	95%

5 Performance indicators

5.1 Performance comparison

A recent study [Beyer C and Muller R, 2005] compared the various broadband offerings in the market, using the categories of price, speed, reliability and support¹⁷. As the offerings are often not directly comparable due to differing features, an analysis of the pros and cons of each offering is also provided and the products rated.

Table 7: Rankings of broadband products

Product	Ranking / rating	Commentary
TELKOM DSL - Home 384	73%	Capped service (2Gig), but rated by the survey as best value option.
TELKOM DSL- Home 512	72%	Capped service (3Gig), for power users.
TELKOM DSL - Home 512 Unshaped	62%	Only true unshaped broadband service. Very high pricing.
SENTECH - MyWireless 128	54%	One of cheapest always on service, but not considered a true broadband service. No Cap.
SENTECH - MyWireless 256	62%	Unlimited usage, competitively priced, questions about service.
WBS - IBurst Pre-Launch	41%	Not a good reflection of the service as it was still in testing phase. Product specifications have subsequently changed.
VODACOM – Vodafone 3G	52%	Good reliability, with GPRS backup coverage. Pricing has changed subsequent to this study. Price capped service, with very high prices for out of package usage.

¹⁷ Since the survey was done, pricing has fallen on several products, notably the Telkom products. The Vodacom 3G and WBS now have a more comprehensive offering.

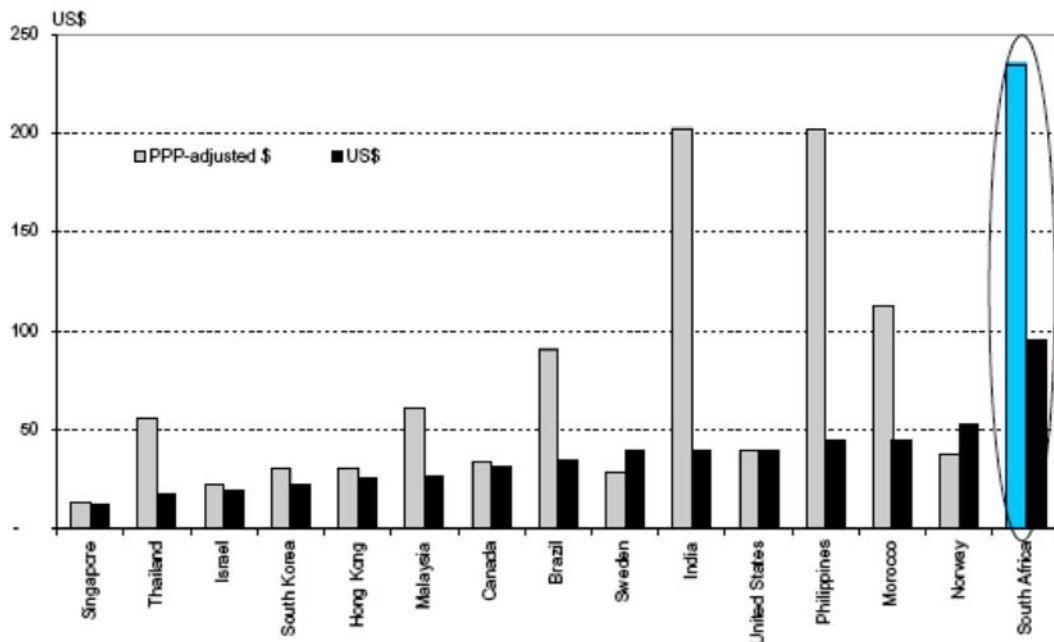
5.2 International benchmarking of local products

South African retail prices for Internet services do not compare well internationally. A recent study [SA Foundation 2005], which compared pricing with Singapore, Thailand, Israel, South Korea, Hong Kong, Malaysia, Canada, Brazil, Sweden, India, The USA, Philippines, Morocco and Norway, showed that South African ADSL broadband:

- is the most expensive of the 15 countries surveyed (in both US\$ and PPP terms)
- is 8 times the cheapest product surveyed

is 139% higher than the average price

Figure1: Comparative Retail ADSL pricing for 512kbps. Source: SA



Foundation

The same study showed that Internet Service Provider costs, despite high levels of competition in the ISP industry, were the highest on a PPP - adjusted basis in the comparison group, or 13 times as expensive as the cheapest country surveyed on a PPP basis.

6 New developments

6.1 3G and broadband wireless

Limited availability of 3G devices has restricted demand for such services in South Africa. Vodacom was first to launch 3G to the local market, in partnership with UK giant Vodafone, with MTN competing largely on GPRS and EDGE services with the intention to launch 3G into the market in 2005. The third mobile operator, Cell-C, has not made public any plans for

3G services.

