Competition, barriers to entry and inclusive growth:

Telecommunications Sector Study

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1 Executive summary

Telecommunications is one of the facilitators of economic growth and participation. As such, countries care about the competitive outcomes in the market. When competition works in telecommunications it can result in expanded services, lower prices, and stimulate innovation.

The South African record of telecommunications policy and regulation has, however, been poor. Telkom was entrusted to invest in the sector and ensure access. The two first movers in mobile telecommunications established a strong duopoly. Entrants were expected to compete with incumbents while the playing field was far from level. This has resulted in very poor outcomes which have taken lengthy competition and court cases to address just in voice communication and even then the successes have been partial.

Despite this poor track record Telkom has recently been identified as the "broadband champion" to facilitate universal broadband roll out. SA Connect requires 90% of South Africans to have access to 5 Mbps by 2020, while 50% of citizens must connect at 100 Mbps. The policy requires access to quality and affordable broadband. This is happening at a time when the demand for broadband is growing at rapid rates. Forecasts of broadband growth is estimated at a CAGR of 47% and 36% for consumer and business demand, respectively for the period between 2014 and 2019.[1]

Sufficient infrastructure deployment is required to support the SA Connect access and speed and competitive rivalry is important for making the broadband affordable.

A CCRED study of the telecoms sector reviews the barriers to entry and expansion in the sector, much of which directly impacts the ability of South Africa to deliver on SA Connect.[2] The study draws on three case studies of entry: by wireless providers; Dark Fibre Africa; and Cell C. These case studies are analysed to understand the challenges faced by entrants in the sector and the impact of entry on outcomes. This brief draws together the main findings and considers policy implications.

Key barriers to entry and expansion

The study identified the following key barriers to entry.

Access to facilities

Obtaining rights of way/wayleave approval to trench and deploy infrastructure is often difficult. The processes can vary significantly across different municipalities and public entities, which introduces unnecessary complexity and uncertainty and the approval process can be quite lengthy. Turnaround period for wayleave approval can take between 4 weeks and 6 months from municipalities, and between 9 – 12 months from entities such as SANRAL and Transnet. However, firms have waited more than 8 years for approval.

[1] Forecasts by Cisco VNI Available: http://www.cisco.com/c/en/us/solutions/service-provider/visual-networking-index-vni/index.html
[2] CCRED Working Paper 2016/1, www.competition.org.za

There are also instances where firms have had to litigate to be able to roll out.[3] This delays rollout and ability of firms to compete and will have a negative impact on achieving the SA Connect goals.

There has also been difficulties in gaining access to Telkom's poles and ducts and to link to their exchange, and exorbitant pricing in the rare instances that access is granted.

Slow pace of regulation

The delays in allocating spectrum have limited the ability of firms to deploy 4G technology, which delivers faster speeds. The delay is in part a result of the delayed digital migration to avail spectrum for allocation to mobile operators. ICASA published the guidelines for allocation in 2013 but there have been no allocations to date. Mobile operators can increase capacity by using more spectrum, using better technology or building more base stations but spectrum is the more cost effective option. Players resorted to procuring spectrum through mergers and acquisitions which have not been concluded due to competition concerns.

Entrants have also struggled to acquire spectrum. Smile Communications has been waiting for the regulator to process its application since 2009. Smile, a Johannesburg based firm, has invested heavily in LTE networks in other African countries focusing on rural areas and providing a competitive discipline to incumbent firms.

Local Loop Unbundling (LLU), which would enable access by multiple providers to the last mile infrastructure (the most expensive network layer), has been part of government policy since 2007 but the process is yet to start. The delay is impeding innovation and competition around broadband services. Neotel tried to gain access by lodging a facilities leasing request with Telkom, this was rejected and the finding of the Complaints and Compliance Committee (the dispute resolution body) was that ICASA should have issued LLU regulations.

In pursuit of services-based competition, the Electronic Communications Act (ECA) has regulations for leasing wires, cables, antenna, masts and radio equipment on condition that it is technically and economically feasible without adverse material consequences. Cell C has alleged that requests for sharing facilities from competitors has been met with resistance or outright refusal. The poor enforcement of the facilities regulations, including leasing and national roaming delays the progress of services competition and infrastructure competition only benefits the incumbent firms.

Strategic responses by incumbents

The differential between retail prices for off-net (between different networks) and on-net (between same network) calls referred to as 'closed network pricing' raises switching costs making it difficult for challenger networks to build a customer base. Incumbent firms build "communities of interest". For example, the incumbent operators have MTN Zone and Vodacom4 less with dynamic discounting for on-net calls which, based on location and the time of day, are up to 100%. In 2013, 95% of MTN's pre-paid subscribers were on MTN Zone, highlighting the success of these plans. Cell C has lodged a case with the Competition

[3] High Court of South Africa (KwaZulu-Natal Division), Case Number 2763/2014, The Msunduzi Municipality v Dark Fibre Africa (Pty) Ltd and Supreme Court of Appeal of South Africa, Case Number 20119/2014, The Msunduzi Municipality v Dark Fibre Africa (Pty) Ltd.

Commission in 2013 alleging that the conduct amounts to price discrimination in contravention of the provisions of the Competition Act.

Critical insights

National champions and first-movers tend to capture the agenda and rarely deliver on the expectations, whilst a plurality of rivals delivers better outcomes. For example, the competitive interaction between the challenger operators and the incumbents led to a fall in mobile voice prices between 2011 and 2015. It could have happened faster and earlier.

Other episodes of entry have delivered substantially improved economic outcomes. When Seacom entered the market for undersea cables in 2009 the cost of bandwidth for typical Internet Service Providers (ISPs) fell by 35%.[4] Prior to Seacom's entry the only cable available was Telkom's SAT-3 cable. Another example is the 87% reduction in the price of transmission over long distance fibre between Bloemfontein and Johannesburg, between 2013 and 2014 due to the construction of two new fibre links by Fibre Co (open access) and the NLD Consortium.

To make effective rivalry possible there is a need to regulate for competition. After the mobile termination rates (MTRs) decision by ICASA in 2011 the challenger operators were better able to compete with incumbent operators which resulted in lower prices. ICASA reduced the termination rates and created asymmetry, whereby the challenger operators paid lower rates to terminate calls on the incumbents' networks. The MTRs decision led to a R1.09 reduction of the termination rate with 81% and 91% pass through to Vodacom and MTN consumers, respectively. Prices to customers declined by 88c on the Vodacom Network and 99c on the MTN network, from the period 2010 to 2015. The total consumer benefit generated by the MTRs for MTN and Vodacom customers amounts to R47.2 billion over the period 2010 to 2015. The incumbent firms also did not incur the losses that they had warned about as call volumes increased.

The call termination rates are still higher than the effective voice rates charged by the Incumbent networks. In 2014 the Vodacom CEO reported that their voice bundles were priced at an effective rate of 7c per minute, which is far below the 20c per minute termination rate that Cell C and Telkom Mobile have to pay to terminate a call on the incumbents' networks.[5]

Entrants have challenges obtaining finance as there are major changes in technology which make returns uncertain. Regulatory uncertainty compounds this. Financiers are thus wary of providing funding to new rivals in this sector. The recent entrants in the fibre space appear to be linked to a formal or informal network of capital and trust that seem to circulate amongst a group of (serial) ICT entrepreneurs.

[4] Stucke, W. (2015).Building a case for rural broadband. Presented at the Future Wireless Technologies Forum, July 2015.
[5] My Broadband (2014) 'What Vodacom customers really pay for calls', 31 July, 2014. [Online] Available:http://mybroadband.co.za/news/cellular/107022-what-vodacom-customers-really-pay-for-calls.html

Policy Recommendations

Competition issues

- The on-net/off-net price discrimination case requires swift and thorough investigation by the authorities.
- Strong powers of competition enforcement by the regulator and competition authorities need to be ensured.

Facilitating broadband rollout

- Government is in a position to be an anchor customer by aggregating its demand from the local municipal offices, clinics, police stations, and department offices. Treasury could set aside a fund that can be accessed on condition that government entities coordinate in rural towns to extend fibre optic networks.
- Telkom's position as a lead agency is useful in so far as it relates to opening up infrastructure. Open access conditions should be imposed to give access to the fixed line infrastructure.
- Roll out projects must make use of existing infrastructure.
- All new roll out projects should be awarded on a competitive tender process at a district/municipal level.
- Broadband Infraco (BBI) has not been a significant positive competitive force in the industry, despite having the second largest fixed network. BBI's assets should be managed more effectively and perhaps there is a need to assess whether or not BBI should be privatised (on condition that open access is provided to its infrastructure.

National Spectrum Management Agency:

- There have been a number of delays in the allocation of spectrum but these have been a result of lack of independence rather than lack of capacity at ICASA. ICASA should be left with the responsibility of managing spectrum allocation and provided with more independence.
- ICASA should be directly funded by the industry levies, as per the international best practice.
- The councilors should be appointed by the head of state and not the line minister.
- The number of councilors should be reduced as per international best practice.
- As far as possible spectrum should be assigned to operators that will use it efficiently. A national body should not be set up to hoard spectrum for the use of a publically owned network.

Lowering barriers to entry and expansion

- Fixed wireless can use TV white spaces (TVWS) to provide more reliable services and become better competitors. ICASA should be given the funding to develop regulations for the use of TVWS on an ongoing basis.

- Consideration should be given to assigning TDD spectrum to new entrants and possibly some FDD spectrum. If FDD spectrum is allocated to new entrants then this could be could be used as leverage to get better MVNO roaming arrangements with the MNOs.

- Access to facilities- Rapid deployment guidelines must be finalized to facilitate rights of way applications for rollout. Access to municipal, provincial and national government infrastructure should be governed by one policy (ducts, poles, rights of way).

- LLU-access to ducts and poles for fixed line networks. The budget that has been allocated Telkom as the “broadband champion” (R1billion) should be earmarked to fund unbundling the local loop and this can be overseen by a team created within ICASA.

- Mobile site access and RAN sharing-Infrastructure sharing should be closely regulated. The current regulations are insufficient. There should be a better dispute resolution process and better monitoring of infrastructure sharing.

- There should be a regulatory framework for services based sharing (bitstream access, national roaming, MVNO access and wholesale data). At the moment, the ECA only makes reference to physical infrastructure and not services based sharing.

- Government policy should support spectrum sharing trading and pooling (including for TVWS) as it leads to the efficient use of spectrum and lowers barriers to entry.

2 Introduction

Telecommunications is a key facilitator of economic growth. As such, countries care about competitive outcomes in this market. When competition works in telecommunications it can result in expanded services, lower prices, and it can stimulate innovation.[6] However, the South African record in terms of telecommunications policy and regulation has been poor. Telkom was entrusted to invest in the sector and expand access, but ended up using its control of upstream infrastructure to frustrate downstream rivals and limit competition, in order to protect its own position. The two first movers in mobile telecommunications established a strong and durable duopoly. Entrants were expected to compete with incumbents while the playing field was far from level. This has resulted in poor outcomes which have taken lengthy competition and court cases to address, just in voice communication. Despite this poor track record, Telkom has recently been identified as the "broadband champion" to facilitate universal broadband roll out as outlined in SA Connect.

There have been some improvements in recent years, even if these are only partial. In terms of voice, there has been a gradual reduction in prices that was prompted by government and regulatory intervention. Each of these interventions represented an attempt at regulating for greater competition. There are important lessons that can be drawn from these experiences that can be used to facilitate the same important changes in terms for data prices. To identify these lessons, there is a need to understand the impact of entrants on competitive outcomes and the support systems that are required to enable the entrants to be effective rivals to established incumbents. This can be achieved by analyzing the barriers to entry and expansion in telecommunications as well as assessing the outcomes in the instances where those barriers have been overcome.

The telecommunications industry has some inherent characteristics that lends itself to high barriers to entry. For example, consumers value a network based on how many other members the network has. This creates a 'chicken and egg' problem when it comes to entry as consumers want viable networks but need to join up for them to exist. As a result first movers tend to have advantages over later entrants, who find it more difficult to attract customers. This can confer on the incumbent an ability to exclude rivals by promoting infrastructure-based competition and stifling competition on services. In such circumstances, regulation has an important role in ensuring competitive markets.

The main aim of this research is to conduct assessments of barriers to entry in the mobile, fixed fibre and wireless telecommunications market segments. This is done by accessing the experiences of Dark Fibre Africa as an entrant in fixed fibre, Cell C as a challenger operator in mobile telecommunications and a range of wireless providers. The research seeks to answer a number of questions. First, it seeks to understand the impact of recent entrants in the industry on levels of competition, price and service, and what challenges they have had to overcome. Second, the research will assess the impact of government intervention and participation in the sector on competition. Other questions that will be addressed include whether competition on services versus competition on infrastructure delivers better outcomes, the potential impacts of recent proposed mergers on competition in the sector, whether local loop unbundling is still relevant and the potential for it to resolve South Africa's broadband price and speed problems as well as the likely competitive implications of Telkom

[6] Jamison, M., Sanford, B., and J, Liangliang. 2009. "Analyzing Telecommunications Market Competition: A Comparison of Cases." Public Utility Research Center, University of Florida.

being designated as the national broadband champion. The research methodology encompassed both primary and secondary research. The primary research was conducted by means of interviews with firms, stakeholders, industry associations and Government. Thirty-three (33) interviews were conducted.[7] Secondary research included analysis of performance data and forecasts to establish general trends, review of competition cases and review of current debates in the sector. The data collected from the desktop research is used to assess the extent of competition in the telecommunications sector by evaluating prices and estimating elasticities of demand.

The rest of the paper is organized as follows, section 2 provides a background to the telecommunications sector. Sections 3, 4 and 5 are the Dark Fibre Africa, fixed wireless, and Cell C case studies, respectively. Within the Cell C case study the paper also considers the extent of competition between the mobile operators in terms of voice. Section 6 provides a summary of barriers to entry emerging from the case studies and the implications for the research questions. Section 7 outlines policy recommendations.

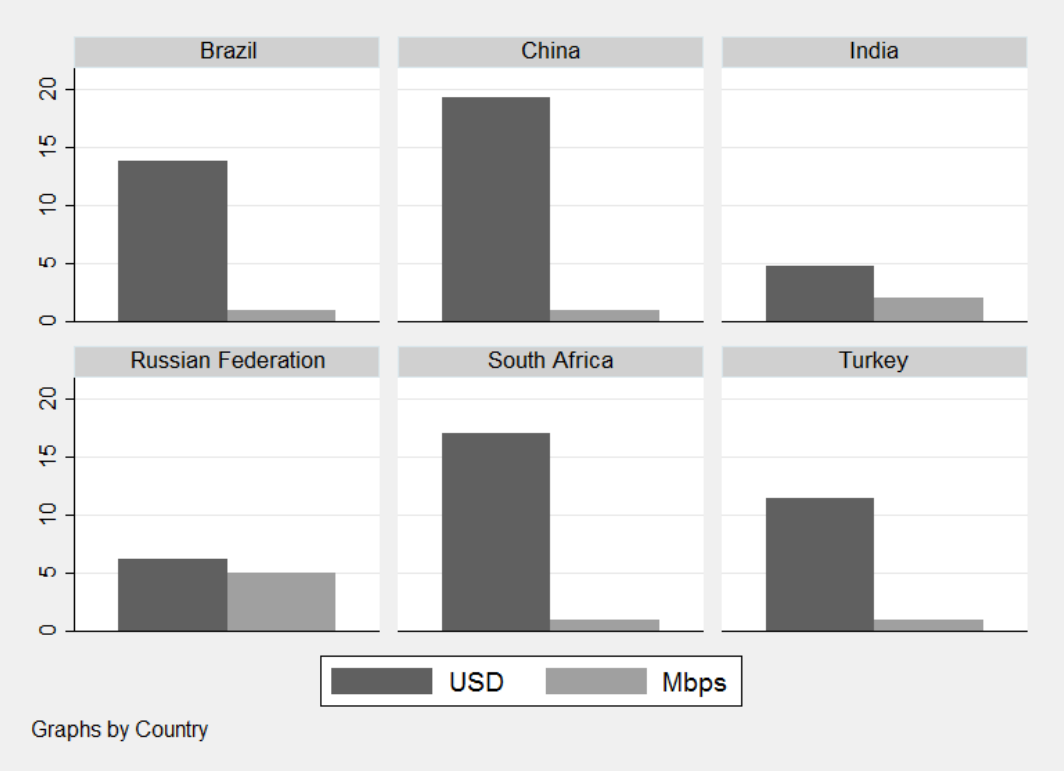
[7] Telkom and Broadband Infraco declined to participate in the study and the DTPS could not be reached.

3 Background to the industry

3.1 Introduction

The 'costs to communicate' in South Africa are high[8], particularly in respect of broadband services, and there is growing political pressure to reduce these costs.[9] The prices of voice services have declined considerably over the last 5 years as a result of interventions by the Independent Communications Authority of South Africa (ICASA), and are now among the lowest in Africa.[10] However, South Africa has very high broadband prices relative to its developing/middle income country peers, for services that have relatively slow speeds (see Figure 1).[11]

Figure 1: Broadband speeds (Kbps) and prices (USD) in South Africa and peer group countries



Source: Analysis of International Telecommunications Union. (2014). 'Measuring the information society'. Available from: http://www.itu.int/en/ITU-D/Statistics/Pages/publications/mis2014.aspx

[8] South Africa's high costs to communicate has been documented in a series of research paper in this area. See, for example, Bonakele, T., Cull, D., Hawthorne, R., & Lewis, C. (2014). 'Review of economic regulation of the telecommunications sector'. Available from: http://goo.gl/YeizRT ; Gillwald, A., Moyo, M., & Stork, C. (2012). 'Understanding what is happening in ICT in South Africa.' *Research ICT Africa*. Available from: http://www.researchictafrica.net/publications/Evidence_for_ICT_Policy_Action/Policy_Paper_7_-_Understanding_what_is_happening_in_ICT_in_South_Africa.pdf ; Aproskie, J., Hodge, J., Lipschitz, R., Sheik, F. (2008). 'South African 15-year Telecommunications Policy Review'. Available from: http://www.thepresidency.gov.za/docs/reports/15year_review/economic/telecommuncations.pdf

[9] See, for one example among many, the Parliamentary Portfolio Committee on Communications' hearings on the 'cost to communicate' in South Africa, held in July 2013.

[10] See, for example, Bonakele et al, cited above

[11] See, for example, Bonakele *et al*, cited above.

South Africa is also falling behind in terms of broadband access when compared with other developing economies. The State of Broadband 2015 report has shown that South Africa's performance is poor. The report shows that in 2015, there were 3.2 fixed broadband subscriptions per 100 persons compared to Brazil's 11, 5; China (Hong Kong)'s 31.2; Turkey's 11.6 and the Russian Federation's 17.5 per 100 capita. However, South Africa was performing better than some economies like India at 1.2 fixed broadband subscriptions per 100 persons. There is a significantly higher record of mobile broadband subscriptions than fixed broad band subscriptions. South Africa recorded 46.7 mobile broadband subscriptions relative to Brazil's 78.1; China's 104.5; India's 5.5; Turkey's 42.7 and the Russian Federation's 65.9.

The poor broadband access has led to a focus on broadband policies by governments all over the world. In 2013, the South African Government released SA Connect, the national broadband policy, outlining the country's objectives and strategies for universal access to high quality and affordable broadband. The SA Connect document has defined broadband as "…*an ecosystem of high capacity, high speed and high quality electronic networks services, applications and content that enhances the variety, uses and value information and communication for different types of users.*" Though other country definitions include specific speeds the South African definition has been broad with specific speed targets. SA Connect has set targets for broadband speeds and availability, which will require 50% of South African users to get access to optical fibre based broadband by 2016 (Table 1).

Table 1: SA Connect targets

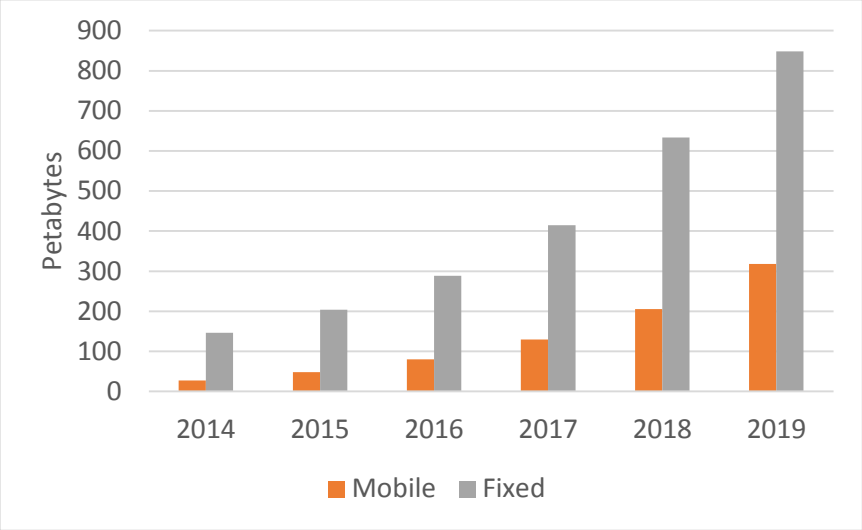
Target	Measure	Baseline (2013)	By 2016	By 2020	By 2030
Broadband access in Mbps user experience	% measure of population	37% internet access	50% at 5Mbps	90% at 5Mbps 50% at 100 Mbps	100% at 10Mbps 80% at 100 Mbps
Schools	% of schools	25% connected	50% at 10 Mbps	100% at 10 Mbps 80% at 100 Mbps	100% at 1G
Health facilities	% of health facilities	13% connected	50% at 10 Mbps	100% at 10 Mbps 80% at 100 Mbps	100% at 100 Mbps
Government	% of government offices		50% at 5 Mbps	100% at 10Mbps	100% at 100 Mbps

Source: http://www.gov.za/documents/electronic-communications-act-south-africa-connect-creating-opportunity-ensuring-inclusion

These targets are rather ambitious given the rate of fixed broadband deployment and the challenges faced by both fixed and mobile broadband providers. The growth in data demand over the years has also been astronomical. The compound annual growth rate (CAGR) of

consumer broadband traffic for South Africa is estimated at 47% from 2014 to 2019.[12] Though mobile broadband is expected to grow at a faster rate than fixed broadband at a CAGR of 63.7% and 42.07%, respectively, the demand for fixed broadband is significantly higher than mobile at 848.6 petabytes by 2019 versus 318.2 petabytes (Figure 2).

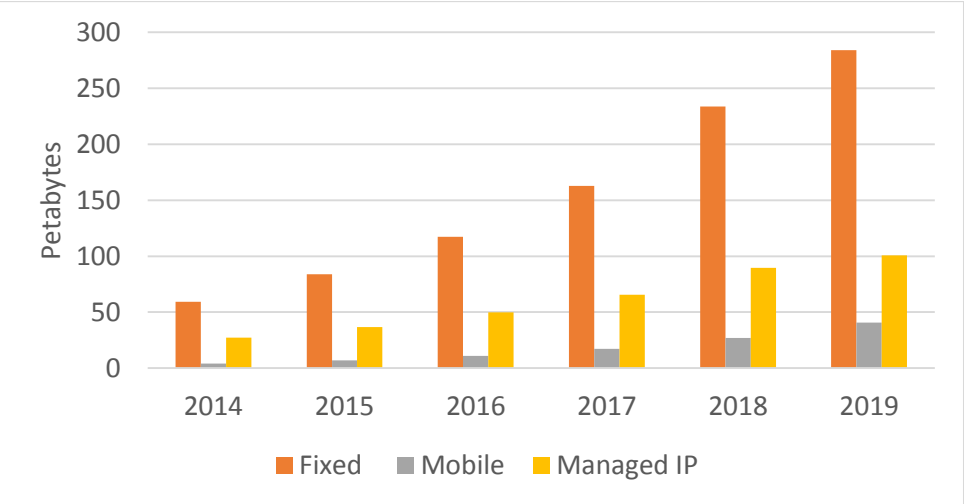
Figure 2: Forecasted growth in consumer broadband traffic



Source: CiscoVNI

Similarly, the business broadband traffic is expected to grow. The CAGR of business broadband traffic for South Africa is estimated at 36% over the period 2014 to 2019.[13] Mobile broadband is expected to grow at approximately 59% CAGR relative to fixed broadband at approximately 37% CAGR (Figure3).