In its initial launch, Vodacom pitched its 3G services at a price level that competes with Telkom's ADSL512 offering and Sentech's Wireless offering. Poor uptake and limited coverage has led to Vodacom reducing the pricing of all its mobile data offerings, with the result that both MTN and Cell-C have followed suit with their GPRS pricing.

Currently, the Vodacom 3G offering can be used interchangeably with GPRS connectivity, with pricing based on Mb of traffic transported. Current pricing on an unbundled package is R2/Mb, which is high compared to ADSL. Vodacom is also planning on rolling out a 3G fixed-wireless modem that can be used by existing landline users.

6.2 Powerline communications

Recent technological developments are making powerline communications a potential viable alternate to ADSL. This is of significance in South Africa because of the large installed base of home electricity connections, which is more ubiquitous than landlines. The attractiveness of powerline communications is that, aside from wireless, it may be the only effective method of overcoming Telkom's last mile stranglehold and competing directly with Telkom DSL. The fact that electricity utilities have last mile access on a wireline basis makes this the only likely wireline competitor to Telkom's DSL. Others are extremely unlikely, given the high costs of installing last mile wireline infrastructure.

Powerline communication is also sometimes mentioned as a potential technology that could allow the SNO to compete head to head with Telkom for home fixed line connectivity.

7 Commentary: Factors affecting Broadband in South Africa

It is evident that that the South African broadband market is constrained by the market dynamics resulting from a historical monopoly by Telkom. This monopoly is now being eroded, though only gradually, by competition, technology developments and slow liberalization.

7.1 Existing infrastructure

Most of the existing installed backbone infrastructure in South Africa belongs to Telkom. While Telkom have been actively digitising the infrastructure over the last decade, they have not yet addressed last mile upgrades. As a result Telkom has an extensive last mile network based on twisted pair copper wires. Since ADSL is able to utilize this medium, it is no surprise that Telkom's broadband supply focuses almost exclusively on ADSL.

Similarly, the lack of comparable infrastructure owned by competitors has forced them into the broadband wireless path. This infrastructure is quicker to install and relatively inexpensive.

7.2 Capital cost of infrastructure

The capital cost of most network infrastructure is largely US Dollar based,

as there is virtually no indigenous telecommunications equipment industry. The local telecommunications supply industry has been heavily dependant on Telkom for procurement and has developed very few of the capabilities, products and systems that are the mainstay of broadband access.

As a result, the capital cost of infrastructure for developing broadband networks is very high in South Africa. Whereas in other global markets, the larger size of the market, plus aggressively competitive network infrastructure vendors, has lead to vendor financing, innovative discounting and the exploitation of economies of scale on the part of the suppliers, in South Africa the small size of the local market and the very limited purchasing power of local operators hampers their ability to negotiate similar deals.

7.3 Restrictive regulation

As outlined earlier, regulatory measures have had the effect of disallowing facilities based competition. This strongly favours the monopoly and restricts innovation and competition.

7.4 Bandwidth bottleneck

Telkom controls access to, and determines the prices of virtually all of the international bandwidth out of South Africa. Whilst there are other ways of carrying traffic in and out of the country (e.g. satellite), the undersea SAT-3 cable is by far the most effective and efficient way of doing so. By controlling the price of this bandwidth Telkom effectively controls the price that competitors must charge to be profitable. This maintains an artificially high cost for broadband services, preventing effective competition from both VANS providers and other resellers.

Under pressure from both industry and government, Telkom has reduced the cost of leasing international circuits, especially for industries critical for government sponsored job creation plans, such as the call centre/Business Process Outsourcing industry. However, the costs still remain high. Government has put forward an argument that the SAT-3 cable should be considered an 'essential service' and a 'national asset', giving that when Telkom invested in SAT-3, it was a public entity. Now that Telkom has private shareholders, the situation is complicated as this "re-nationalisation" may threaten further private investment in such projects. As yet, there has been no resolution of this issue.

Alternate international connectivity may become a reality if either the East African or West African undersea cables materialize. However, whether such cables could create effective competition for Telkom and drive down prices is unknown.

7.5 Vested interest

Until November 2003, there was effectively only one provider of broadband services in South Africa, viz. Telkom. Although it was possible for other providers to resell Telkom's ADSL services, there is no regulated wholesale offer (i.e. the regulator has not tempered the pricing control of the dominant player). As a result, the price differential is said by providers

to be too narrow to provide viable margins [Government Gazette, 2005]. Consequently, most wireline broadband customers today are Telkom customers.

The Yankee Group Report (ibid), lists three factors that are preventing the more rapid spread of broadband, namely:

The lack of a wholesale pricing regime, or another similar mechanism (such as local loop unbundling) that would encourage the development of competition and potentially lead to the creation of consumer-specific broadband services.

The high price of Telkom's ADSL service; for comparable services in Europe, the price is approximately R250, less than one-third of the price in South Africa, despite the fact that average incomes in Europe are much higher. Prices are even lower in Asian countries such as Japan and Korea that have specifically targeted mass-market broadband.