Figure 3: Forecasted growth in business broadband traffic



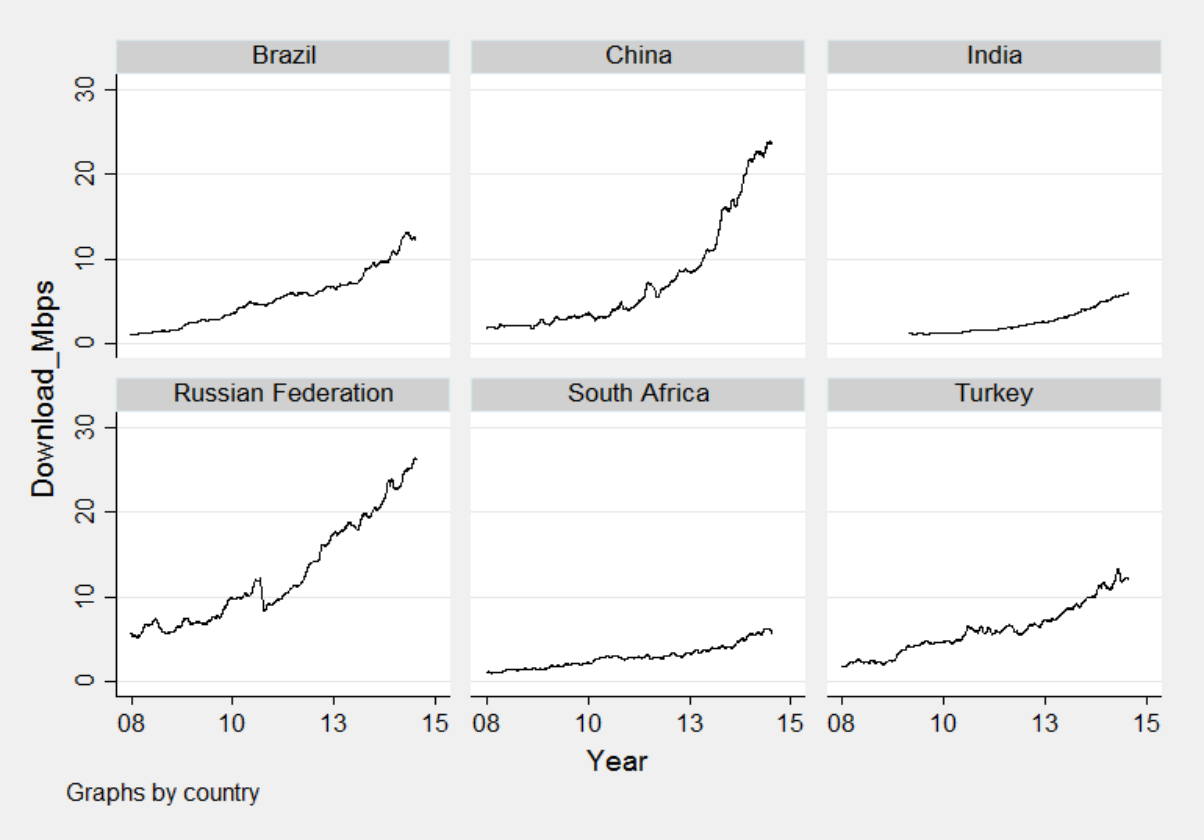
Source: CiscoVNI

[12] Broadband traffic forecasts obtained from CiscoVNI,
[13] Broadband traffic forecasts obtained from CiscoVNI,

As with the consumer broadband segment, fixed broadband demand is significantly more important estimated at 284 petabytes by 2019, while mobile broadband is for the same year is estimated at 41 petabytes. The remaining business broadband traffic is carried through managed internet protocol (IP). Figures 3 and 4, highlight the importance of fixed broadband in South Africa. This is concerning as the slow deployment of fixed broadband coupled with the relatively high cost has meant that mobile broadband has been used as a primary form of broadband access rather than a complementary services, as is the case in mature economies.[14] The mobile broadband demand is also increasing rapidly. Thus the challenge for South Africa is to increase fixed broadband deployment and the capacity of the mobile networks.

In addition to broadband access and price, the bandwidth speed is also important to customers. South Africa is falling behind its developing and middle income country peers in respect of broadband speeds. While India was the slowest of the above group of countries historically, India has now caught up to South Africa. South Africa has significantly slower speeds than the Russian Federation, Brazil, China and Turkey (Figure 4).

Figure 4: South Africa's broadband speeds compared to those in Brazil, China, India, Russia and Turkey



Source: Analysis of: Ookla. (2015). 'Netindex'. Available from: http://www.netindex.com

[14] SA Connect

South Africa's broadband speed are particularly poor when fixed broadband services are compared (Table 2).

Table 2: SA vs Brazil internet/broadband speeds

Mbps	South Africa		Brazil	
	2014	2019	2014	2019
Average mobile speed	1.7	3.9	0.8	2.2
Smart phone	3.1	6	3.9	7.5
Wi-Fi from mobile devices	2.8	5	5.9	10
Fixed wired & Wi-Fi	3.5	9.5	8.3	18.6

Source: Cisco VNI

Based on forecasts, it is unlikely that the 2020 SA Connect targets will be met. In 2014 the average mobile speed was 1.7 Mbps while the average speed for fixed internet was 3.5 Mbps below the target of 5mbps by 2016 (table 2).

These outcomes are despite the de-facto liberalisation of the telecommunications sector as a result of the Altech judgement.[15] There are hundreds of licensees able to compete in markets for broadband services. There are two main competing theories that explain South Africa's slow speeds (which are not mutually exclusive): the first is that mobile operators need more spectrum for broadband in order to be able to deliver higher speeds and that competition over fixed line networks is largely irrelevant.[16] The second theory is that greater competition among providers of fixed line service providers is required: while mobile networks need more spectrum, their networks are not suitable for 'broadband', described (narrowly) as networks that allow for high levels of usage and high speeds. This is because of the shared nature of wireless spectrum: the more users on wireless networks, the slower the speeds experienced by users. Mobile operators manage user experience by charging high prices for usage, thus reducing usage and offering users a better experience. Fixed line networks, because they provide dedicated capacity to end users, do not need to charge high usage prices in order to manage user experience; usage therefore tends to be orders of magnitude cheaper on fixed line networks, with many services offering unlimited usage ('uncapped' services).

If fixed line network competition is indeed relevant, a further debate is whether allowing new entrants to use existing fixed line networks would result in lower prices and higher speeds. Local loop unbundling (LLU), which allows for competing providers to use incumbent fixed line infrastructure, is used to deliver competition over fixed lines in European Union countries, for example.[17] LLU relies on the 'ladder of investment' theory, which allows new entrants to use

[15] See: Altech Autopage Cellular (Pty) Ltd v the Chairperson of the Independent Communications Authority of South Africa *et al*, case No. 20002/08.

[16] The mobile operators, collectively and individually, have made numerous submissions regarding the assignment of spectrum. See, for example: Analysys Mason. (2010). *Assessment of economic impact of wireless broadband in South Africa*. Available from: http://www.analysysmason.com/PageFiles/16954/AML-GSMA-spectrum-benefits-in-South-Africa-10-11-03.pdf

[17] European Parliament and Council. (2009). *Amending the Directives 2002/21/EC on a common regulatory framework for electronic communications networks and services, 2002/19/EC on access to, and interconnection of, electronic communications network and associated facilities, and 2002/20/EC on the authorisation of electronic communications networks and services*. Available from:

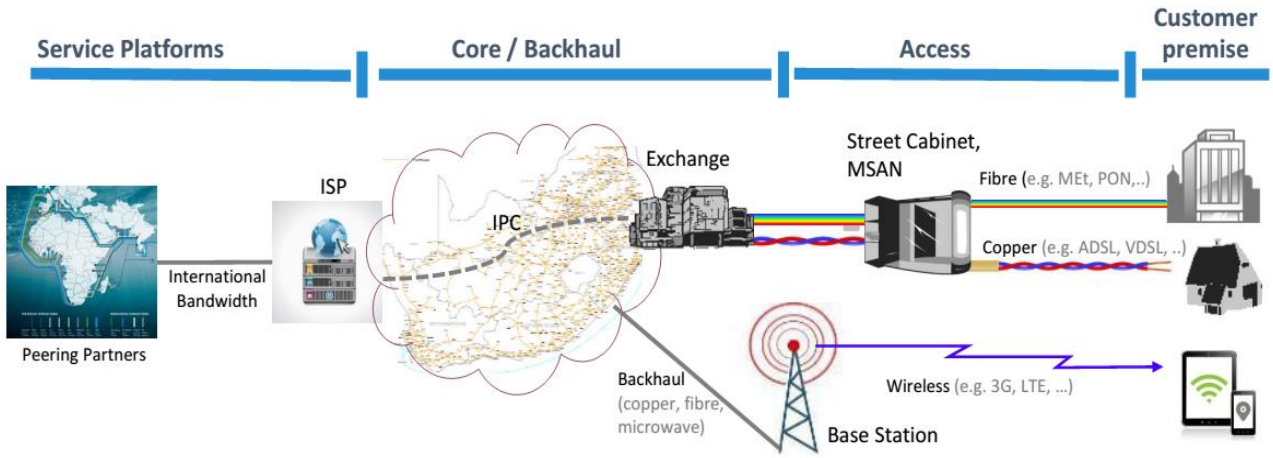
incumbent infrastructure for a period of time as they learn about patterns of demand and ultimately build their own local loop infrastructure.[18] Opponents of LLU explain that it reduces the incentives for new entrants to invest in their own networks, and is in any event unnecessary due to competition from other broadband connectivity options, including mobile broadband (such as 3G and 4G).[19]

To the extent that mobile networks are replacing fixed line networks, LLU would be a costly and unnecessary intervention, in that fixed line networks would be competing with several mobile networks in South Africa. However, the broadband traffic forecasts indicate that fixed broadband is important and as such the LLU may still be important.

Understanding the cost drivers of broadband deployment

Broadband is made up of many layers such as the service platforms that provide the international bandwidth and peering partners, often provided by the internet service providers (ISP); the core and backhaul of the network which is made up of the exchange and backhaul (long distance fibre, copper and microwave), access, and the connection to the customer premises (figure 5).

Figure 5: Broadband network layers



Source: Brian Armstrong, Telkom

The service platforms include applications to allow for product and service configuration and are the central operational costs of the service provider.[20] The backhaul is based on fibre optic, copper or microwave technology and is the backbone that connects to the exchange.[21] However, there is a preference for fibre optic technology in backhaul by all due to superior

http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2009:337:0037:0069:EN:PDF

[18] See Cave, M. (2006). 'Encouraging infrastructure competition through the ladder of investment', *Telecommunications Policy, vol. 30.*

[19] See, for example, Hausman, J. & Sidak, G. (2005). Did mandatory unbundling achieve its purpose: Evidence from five countries. *Journal of Competition Law and Economics 1(1),* available from: http://criterioneconomics.com/wp/wp-content/uploads/2012/06/Did_Mandatory_Unbundling_Achieve_its_Purpose1.pdf

[20] Armstrong, B. (2013). Broadband in South Africa: The Roadmap to Growth. Presented at the annual MyBroandband conference. Johannesburg.

[21] Ibid

quality versus the alternative technologies. The access layer of the network is the most capital intensive layer. It covers the last mile connection between the exchange and the customer premises. This could include fibre, copper, wireless and others.[22] The customer premises layer includes end user devices such as modems, routers, and Wi-Fi.

The highest proportion of capital and operational expenditure is spent on the access layer of broadband, with between 50-60% of expenditure (table 3).

Table 3: Costs associated with the broadband network layers

	Platforms	**IP and DSL backhaul**	**Access costs**
Global experience-typical share of opex	15%	25%	60%
Global experience- typical share of capex	20%	30%	50%
South Africa	25%	25%	50%

Source: Brian Armstrong

Fibre has greater bandwidth than other means of transmission and has at times been described as the holy grail of broadband. It can provide the SA connect speeds that are targeted by 2030, i.e. 100Mbps and 1Gbps to the schools. However, again there are things that need to be in place to facilitate the fibre deployment. The firms that are deploying fibre have been struggling with access to facilities i.e. rights of way to be able to trench and lay the fibre, and access to ducts and poles to be able to connect the fibre. Local loop unbundling also needs to be implemented as it would allow for fibre to be deployed to the cabinet and then linked to the Telkom lines going into the home. Fibre to the cabinet (FTTC) is far cheaper to deploy than fibre to the home (FTTH) and thus LLU would allow more people to be connected with the same capital outlay.[23]

Wireless could also play a role in terms of ensuring access to broadband and this would particularly be the case in rural areas where there may not be a business case to deploy fibre. The wireless providers could also be allocated more spectrum in order to be more reliable. In all these cases it would be important to ensure that there is rivalry such that the broadband is affordable. It would be of little use to have access across the country with only a small proportion of the population being able to afford these services.

The rest of this section will provide a brief description of the market structure in each segment: fixed, wireless and mobile.

[22] Ibid

[23] FTTC would not be able to deliver the same speeds as FTTH due to the last mile connection being on copper lines.

3.2 Industry development and structure

3.2.1 Fixed

Telkom was the fixed line monopolist in South Africa until government's decision, reflected in the 1995/96 White Paper, to follow a process of managed liberalisation in the telecommunications sector. As part of this process Telkom was partially privatised and given notice that it would face competition from 2002 onwards, when a second network operator (SNO) would be licensed. This effectively gave Telkom a further five years of monopoly in fixed lines in return for undertaking universal service obligations. In practice, the process of licensing the SNO took much longer than expected, and Neotel was only licensed as the SNO in 2005 (see appendix A for Neotel's entry experience).

In the meantime, downstream competition to Telkom was enabled by the licensing of Value Added Network Services (VANS) providers. However, these providers were reliant on Telkom's fixed line infrastructure to provide services to customers and Telkom was also competing downstream. Anticipating the end of its upstream monopoly once the SNO was licensed, Telkom proceeded to use its control of the essential upstream input to exclude competing VANS providers through engaging in a "margin squeeze" where it charged high prices for the essential inputs required by its downstream competitors. This was the basis for two findings of anti-competitive conduct against Telkom by the competition authorities, resulting in two large fines and behavioural remedies.[24]

Neotel entered as the SNO in 2006 and was subsequently awarded spectrum in the 3500MHz, 1800MHz and 850MHz bands (BMI, 2013). Initially it was intended that Neotel would acquire the fixed line infrastructure belonging to electricity and transport parastatals Eskom and Transnet, which would have given Neotel critical backbone infrastructure on top of which it could have rolled out fixed line broadband to homes and businesses. However, government belatedly decided to instead create a state-owned entity, Broadband Infraco, to own and operate the assets, which meant that Neotel was obliged to invest in setting up a network from scratch. In 2013, Neotel had 6500km of fibre to Telkom's 105 000km (Hawthorne, 2014). Since its inception, BBI has performed poorly, winning few customers and exhibiting dire financial performance (Robb, 2014). The decision to give Eskom and Transnet's network to BBI instead of Neotel as the SNO may have knock-on negative impact on competition in the retail market, as BBI has no intention of entering the retail market, whereas Neotel is present in the retail market (Robb, 2014).

More recently there has been entry by a variety of wholesale service providers who have built national and metro fibre transmission facilities (BMI, 2013), the most prominent of which is Dark Fibre Africa (DFA). In addition, there has been entry at the level of "last mile" infrastructure in the form of providers of fibre to the home and business (FTTH/B) such as Vumatel and FibreHoods.

Despite all this, Tables 4 and 5 below illustrate the scale that Telkom still enjoys in terms of both revenue and infrastructure, compared to its competitors.

[24] Competition Tribunal case 11CRFeb04 and 016865

Table 4: Fixed operator market shares, revenue

Operator	Revenue (Rm, 2013)	Market share
Telkom	29 118	88%
Neotel	2959	9%
DFA	683	2%
Broadband Infraco	237	1%

Source: annual reports

Table 5: Fixed operator markets shares, kms of fibre

Operator	Kms of fibre (2013)	Market share
Telkom	105 000	80%
Neotel	6500	5%
DFA	7315	6%
Broadband Infraco	12 800	10%

Source: annual reports

A final development in the fixed segment worth mentioning is that some municipalities, particularly metros, have started to deploy fibre networks. These are generally intended to service government sites but also to enable the local government to expand broadband access within the metro. This seems to overlap to a large extent with the mandate of BBI, and has also been criticised for duplicating on-going private sector infrastructure investment.

For example, Cape Town is currently building a fibre network to government sites which will be complemented by a wireless mesh network to reach end consumers.[25] The network is intended to be open access, such that it can provide wholesale access to ISPs as an alternative to Telkom. The first stage of the project has been completed and the City is already leasing lines to private sector operators.[26]

The City of Johannesburg has undertaken a similar initiative. The Johannesburg Broadband Network Project (JBNP) involves laying 900km of fibre.[27] This was initially implemented as a PPP between the City and a private sector service provider; however, following a contractual dispute with the service provider, the City has announced that it is to buy out the infrastructure. The network will now be owned and operated by a Municipal Owned Entity (MOE).[28] The initiative has faced criticism from some who argue that it has unnecessarily duplicated private sector infrastructure, and that the City lacks the expertise required to operate the network

[25] TechCentral 24 May 2012. “Inside Western Cape’s big broadband push”. Available online: http://www.techcentral.co.za/inside-western-capes-big-broadband-push/32115/
[26] Tech Central 16 April 2014. “Cape Town signs up broadband partners”. Available online: http://www.techcentral.co.za/cape-town-signs-up-broadband-partners/47643/
[27] ITWeb 6 February 2015. “ ITWeb investigates: Joburg's R1.2bn broadband 'white elephant'”. Available online: http://www.itweb.co.za/index.php?option=com_content&view=article&id=140971
[28] Ibid

effectively.[29] There have also been suggestions that the City overpaid for the infrastructure. The network is not currently being utilised except by the MNOs.[30]

3.2.2 Wireless

The first wireless broadband solution in South Africa was launched when Sentech introduced the MyWireless and BizNet services in 2004 (BMI, 2013). Coverage was limited and the service struggled to reach mass adoption. As a result, Sentech removed the products from the market in 2007 (BMI, 2013).

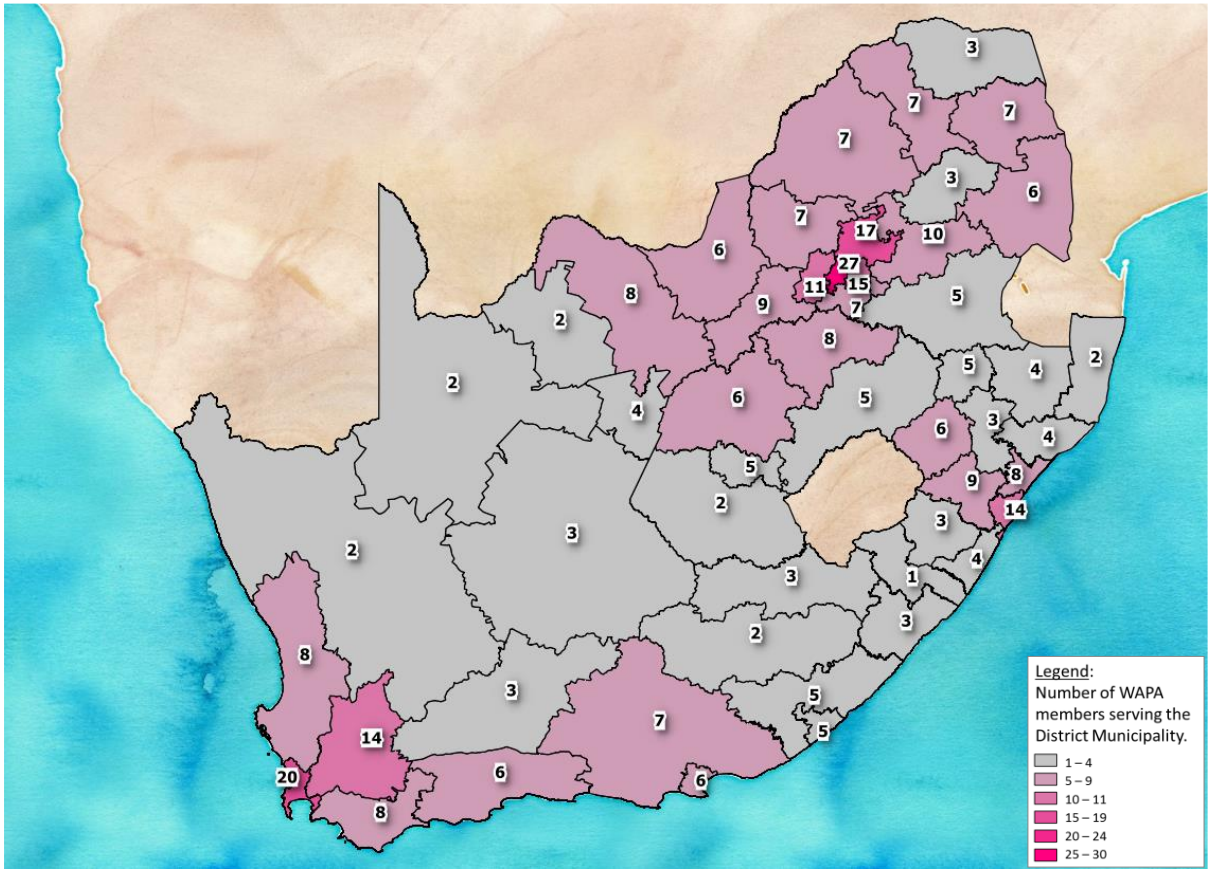
The iBurst system was also launched in 2004 by Wireless Business Solutions (WBS) and grew to 60 000 subscribers at its peak before declining. In 2008, Vodacom partnered with iBurst to roll out a WiMAX network in Gauteng, Durban and Cape Town. Vodacom bought a 24.9% stake in WBS/iBurst but subsequently sold the shares (BMI, 2013). Currently, the big national players in this market are Neotel, Internet Solutions and Comtel but there are also a number of small players, mainly operating in smaller towns.

The map below illustrates the location by district municipality of members of the Wireless Access Providers Association (WAPA) in South Africa. The map shows that in rural parts of the country there are typically a small number of providers, often fewer than 5. Within a given district municipality the providers which are present may be servicing different local areas, so in the most remote parts of the country there is likely to be little competition between providers. In urban areas there are typically many more providers, with Johannesburg having the greatest number with 27 fixed wireless providers. Cape Town has 20 providers and Durban 14. This suggests that consumers in the major metros will have a choice of several wireless providers, whereas in rural areas there may be only one or two options.

[29] Ibid

[30] IOL News 26 August 2014. “R1bn Joburg broadband project under fire”. Available online: http://www.iol.co.za/news/south-africa/gauteng/r1bn-joburg-broadband-project-under-fire-1.1741234#.VS9-JPmUe3I

Figure 6: Map of WAPA members in South Africa



Source: WAPA (2014) prepared by BMI-Tech Knowledge

Wireless solutions could be used in cities more than they have been up to now, however, spectrum is a constraint. As BMI (2013) notes:

> *"the failure of ICASA to assign radio frequency spectrum suitable for the provision of local access services is seen to have held back the introduction of competition into the local access market. For example, this can be seen to have hindered the introduction of WiMAX based services between 2005 and 2010" (BMI, 2013: 48)*

An example of dynamic spectrum usage is the use of so-called television white spaces to deliver wireless solutions. These could be utilised by providers in South Africa if access was effectively regulated (Stucke, 2015a). This is an approach which is being explored internationally and which has had some success in the UK and the US. In South Africa, trials have been undertaken as will be discussed further in the wireless case study.

In Tshwane, Project Isizwe (a non-profit organisation) is currently rolling out free Wi-Fi access points across the city, funded by the metro. Already more than 600 sites have been enabled, with at least one site in every ward across the city. Users can use up to 250 MB of data per device for free each day and also access educational content via the City's Tobetsa portal. The network uses Neotel fibre as well as a range of City infrastructure including hi-sites, electricity and fibre for free. The project aims to provide internet access to communities who would not otherwise be able to afford it.

3.2.3 Mobile

The first mobile operators in South Africa – Vodacom and MTN – were licensed in 1993 (BMI, 2013), followed much later by Cell C in 2001 and Telkom Mobile in 2010. The latter two entrants have struggled to grow their market share, and neither has been profitable to-date (Hawthorne, 2014). All four MNOs have extensive 3G networks and LTE was introduced in late 2012 by Vodacom and MTN and in early 2013 by Telkom Mobile. The rollout of LTE has been slowed to some extent by the delayed digital migration in South Africa which has meant insufficient spectrum has been available to-date for the rollout of next generation networks (BMI, 2013).

Despite the constraint posed by the lack of spectrum availability, there have been some key regulatory interventions aiming to stimulate competition in the segment. Number portability was required from 2005 onwards and call termination rate interventions by ICASA from 2010 onwards seem to have been successful in lowering prices to customers. Hawthorne (2014) reports that churn has increased to more than 50% for mobile prepaid customers, indicating an increase in competition. However, they find that churn for post-paid customers is much lower at 10%, and that this did not change significantly after the introduction of mobile number portability. This suggests that competition for prepaid mobile customers is more intense than it is for post-paid customers (Hawthorne, 2014).

The table below illustrates that Vodacom and MTN still dominate the sector in terms of market share, whether measured by revenue or subscribers. Cell C's market share is 50% higher when measured in terms of subscribers than when measured in terms of revenue, suggesting that it is gaining subscribers by charging low prices to attract consumers.

Table 6: Mobile operator market shares

Operator	**Market share based on revenue, 2012**	**Market share based on subscribers, 2015**
Vodacom	52%	38.4%
MTN	37%	33.2%
Cell C	10%	25.1%
Telkom	1%	2.6%
Other		0.7%

Source: Vodacom, MTN and Telkom annual reports

3.3 Policy context: issues impacting competition

This sections discusses the key policy issues that have a relevance for barriers to entry and competition in telecommunications. These have been identified as spectrum allocation, local loop unbundling and facilities leasing.

3.3.1 Spectrum allocation

Radio frequency spectrum is used for a number of purposes including broadcasting and the provision of broadband services. Spectrum is a finite resource, meaning that to some extent these different users compete with one another for access to spectrum. In response to this, different methods of spectrum allocation have been developed internationally, to try to ensure that spectrum is assigned to the users which value it the most, whilst at the same time ensuring effective competition (Hawthorne, 2015). This typically takes the form of a spectrum auction. In South Africa, the ECA mandates ICASA to control, plan, administer and manage radio frequency spectrum and to develop a spectrum plan in conjunction with the Minister of Communications (Hawthorne, 2015). The current allocation of high demand spectrum is illustrated in the table 7 below.