The high cost of international bandwidth. When buying a leased circuit to the US, the most important Internet destination, some ISPs and VANS report that they pay about five times as much for the outbound half-circuit from Telkom as they do for the inbound half-circuit from AT&T or other US providers. As a result, circuits tend to be run close to capacity (or in the jargon are 'over-subscribed') because each circuit is sold to more users than is reasonably to ensure maximum utilisation.

The evidence is therefore highly suggestive of the incumbent operator, Telkom, protecting its vested interests in other revenue streams and focusing product development in other arenas of the corporate data market. The incentive for Telkom to significantly expand its customer base for broadband is therefore limited. As a result, Telkom's ADSL packages currently available in the South African market have limited attraction to businesses (see below). In addition, the lack of availability of true wholesale DSL prices (or indeed an unbundling regime) means that other operators are not in a position to remedy this situation.

From Telkom's standpoint, business DSL is a double-edged sword. Although DSL provides new revenue opportunities, it also speeds revenue decline in traditional legacy data services, in particular in frame relay and dial-up PSTN and ISDN.

In Europe, for example, larger companies are considering DSL as a less-expensive alternative to leased lines and frame relay networks, particularly for their branch offices and teleworkers. SMEs are also migrating to DSL to reap the benefits of an always-on connection with predictable cost. Finally, referring back to our earlier discussion of convergence, DSL is becoming part of the infrastructure platform used for the delivery of bundled voice and data services, including VOIP.

Business DSL is potentially disruptive to Telkom's existing revenue stream, since it threatens Telkom's leased line, frame relay, ISDN and PSTN revenue streams, but it also provides a path to converged services.

7.6 Cost

Cost of access is the main impediment to increased broadband penetration and in this regard the newly found muscle in the regulator is a

welcome change in attitude. The regulator is apparently now increasingly concerning itself with the interest of the consumer and the prevalent high cost of telecommunications.

7.7 The role of the Regulator

The regulator has a key role to play in achieving the following:

- Preventing predatory pricing and monopolistic control of the SAT3 cable for international bandwidth.
- Fast tracking the market entry of the Second Network Operator.
- Enabling facilities based competition by allowing VANS or PTNs to self-provision infrastructure.
- Unbundling and providing access to the local loop for VANS, the SNO and PTNs.
- Monitoring dominant players, and acting to curb anticompetitive behavior including price gauging and limiting competition.

In addition to the role of the regulator, it is important to flag the rising status of mobile operators as broadband access providers. Given the low penetration of broadband wireline infrastructure like cable and fibre to the home, it is anticipated that cellular broadband could quickly overtake ADSL as the dominant access technology, if costs become competitive.

8 Conclusion – The way forward

The South African economy has enjoyed steady if not spectacular growth over the last decade. Currently, the rate of growth exceeds 4% and government is seeking to reach 6% within the next few years. There are many ingredients to this growth surge – including major increases in consumption spending at home and high commodity prices abroad. One major concern is that potential new areas of economic activity and, in particular, new areas of export activity are not in evidence and the reliance on commodity and commodity based exports is, if anything, intensifying.

High transport and logistic costs, including critically telecommunications related costs, are one critical factor constraining the further diversification of the SA economy. In a number of areas, SA firms are competitive ex-factory, but saddled with higher transport and infrastructure costs are unable to compete effectively, especially on global markets. In some notable areas where SA enjoys some significant potential comparative advantage, telecommunications costs in themselves are a fundamental constraint. In Call Centers and Business Process Outsourcing for example which offer huge economic and employment potential, lack of skills and high telecommunications costs have been identified as the two key constraints. But, more critically, high cost and low quality are a constraint throughout the economy. Failure to address this issue will severely inhibit economic growth in the formation of new non-traditional activities and economic growth in general

There are increasing signs that government has come to recognise and

accept that this must change. The President's International Advisory Council has long warned of the consequences and called for action. More recently the President himself has directly called for lower telecommunications prices in general. There are four major requirements to secure the availability of affordable broadband connectivity?

1. The introduction of competitors to Telkom. In addition to the introduction of the SNO, any company that can meet minimum basic requirements of capability to comply with numbering systems, network interconnection agreements, security and privacy should be licensed to offer broadband.
2. VANS and PTN license holders should be allowed to invest in their own infrastructure, including last mile connections to using whatever technology they wish (whilst still complying with spectrum licensing requirements when appropriate, local right-of-way by-laws, etc.).
3. All telecommunications license holders should have access to the SAT-3 cable with pricing based on the LRIC (long run incremental cost) model. Investors in new international connectivity should be welcomed.
4. The regulator, ICASA, must be given the mandate and resources to address market failure, and deal with anti-competitive behaviour by dominant market players. Monitoring should especially guard against a possible collusive duopoly between Telkom and the SNO.

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