Table 7: Spectrum Allocations

Band	CDMA 850	GSM/LTE		UMTS			WiMAX/LTE		
		900	1800	1.9G TDD	2.1G TDD	1.9 & 2.1 FDD	2.3G TDD	2.6	3.5
Vodacom		11+11	12+12		5	15+15			
MTN		11+11	12+12		5	15+15			
Cell C		11+11	12+12			15+15			
Telkom			12+12	40		15+15	68		28+28
Neotel	7.5+7.5		12+12						28+28
iBurst/WBS			12+12					15+15	
Sentech									
Allocated	~60%	100%	100%	100%	67%	100%	100%	8%	70%

Source: BMI, 2013

Spectrum can represent a barrier to entry, particularly since established players already have spectrum allocated to them and new spectrum is not allocated frequently. For example, in South Africa, very little progress has been made in terms of assigning spectrum suitable for the deployment of access networks since 2006 (BMI, 2014). However, whilst competition in markets for mobile broadband services is important, it is also not efficient to allocate large amounts of spectrum to small scale entrants who are going to struggle to compete with the big networks. Hawthorne (2015) point out that neither Cell C nor Telkom mobile has ever been profitable, and it may not therefore be efficient to allocate spectrum to another new mobile entrant at this point.

Hawthorne (2015) conclude that delays in the assignment of spectrum for broadband, including arising from delays with the digital migration process, are hampering the extension of broadband services to more consumers thus negatively impacting economic growth. Similarly the Internet Service Providers Association (ISPA) in its submission to the ICASA inquiry on competition states that delays in assigning spectrum suitable for the provision of access services has retarded the evolution of competition in the provision of network services, directly benefiting the incumbent MNOs (ISPA, 2014). As discussed above, another area which is being explored in order to open up wider access to spectrum is the use of TV white spaces for broadband which are illustrated by the white spaces in Figure 7.

Figure 7: Digital Dividend

Source: https://manypossibilities.net/2013/02/how-to-make-the-digital-dividend-pay-out-in-africa/

Once spectrum has been allocated it is also important to ensure that it continues being used by the user which values it the most, and for this reason spectrum fees are typically charged. ICASA promulgated regulations in 2010 which set out prices for different kinds of spectrum, reflecting its economic value (Hawthorne, 2015). These fees are payable annually.

3.3.2 Local Loop Unbundling

Hawthorne (2014) define local loop unbundling (LLU) as:

> *"a regulatory process which allows multiple telecom providers to use connections between the fixed line operator's network and the customer's premises. Unbundling of the local loop is intended to facilitate services-based competition, stimulate innovation, lower the price of telecommunications and offer consumers and businesses a variety of access options for ICT services." (*Hawthorne, 2014: 137)

Local loop unbundling (LLU) is often seen as an important step in creating a level playing field for new entrants by granting them access to the incumbent's network of "last mile" infrastructure. This is the most expensive part of the network to replicate and exhibits natural monopoly characteristics which means it would not be efficient for new entrants to duplicate the infrastructure. Hence LLU has been implemented in most developed countries and in Europe it has been a requirement of EU competition policy in telecommunications for member states since 2001. LLU can be supported by functional separation of the incumbent monopolist in order to separate its upstream and downstream activities to prevent discrimination against downstream competitors (Hawthorne, 2014). Studies on the impact of LLU have had mixed results, however, recent literature suggests a significant positive impact on market outcomes for consumers (see e.g. Berkman Centre, 2010; Nardoto et al, 2013).[31]

[31] For a more detailed discussion of the literature around LLU, see Hawthorne et al (2014).

In its submission to the recent ICASA hearings on competition in the sector, Neotel identified a number of advantages to LLU for South Africa. These include an increase in innovation around broadband services provided using copper local loops, likely new entry, cheaper broadband due to increased competition for the provision of services to consumers and SMEs, higher broadband penetration amongst consumers and SMEs, supporting SME development; and, increases in investment and employment as operators invest in rolling out infrastructure to the incumbent's exchanges (Neotel, 2014).

In South Africa, LLU has been an explicit part of government policy on telecommunications since 2007 when the Minister of Communications issued a policy directive calling for the completion of LLU by 2011 (DoC, 2007). The legal framework to support LLU exists in the form of the Electronic Communications Act of 2005 (ECA). Despite this, the process to open up the local loop has not yet started. Initially it seems that the attention of the DoC and ICASA was on voice services and call termination rates (Hawthorne et al, 2014), and this meant that ICASA only published a draft framework for LLU and held hearings on the issue in 2011. Following this, a change of minister in the DoC seems to have led to reduced political will to implement LLU which caused the process to stall, and substantial progress has not been made on the issue to-date (Hawthorne et al, 2014). ICASA published draft LLU regulations in 2013 and held a public workshop in early 2014 to consider the issue of wholesale access. The regulations are, however, still in draft form.

In the meantime, Neotel attempted to force the issue by lodging a facilities leasing request with Telkom which Telkom rejected, leading Neotel to lodge a dispute with ICASA (Hawthorne et al, 2014). The Complaints and Compliance Committee (CCC) unhelpfully found that ICASA should have issued LLU regulations but did not order ICASA to impose terms and conditions for the case.

Hawthorne et al (2014) make the point that given Telkom's history of excluding downstream rivals, LLU is unlikely to succeed in South Africa without full functional separation being implemented.

Some commentators have argued that the market has developed to a point where LLU is now irrelevant due to the availability of wireless and mobile broadband and the entry of new FTTH players.[32] Whether this is true or not depends to some extent on the question of whether fixed and mobile broadband are substitutes for one another from the perspective of customers (we deal with this question in detail in Section 5). This in turn will differ depending on the customer segment. For consumers, a mobile solution may prove sufficient to meet their needs, but businesses require greater reliability and have higher throughput requirements, which makes it a less attractive option for them (Hawthorne et al, 2014). Fibre has so far been rolled out to a very limited number of high income households, and is very much a niche solution. Thus the need for LLU does seem to still be a relevant policy question which will be addressed further in the rest of the report.

[32] My Broadband 6 January 2015. "Telkom local loop unbundling stalling and FTTH: the silver lining". Available online: http://mybroadband.co.za/news/telecoms/115853-telkom-local-loop-unbundling-stalling-and-ftth-the-silver-lining.html

3.3.3 Facilities leasing

As noted by Hawthorne (2014), the telecommunications sector is characterised by high start-up investment costs and significant economies of scale which make it desirable to facilitate entry by encouraging facilities leasing on fair terms. The ability to enter the market in this manner and gain important information about customers and demand reduces the level of uncertainty for investors and in theory allows them to make their way up the "ladder of investment" where they build out their own networks over time (Cave, 2006). The ECA therefore provides for facilities leasing regulations and requires licensees to lease facilities to any other licensee. The facilities listed in the ECA include wires, cables, antenna, masts and radio apparatus. Licensees must agree to lease such a facility where it is technically and economically feasible, defined as "not having adverse material consequences".

Unfortunately, the interpretation of these phrases has not been tested in practice as no disputes have been brought before ICASA or the CCC (Hawthorne, 2015). Cell C notes in its recent submission to ICASA's hearings on competition in the sector that its experience has been "*that requests for facilities from each of our competitors (MTN, Vodacom, Telkom and Telkom Mobile) are frequently met with resistance or outright refusal*" (Cell C, 2014). In its submission, Cell C relates a number of examples of access being refused or, where its competitors do agree to allow it access to their facilities, of a high price being charged for such access. Similarly in terms of national roaming, Cell C claims that it is charged a high price by Vodacom and receives a poor quality of service since Vodacom refuses to implement seamless handover. Thus it seems that the provisions of the ECA related to facilities leasing are not being effectively enforced.

3.4 Proposed mergers and JVs

Vodacom/Neotel

Vodacom notified the Commission of the proposed 100% acquisition of Neotel for R7 billion in May 2014.[33] A major concern with the merger which has been raised by stakeholders relates to the spectrum consolidation which would result. The acquisition of Neotel could give Vodacom access to the additional bandwidth in the 800MHz, 1800GHz and 3500GHz spectrum bands currently assigned to Neotel, which has raised concerns for Vodacom's competitors. Cell C in particular has argued that this would entrench Vodacom's dominant position in the market.[34] The acquisition would also give Vodacom access to Neotel's fibre assets and a potential advantage in the roll-out of 4G or Long Term Evolution (LTE) wireless network.

In terms of spectrum, MTN argues that the acquisition of Neotel's spectrum would enable Vodacom to launch a national LTE network well in advance of its competitors which would provide an already dominant player with a competitive advantage and head-start in the LTE

[33] ITWeb 2 October 2014. "Neotel protects Vodacom deal". Available online: http://www.itweb.co.za/?id=138130:Neotel-defends-Vodacom-deal
[34] Business Day 18 January 2015. "The pros and cons of a Vodacom/neotel deal". Available online: http://www.bdlive.co.za/businesstimes/2015/01/18/the-pros-and-cons-of-a-vodacom-neotel-deal

data market.[35] In addition, MTN notes that Vodacom would benefit from structural cost advantages as the additional spectrum would mean it has to build fewer radio sites to serve demand.[36]

Vodacom points out that it plans to invest heavily in Neotel's fixed-line network with the aim of taking broadband fibre to a million end points over the next few years, creating greater competition to Telkom as was intended when Neotel was originally licensed as the SNO. [37]

In June 2015, the Commission recommended the approval of the merger with conditions which would require Vodacom to wait two years before making use of Neotel's spectrum and make certain investments in fixed and mobile infrastructure following the merger. Several parties were unhappy with this recommendation and were granted leave to intervene in the Competition Tribunal's hearing of the matter. These parties are MTN, Cell C, Telkom, Internet Solutions, ICASA and the ministers of Telecommunications and Postal Services and Economic Development. The intervenors argue that the conditions proposed by the Commission are insufficient to counteract the anti-competitive harm arising from the transaction.

The Tribunal hearing was scheduled to take place during November and December 2015, but was postponed at the request of Vodacom and Neotel. The merging parties restructured the deal in December 2015. As part of the restructured deal, Vodacom would acquire Neotel's fixed line business, but would no longer make a bid for Neotel's spectrum, which was the major point of contention raised by intervenors. However, in March 2016, the North Gauteng High Court ruled in a separate case that ICASA's initial approval of the deal was unlawful and should be set aside entirely (Gilbert, 2016). The merging parties subsequently abandoned the deal.

MTN/Telkom

In March 2014, MTN and Telkom announced a network sharing agreement in terms of which MTN would take over financial and operational responsibility for the roll-out and operation of Telkom's radio access network (RAN) and both operators would roam on each other's networks.[38] Such infrastructure sharing agreements have become more common internationally as MNOs experience declining voice revenue combined with the requirement to roll out expensive next generation (LTE) networks. Telkom claimed that the agreement would allow it to expand its mobile coverage and reduce costs and capital expenditure whilst providing customers with a better service.[39]

The parties were required to notify the agreement with the Commission, which investigated its likely impact on competition and on 14 August 2015 recommended that the Tribunal prohibit the agreement. Although the transaction did not involve the combination of MTN's and Telkom's mobile retail businesses, the Commission found that the proposed transaction was

[35] MTN submission to ICASA consultation on the Vodacom/Neotel transaction. Dated 15 October 2014. Available online: http://www.ellipsis.co.za/wp-content/uploads/2014/12/MTN-1.pdf
[36] Ibid.
[37] Ibid.
[38] TechCentral 7 March 2014. "Telkom, MTN sign network deal". Available online: http://www.techcentral.co.za/telkom-mtn-sign-network-deal/46853/
[39] Ibid.

likely to substantially prevent or lessen competition in the mobile services market, again primarily due to the spectrum concentration which would occur.

It found that the transaction would give MTN access to additional spectrum capacity which would confer first mover advantages to MTN relating to network speed, capacity and mobile offerings, and that it would consequently be difficult for competitors to act as a constraint on MTN in future. The Commission also argued that Telkom Mobile's ability to aggressively grow and respond to competition would be reduced by the merger as the mobile data capacity available to Telkom would be limited by the agreement between the merging parties whereas MTN's capacity would not. Therefore it found that the outcome of the transaction would be to reduce Telkom's ability to act as an independent competitor and thereby entrench a duopolistic market structure dominated by Vodacom and MTN. This would result in harm to customers, since price competition has been driven by smaller competitors. [40]

Following the recommendation of the Commission, MTN and Telkom abandoned the deal.

Telkom/BCX

In 2014, Telkom made a R2.7-billion offer to buy IT services company Business Connexion. This would help Telkom to become a "one stop shop" for private and business customers through Telkom Business and make Business Connexion a stronger competitor.[41] The same transaction was proposed by the parties and prohibited by the competition authorities in 2007 as the Competition Tribunal ruled that the merger would result in the removal of an effective competitor to Telkom and allow Telkom to engage in unilateral conduct in the market for managed network services (MNS) to the detriment of its retail customers.[42]

The transaction was approved by the Common Market for Eastern and Southern Africa (COMESA) Competition Commission and on 14 May 2015 the Competition Commission of South Africa recommended that the transaction be approved with conditions. In its press release regarding the decision, the CCSA found:

> *"that Telkom, being the largest provider of wholesale leased lines to downstream customers, has the ability to foreclose its downstream rivals from access to these wholesale leased lines which are essential inputs for the provision of downstream services including managed network services (MNS), value added network services (VANS), hosting and information technology services (ITS). The Commission also found that the merger will result in the merged entity having the ability and incentives to engage in bundling strategies that may result in anticompetitive effects."*[43]

The Commission recommended that conditions be imposed on Telkom to mitigate these potential anticompetitive effects which include non-discriminatory and cost-based pricing

[40] Competition Commission media release, 17 August 2015. http://www.compcom.co.za/wp-content/uploads/2015/01/Commission-recommends-prohibition-of-MTN-and-Telkom-RAN-sharing-and-bi-lateral-roaming-merger.pdf
[41] Business Day 18 March 2015. "Business Connexion merger concerns rivals". Available online: http://www.fin24.com/Tech/Companies/Telkom-edges-closer-to-sealing-BCX-deal-20150317
[42] Tribunal case number: 51/LM/Jun06.
[43] Competition Commission press release 14 May 2014, Annexure A. http://www.compcom.co.za/wp-content/uploads/2015/01/Telkom-BCX-Annexure-A-revised.pdf

provisions which will apply for a five year period. The Tribunal conducted a hearing on the matter, during which the merging parties offered amended conditions to address certain residual concerns of the Commission and Dimension Data which had intervened in the matter. The Tribunal felt that these conditions adequately addressed the concerns and approved the merger subject to the revised conditions on 12 October 2015.[44]

MTN/Afrihost

On 5 November 2014, the Competition Tribunal unconditionally approved the acquisition of Afrihost by MTN.[45] Afrihost is an internet service provider (ISP) whose activities include data hosting services, ASDL internet access services and mobile internet access services.

Prior to the merger, MTN had provided Afrihost with internet connectivity which it resold to customers. From a horizontal perspective the Competition Tribunal concurred with the assessment of the Competition Commission which found that the merger was unlikely to lead to anti-competitive effects in the markets for the provision of hosting services, ADSL or mobile data services at the retail level due to the merging parties' small combined market share in the first two markets and the small market share accretion in the third market. In addition, the focus of the two companies was on different market segments, with MTN focussing on large corporate customers and Afrihost serving mainly the SMME and residential segment.

Concerns were raised around the possibility that the merged entity could engage in vertical foreclosure or margin squeeze to the detriment of downstream competitors. However, the Tribunal concurred with the Commission that MTN would not have sufficient market power at the wholesale level to be able to foreclose downstream resellers effectively. In addition, MTN is already vertically integrated pre-merger and so may not have an increased incentive to engage in such conduct. Finally, MTN assured the Tribunal that its rate card prices are implemented in a non-discriminatory manner, making margin squeeze impossible.

Summary

So far the report has laid out the status quo of the South African telecommunications sector. South Africa's relative performance is poor, there is limited response to changing telecoms needs/demands, and if the status quo prevails it is unlikely that Broadband Connect targets will be met. The rest of the report focuses on establishing the barriers to entry and expansion in the three identified segments of the market and what the status quo means for entrants.

[44] Tribunal case number: LM/065/Aug14
[45] Tribunal case number: 019075.

4 Fixed - Dark Fibre Africa

The primary mode of data collection was a series of interviews with firms, associations and other stakeholders in the sector. Interviews were conducted with Neotel, Cell C, MTN, FibreCo, Dominic Cull of Ellipsis Regulatory Solutions, Richard Came (ICT entrepreneur, co-founder of DFA and Conduct, and current Chair of the FTTH Council), Juanita Clark, (CEO of the FTTH Council), Jo-Ann Johnston (the official overseeing the Western Cape Provincial Government's fibre-based broadband rollout), and Dark Fibre Africa.[46] A brief profile of each interviewee is included as Appendix B. The interviews were supplemented with publicly available data.

The DFA case study proceeds in 3 parts. Firstly, we provide a brief overview of DFA's business. The second part evaluates the barriers to entry and expansion faced by DFA. This is supplemented with information on the challenges faced by other providers of dark fibre. The third section concludes.

4.1 DFA's entry experience: barriers to entry and expansion

Mode of entry and the process of building a customer base

At the time that DFA entered (around 2007), its potential customer base was largely limited to the telecommunications companies: Neotel, Vodacom, MTN and Cell C. These companies had just started rolling out their own fibre networks but had not yet reached any significant scale. Though some of these companies agreed to use DFA's infrastructure if and when it became available at sufficient scale and coverage, they were initially wary of entering into long-term contracts with a start-up. They did, however, agree to share their ducting infrastructure with DFA, which assisted DFA in rolling out its network.

DFA started building a network with just 2 customers. Those interviewed report that it became much easier to attract customers after Remgro acquired a stake in the company in 2010. Remgro's investment provided greater certainty that DFA would have the resources to extend and maintain tits networks, providing surety to potential customers. Other new entrants may not be able to replicate this advantage.

The 2008 Altech judgment, which paved the way for VANs to self-provide, also opened the field of potential DFA customers. For all VANs or ECS licensees looking to roll out their own infrastructure, it made sense to consider swaps or leases with DFA to avoid costly and duplicative infrastructure spend.

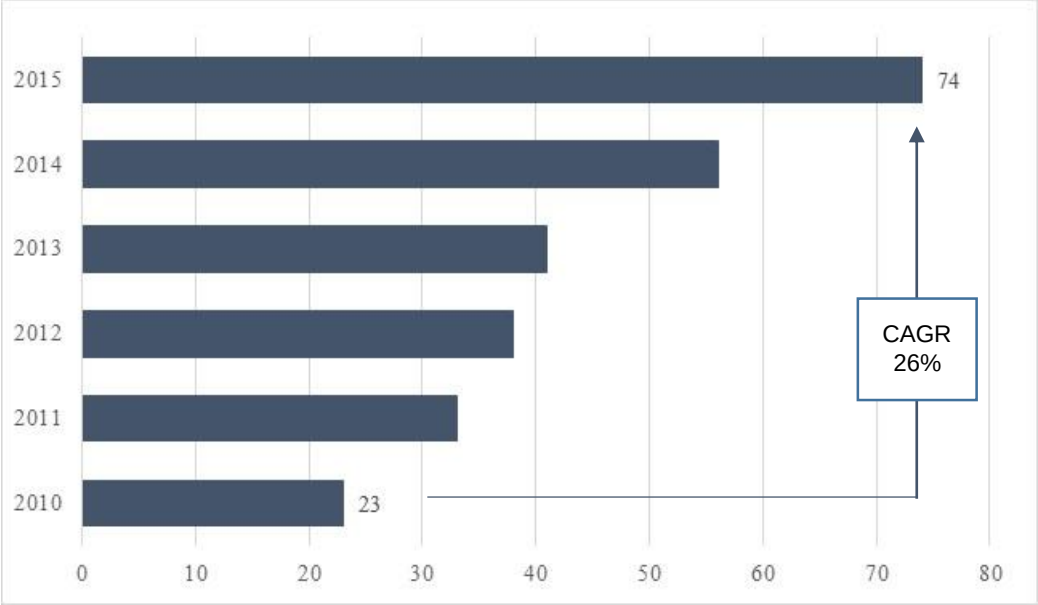
By March 2015, DFA had 74 commercial contracts, the future value of its contract base amounted to R8.5bn, and it had a fibre network valued at greater than R5bn. Thus far, DFA

[46] Broadband Infraco was contacted, but was only willing to participate on the basis that we enter into a strict confidentiality agreement which specified that any information obtained in the meeting would not be shared with any other persons and would not be used in the compilation of his report. We decided not to proceed with the interview.

has not seen significant churn in its customer base, reporting that only 1 of its long-term customers (Telkom Media[47]) has exited the market.

The charts below show DFA's growth over the past 3 - 5 years. Since 2010, DFA has grown its customer base at a compound annual rate of 26%, from 23 commercial leases in 2010 to 74 in March 2015 (Figure 9).[48] In response to increased demand for mobile data, DFA has focused on connecting mobile operators' base stations to its network. The rollout to mobile base stations has grown at a compound annual rate of 34% over the past 3 years. The rollout of the fibre network has been similarly impressive; with a compound annual growth rate of 47% from 2010 to 2015. DFA's revenue has grown from R549mn in 2012 to R1 047mn in 2015 (a compound annual rate of 24%). Revenue has been driven mainly by increased annuity income.

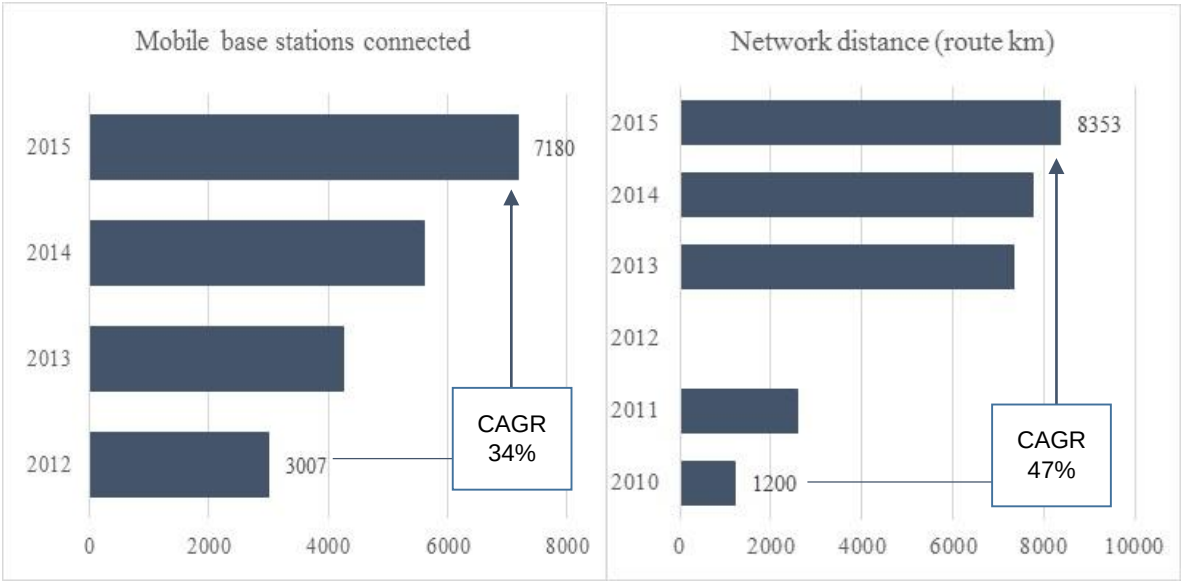
Figure 8: Number of commercial lease agreements (growth in long-term customers)



Source: Remgro Limited Annual Reports

[47] Telkom Media was granted a monopoly license for cable TV in 2007 but exited via a sale to Shenzen Media in 2010.
[48] Taken back to their entry in 2007, DFA's customer base has grown at a compound annual rate of 57%.

Figure 9: Other measures of network growth: route kilometres of fibre and number of mobile base stations connected to DFA network

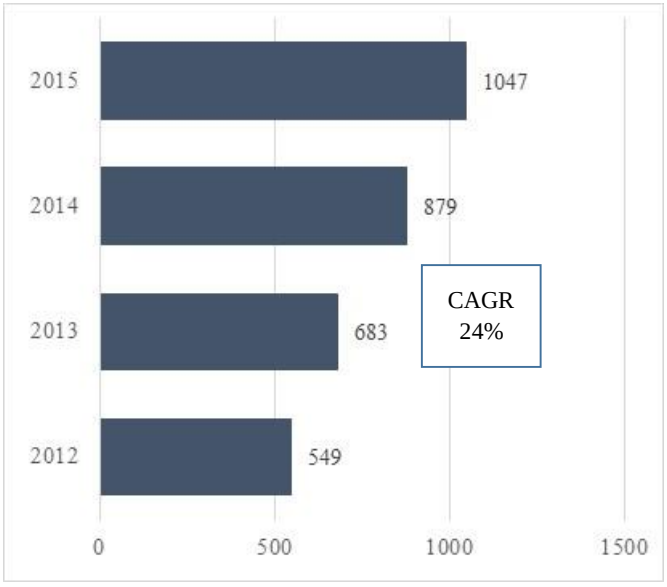


Source: Remgro Limited Annual Reports

Note 1: No data available for number of mobile base stations connected prior to 2012.

Note 2: No data available for DF's route kilometres in 2012. This does not affect the CAGR

Figure 10: Revenue Growth



Source: Remgro Limited Annual Reports

In extending its network, DFA upholds the general principle not to duplicate routes but to rather buy, swap, or lease fibre from other players to complement its own network.

On the point of fibre swaps, we note that smaller fibre players mentioned that they find it more difficult to enter into these deals than larger players such as DFA. Fibre swaps are only viable

where they are mutually beneficial; that is, both parties must have something that the other needs. The scale of DFA's network means that it is more likely to have unique fibre networks, and can more easily engage in swaps than new or smaller entrants. One interviewee actually mentioned that larger players, such as the mobile network operators, are much less interested in renting out their fibre than in obtaining access to new routes via swaps, which makes it critical for new entrants (such as FibreCo) to invest in rolling out fibre on an unserved route as part of their entry strategy.

The costs of rolling out fibre

The main cost components of rolling out a physical fibre network are: trenching (digging trenches for laying cables and rehabilitating or restoring the area when complete), installing ducts and manholes, and the fibre optic cable itself. Interviewees reported that civil works account for 70 – 85% of their cost, ducts and additional infrastructure amount to about 10%. The fibre itself is inexpensive, amounting to less than 10% of costs.[49]

DFA also emphasised the importance of investing in a geographic information system that tracks where the fibre has been laid and in a monitoring system that tracks the performance or uptime of its network. There are significant costs associated with these maintenance operations, which employ 70% of DFA's staff. On average, maintenance costs amount to ~80c/m/month, which equates to about R6.8mn per month for DFA's existing network.[50]

Maintenance is also the area in which DFA finds it most challenging to attract suitably skilled employees. There are currently no external training providers for splicing and maintenance of fibre networks. DFA has trained all 250 of its maintenance technicians in-house.

As an indication of the costs of laying a fibre network, we consider recent quotes by DFA and two FTTH providers, Vumatel and Cybersmart (Vermeulen, 2014). All costs are quoted for FTTH access, not long-haul networks.

The total cost of connecting a household is based on an average distance of 15m from curbside to house. Both Vumatel and DFA report that it costs on average R350 - R500/m for the fibre loop and about R195/m for the link from the curb to the house. These costs vary based on factors such as the quality of the trench, the existing state of the curbs, and the density of the households. To connect one household, DFA's estimated cost is R2 925 for the 15m link to the house and about R1500 for equipment; totalling R4425. This is similar to Cybersmart's estimated average cost per household of R5000 to get fibre into the household.

Rights of way/wayleaves

Interviewees raised two primary concerns with obtaining rights of way/wayleave approval. The first is that the processes can vary significantly across different municipalities and public entities, which introduces unnecessary complexity and uncertainty. The second is that the approval process can be quite lengthy.

[49] Fibre costs approximately R30/m, and R60/m including the plastic coating.
[50] Note that this estimate reflects the lower bound of the maintenance costs as it is based on DFA's route kilometers, which are less than actual kilometers of fibre.

Some firms reported waiting between 4 weeks and 6 months to obtain approval from municipalities, and between 9 and 12 months from entities such as SANRAL and Transnet. On the opposite end of the scale, one firm has waited more than 8 years for approval and still has not received a response.

Though DFA did not mention wayleaves as a significant barrier to entry or expansion (partly because it is now simply considered a feature of doing business in this market), prior legal proceedings between DFA and the Msunduzi Municipality shows how difficult these approval processes can be.

The Msunduzi case

The Msunduzi was about the interpretation of section 22 of the Electronic Communications Act which sets out the rights afforded an ECNS licensee. Section 22 states:

> ***22. Entry upon and construction of lines across land and waterways***
>
> *(1) An electronic communications network licensee,* ***may*** *-*
>
> *(a) enter upon any land, including any street, road, footpath or land reserved for public purposes, any railway and any waterway of the Republic:*
> *(b) construct and maintain an electronic communications network or electronic communications facilities upon, under, over, along or across any land, including any street, road, footpath or land reserved for public purposes, any railway and any waterway of the Republic, and*
> *(c) alter or remove its electronic communications network or electronic communications facilities, and may for that purpose attach wires, stays or any other kind of support to any building or other structure.*
>
> *(2)* ***In taking any action*** *in terms of subsection (1), due regard must be had to applicable law and the environmental policy of the Republic. (****own emphasis****)*

The background to the case

Dark Fibre Africa submitted an application for permission to construct a fibre network in Pietermaritzburg in July 2012. Sixteen months later, and despite numerous attempts to obtain approval, DFA was refused wayleave approval by the municipality.

In November 2013, DFA commenced construction based on its interpretation that section 22 of the Electronic Communications Act affords it a right to do so with or without wayleave approval. In February 2014, the Msunduzi Municipality launched an urgent application in the KwaZulu-Natal High Court to interdict Dark Fibre Africa from continuing with its construction on municipal property pending an approval of its wayleave application. The municipality argued in its reading of section 22(2), DFA's rollout was contingent on the Municipality providing wayleave approval.

The High Court ruled that subsection 22(2) does not limit DFA's ability to take the action specified in subsection 22(1), but sets out how it should go about carrying out the section 22(1) action.[51]

The Municipality took the matter to the Supreme Court of Appeal (SCA) on review. The SCA concurred with the High Court's interpretation.[52] This position was confirmed by the Constitutional Court decision in the matter between the City of Tshwane Metropolitan Municipality and Link Africa (Pty) Limited and Others.[53] The Court found that ECA licence holders can enter upon any property without the consent of the land owner provided that they exercise these rights respectfully and with due caution.

Although all licensees interviewed do still apply for wayleave approvals, these cases provide some protection against lengthy and arbitrary delays in the approval process.

A further complication in obtaining access to sites is that there are additional approval processes that run parallel to the wayleave process, such as the need to obtain water use licenses to cross any waterway[54] and the need to conduct environmental impact assessments. An environmental impact assessment is required even when applying for access to existing telephone poles within the City of Cape Town. These processes, which are dealt with by two different departments, the Department of Water and Sanitation and the Department of Environmental Affairs, have no fixed timelines and are not aligned with the municipal approval processes and can cause significant delays.

Obtaining wayleave approvals has not only become more administratively burdensome over time, but have also become more costly as municipalities and public entities (mainly SANRAL, but also ESKOM and Transnet) realise the value of providing access to their facilities.

The City of Cape Town is said to charge approximately R6 000/linear metre for a trench. The interview with the Western Cape Provincial Government confirms that municipalities are starting to see wayleaves as a significant income stream. Public entities, particularly SANRAL, were said to prefer entering into revenue sharing contracts rather than charging a once-off access fee. In terms of these revenue-sharing contracts, providers pay them a monthly fee, based on revenue earned from the fibre laid in the roadside reserve. Interviews suggest that SANRAL charges differing rates to various providers for accessing the roadside reserve.

As the demand for FTPP grows, some municipalities have resorted to placing a temporary moratorium on new wayleave applications and fibre rollouts to minimise the social and environmental disruptions caused by multiple sequential rollouts.[55] SANRAL deals with this

[51] High Court of South Africa (KwaZulu-Natal Division), Case Number 2763/2014, The Msunduzi Municipality v Dark Fibre Africa (Pty) Ltd.
[52] Supreme Court of Appeal of South Africa, Case Number 20119/2014, The Msunduzi Municipality v Dark Fibre Africa (Pty) Ltd.
[53] Constitutional Court of South Africa, case number CCT 184/14, City of Tshwane Metropolitan Municipality v Link Africa (Pty) Limited and Others.
[54] Neotel stated that it had to obtain 450 such approvals for the Johannesburg - Durban route alone.
[55] These disruptions are worsened by the fact that municipalities often do not have up-to-date maps of existing gas, water and electricity reticulation within their towns. This makes accidental damage more likely, and roll-outs more costly.

differently; it generally prefers to allow only one fibre player on each route and thus favours open-access players (though it is uncertain whether it insists on the terms of this access).

Interviewees suggest that these unnecessary delays in wayleave approval underscore the urgent need for the release of rapid deployment guidelines.

Regulatory requirements and firms' response to regulatory impasse

Discussions about the regulatory framework, the capacity of regulators, and the extent to which firms consider these as barriers to entry offered somewhat unexpected insights. Many interviewees reflected a general sentiment that issues such as the failure to complete local loop unbundling and failure to enforce facilities leasing are no longer a competitive constraint or barrier to entry, but simply a feature of the South African telecoms markets. In a sense, the market has "moved on" and simply works around these constraints.

In addition to this sentiment of "moving on" from regulatory processes that seem unlikely to be completed, interviewees view the evolution of the regulatory framework as a slow and lumbering process. By contrast, progress in telecommunications is swift and new entrants respond nimbly to these advances. DFA's entry and the sudden growth in FTTH were given as examples of this rapid pace of change and the responsiveness of ICT firms to new opportunities. The result is a divergence between the environment that regulation is developed for, and the constantly evolving present-day reality. Cell C described this succinctly when it noted that "regulation tends to take the shape of what already exists and often lags changes in technology and best practice."[56] In DFA's experience this was reflected, for example, in the fact that there was initially considerable confusion about how to classify its business as the ECA did not make provision for a business that sells fibre, and not services. This is a small indication of a more general trend in which some industries move faster than regulations and regulators with the implication that the regulator is always a step behind the players. This may have a lasting effect on the ability of new entrants to compete, as we discuss in more detail when we consider call termination rates in the mobile case study.

Excess capacity in existing networks

A number of interviewees indicated fibre networks are "future proof" in that there is more capacity in existing fibre networks than South Africa could ever use. DFA uses only the latest optical fibre technologies, which is expected to handle bandwidths far greater than South Africa's expected broadband traffic requirements over the next 20 years.[57] The roll-out of excess capacity is justified on the basis of the high construction costs of laying fibre.[58] Once installed, fibre can be used for up to 30 years with ongoing maintenance and repair.

In evaluating whether the excess capacity in existing fibre networks may deter new entrants, we do need to differentiate between the costs of constructing the route (physical trench, manhole, and ducts) and the cost of installing additional fibre in existing trenches (with fibre costs at approximately R60/m). Absent an open-access arrangement that extends to the

[56] Interview with Cell C, 22 July 2015
[57] Slater, D. 2015. *Open-access fibre-optic network key to smart city success.* Engineering News. Available at http://www.engineeringnews.co.za/article/open-access-fibre-optic-network-key-to-smart-city-success-2015-06-12
[58] Interview with DFA, 06 July 2015. Interview with FibreCo, 25 June 2015

physical infrastructure, significant excess capacity could present a significant barrier to entry. However, all interviewees have reported that all firms, bar Telkom, are open to providing competitors access to their ducts and that new entrants will generally not face the high capital costs of duplicating civil works. This indicates that the excess capacity on existing networks may not be a significant deterrent to those firms that prefer to roll out their own networks within existing ducts (though it may still be a potentially wasteful duplication of resources).

Assessment of state involvement in the sector

Interviewees were asked for input on the recent trend of self-provision of fibre networks by local governments, particularly the City of Johannesburg and Western Cape Provincial Government, which used two different rollout models.[59] The general sentiment is that the City of Johannesburg, in particular, vastly overpaid for its network and simply duplicated the existing DFA network (it is said to have placed its own cables next to DFA's existing infrastructure).

Two interviewees indicated that it cost the City of Johannesburg about 10 times more to roll out this network than it would have cost them to lay the same fibre route. Interviewees even estimate that the City of Johannesburg could have provided last-mile access for all buildings in Johannesburg for half the amount of money it spent on the fibre rollout. Given this high sunk cost and considering the excess capacity available from private players, interviewees consider it unlikely that the City of Joburg's network will ever be commercially viable.

An additional concern raised by interviewees was whether these roll-outs adequately considered ongoing operational expenses required to maintain the networks, or whether feasibility studies simply considered the initial capital expenditure required. As indicated by DFA, operational expenditure is significant.

There was general consensus amongst all firms interviewed that it would be more rational for governments to act as anchor tenants in areas wherein it would otherwise not be viable for the private sector to supply fibre, along the line of the model adopted by the Western Cape Provincial Government.[60] Even in these areas, it is not necessary for government to build its own networks, as the anticipated revenue from an anchor tenant would encourage private provision. This would ensure that universal access is achieved in a manner that is as efficient as possible.

First-mover advantage?

DFA emphasised the importance of timing entry correctly. It indicates that there are definite first-mover advantages in an infrastructure business with near-limitless capacity such as this, and that it would not make financial sense for a second firm to roll out networks where DFA networks already exist. A further challenge to any new entrant is that DFA has long-term (15 year) contracts with existing customers and any new entrant would need to find new customers to ensure sustainability.

FibreCo, a competing open-access fibre infrastructure firm, has confirmed that it is difficult to compete against established players, given the scale required to be profitable. A first-mover

[59] An overview of each of these projects is provided as Appendix 5
[60] See Appendix 5.

in this sector thus seems to have a sustained and entrenched advantage, which will be difficult to erode.

In such a situation, there would generally be cause for concern about the exercise of unilateral market power by the incumbent. However, this concern is mitigated by the entry of other firms, particularly telecommunications companies, the competitive constraint of the existing Telkom copper network (albeit limited due to differences in quality of transmission, uptime, and speed of maintenance), and the current open access nature of these fibre networks.

Access to office parks and new townships

Opinions on access to office parks and new townships differ. Though DFA has not faced any challenges in accessing office parks or new residential sites, access to new sites was cited as a growing concern for other members of the FTTH Council. As property developers realise the potential value of accessing their sites, they have started bidding up the price and demand a percentage of the operator's monthly revenue as part of their non-GLA[61] revenues. Some say that office parks behave like "a monopoly at the end of road". This places upwards pressure on the prices that businesses pay for broadband. Though a regulatory solution has been suggested, some interviewees doubt that it would be effective to add another function to an already over-burdened regulatory environment.

There is also speculation that Telkom is still seen as the default telecoms provider by developers and town planners with the result that it (Telkom) is often the only infrastructure provider asked to install ducts when new sites are developed.[62] The practice of treating Telkom as the default provider of infrastructure may have an exclusionary effect as Telkom does not readily allow competitors' access to its infrastructure. Neotel indicated that Telkom has steadfastly refused to grant it access to any of its ducts. This exclusion is heightened by the fact that property developers are often unwilling to allow competing providers to trench and install their own infrastructure anew.

Summary of barriers to entry and main insights from the DFA case study

Fibre is a scale business that requires significant capital outlays

Fibre is a scale business. A significant proportion of costs is incurred in physically laying the fibre, which cannot be fully recovered upon exit. In addition to these costs, the value of using a particular firm's network increases in proportion to the size and coverage of the network; particularly in high-demand areas. It is very difficult to monetise smaller, fragmented networks.

These characteristics of the fibre market confer advantages on first movers and leads to concentration in infrastructure provision. The potential exclusionary effect of these characteristics is heightened if competing infrastructure providers are denied access to ducts, poles, and other infrastructure (as Telkom is said to do), and by the absence of working facilities leasing regulations. However, Telkom seems to be the exception in this regard. Interviewees indicated that all other infrastructure players are relatively open to providing competing providers access to their infrastructure.

[61] GLA refers to "gross lettable area". Non-GLA revenue refers to all income other than rental income.
[62] There is even colloquial reference to a "Telkom room" in new developments.

The impact of the policy environment is uncertain

Interviewees raised general concerns about increasing policy uncertainty since the split in the Department of Communications after the 2014 general election. Firms indicate that it is often unclear who to approach, particularly on matters of policy that preceded the change. Some argued that this type of uncertainty is a big inhibitor to private investment.

But an alternative view also emerged; some interviewees indicated that the often haphazard and ineffective regulatory environment was in some ways a benefit for entrepreneurs who innovate in grey areas and unregulated spaces. It creates a space for entrepreneurs to easily identify opportunities, take risks and introduce new products. The entire FTTH phenomenon was given as an example of the innovations that happen unaided and before they are even contemplated by regulators.

In a similar vein, the flexibility of private players in response to regulatory challenges was emphasised. Issue such as LLU and challenges in obtaining wayleaves very quickly move from being considered a barrier to entry and expansion, to simply being seen as a feature of the market. Though these challenges are not costless, firms find ways around these constraints. This speaks to the entrepreneurial nature of many firms in the telecommunication sector.

There are opportunities for rent-seeking at "the end of the road"

Access to office parks and high-density residential areas is an important revenue stream for FTTP providers. Interviewees raised two issues in this regard. The first is that Telkom is still seen as the default provider, and often refuses to grant competitors access to its facilities. The second is that property developers, in realising the value of access to these areas, are trying to maximise their profits by bidding up costs to access these sites. This raises costs of services to customers. Interviewees were unclear about a solution to this challenge. Though some felt that open access on an equal basis should be ensured, others questioned the feasibility of adding another regulatory requirement.

Access to capital remains a major challenge

Two interesting insights emerged on access to capital for start-ups and new firms in the telecommunications sector more broadly. The first is that financiers are wary of providing funding to a sector that changes so rapidly due to a concern that present-day technology may become obsolete long before they realise a return on their investment. A second insight came from a review of the companies owned by, or related to, DFA. Many of these companies share the same founders or investors. This indicates that there may be formal and informal networks of capital and trust that circulate amongst a group of serial ICT entrepreneurs. Though this is undoubtedly linked to the first challenge (that is, the latter group is probably less risk averse than the first and understand the nature and type of returns in the technology space better), it is unclear how easy it would be for an "outsider" to access these networks.

4.2 Background to Dark Fibre Africa

Dark Fibre Africa is Africa's first provider of dark fibre services.[63] It was formed in 2007 and started rolling out open access fibre networks in 2008. DFA was initially funded with private equity and is still a privately held business.

"Dark fibre" is optical fibre infrastructure that has been installed, but which does not carry a signal. The term derives from the fact that data is transmitted via light in fibre optic cable, so "inactive" or "unlit" fibre is referred to as "dark".

DFA is primarily an infrastructure provider. It builds, manages, and maintains an open-access optical dark fibre network to transmit metro and long-haul telecommunications traffic. Its business model involves financing and rolling out a physical fibre infrastructure backbone for use by organisations (ISPs, firms, government, etc.) who do not have the scale, capital, or inclination to roll out their own network. As discussed in more detail below, rolling out fibre networks is highly capital intensive, and is characterised by significant sunk costs and economies of scale, which means that it is not efficient for all those who require fibre backhaul to roll out their own independent network. These costs would be particularly onerous for smaller operators. DFA's business proposition thus rests on removing this infrastructure barrier and making its network available to all parties on an open-access basis.

In the 7 years since it started its roll-out, DFA has built a network of about 8 353km of fibre routes at a cost of R5bn.[64] DFA's fibre rollout started in dense urban centres: Johannesburg/Midrand, Pretoria/Centurion, Cape Town, and Durban/Pietermaritzburg. In the past two years it has also moved into smaller metros including East London, George, Emalahleni, and Polokwane.[65] DFA currently employs 350 staff members, 250 of which are technical/maintenance staff.

Contracting with customers

Contracting takes place in the form of indefeasible rights of use agreements (in terms of which a lump sum is paid in advance) or multi-year annuity agreements ranging from 5 to fifteen years.[66] As at March 2015, 75% of DFA's total revenue was annuity revenue and most of DFA's customers were on 15 year contracts.[67] The users of the DFA network are responsible for commissioning and "lighting" the fibre, either for their own use or to on-sell capacity to their customers.

Additional services: operations and maintenance

[63] Interview with Richard Came, 9 June 2015
[64] Remgro Annual Report, 2015. Figures quoted as at the end of DFA's financial year, which is March 2015. Note that the actual fibre distance is much longer than the route kilometres quoted here.
[65] To view DFA's network, see its live coverage network available here
[66] An indefeasible right of use (IRU) as "an agreement that confers an exclusive right of access to some or all of the capacity in a telecommunications cable system on another party. 'Indefeasible' is a term meaning not liable to be annulled or forfeited". See UK Revenue & Customs Authority, http://www.hmrc.gov.uk/manuals/cirdmanual/cird70340.htm
[67] Remgro Limited 2015 Annual Report

DFA's business extends beyond the physical roll-out of fibre networks. An important part of its business involves continuous (24/7) monitoring of the performance of the network and conducting continuous preventative maintenance. DFA's technical response teams work on a 24-hour cycle, and it promises a 4-hour turnaround time for any downtime or interference. DFA had an average uptime of 99.99% over the last financial year.[68]

Expansion into related infrastructure services

In early 2014, DFA acquired fibre optic infrastructure provider, Conduct Telecommunications (Pty) Ltd, which gave it immediate capability to provide last-mile access. Since then, DFA has entered the FTTB space, and aims to connect 20 000 businesses by March 2016.[69] FTTB is considered a more sustainable and lucrative opportunity than FTTH at present, though DFA has rolled out FTTH in Parkview, Johannesburg, and has submitted bids for other suburbs in the Johannesburg area. In line with their FTTB strategy, DFA is proactively connecting buildings and is deliberately extending its network to pass key buildings like government facilities.

The acquisition of Conduct addressed a gap DFA identified for providing cost-effective connectivity to enterprise customers and is considered "the next logical step" in expanding their business. It is seen as a natural extension of the capabilities it acquired in rolling out, monitoring, and maintaining long-distance fibre networks. Until the Conduct acquisition, the slow roll-out of last-mile connectivity by customers was repeatedly noted as a constraint to optimal use of DFA's dark fibre network.[70]

It seems unlikely that DFA will expand beyond infrastructure provision to compete in services. An important tenet of its business seems to be competitive neutrality, The company commits to providing equal access to all customers on an equal footing and any DFA involvement in the services segment may create a conflict of interest.[71]

Shareholding

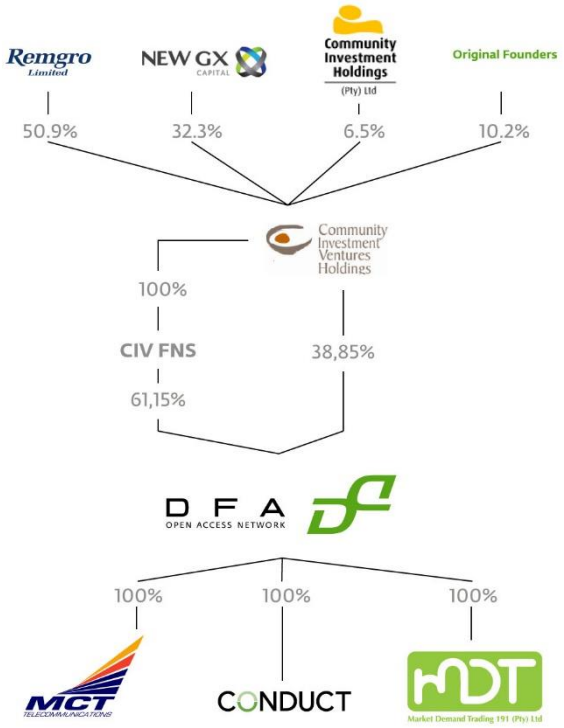
DFA's largest shareholder is Remgro Limited, which holds an effective 50.9% stake in the company. The original founders of DFA hold a 10.2% stake in the company (Figure 8). Remgro's shareholding in DFA was instrumental in providing it with access to capital to expand its network and in attracting long-term customers who were wary of entering into long-term contracts with a start-up.

DFA initially approached the IDC for funding but was unsuccessful as it could not meet the IDC's requirement to show sufficient signed contracts as guarantee of future revenue. DFA's difficulty in securing funding reflects a broader challenge of attracting investment in the fast-

[68] Ibid
[69] ITWeb. June 2015. *DFA targets 20 000 fibre connections.* Available at http://www.itweb.co.za/?id=143604:DFA-targets-20-000-fibre-connections
[70] Remgro Limited's Annual Reports from 2012 to 2015 all mention the slow pace of las mile access as a challenge for DFA.
[71] See presentation by Malcom Kirby (2009) entitled *"Dark Fibre Connectivity. Changing the rules – Connecting on fibre"* available at www.iweek.org.za/wp-content/uploads/2009/09/**9**.**Malcolm**.**Kirby**.ppt

changing technology sector in which funders are often reluctant to invest due to a concern that today's technology will become obsolete before they are able to recoup their investments.[72]

Figure 11: DFA Shareholding



Source: DFA Website

5 Fixed wireless

The fixed wireless case study was carried out through a series of interviews with market participants and other stakeholders. We interviewed a range of wireless firms in terms of size and geographic coverage. These are: Neotel, BitCo, Megasurf, Breedenet and HeroTel. We also interviewed the Wireless Access Providers Association (WAPA), the Tertiary Education and Research Network of South Africa (TENET), Project Isizwe, Dominic Cull of Ellipsis Regulatory Solutions, the Internet Service Providers Association (ISPA) and William Stucke. A full profile of all interviewees is provided in Appendix C. Interviewees were asked a range of questions around the barriers to entry in the fixed wireless market and the challenges involved in growing into an effective competitor in the market. The key barriers to entry which emerged are discussed in the section which follows.

5.1 Barriers to entry

Modes of entry

[72] Wilson, C. 2013. *Citizen Came.* Techcentral. Available at http://www.techcentral.co.za/citizen-came/37523/

Since the first wireless services were launched in South Africa, there has been a proliferation of firms offering wireless broadband. Today, WAPA has over 150 members and there may be many more firms which have chosen not to become WAPA members. A small number of these players are large firms selling wireless broadband country-wide to consumers and businesses and for whom wireless broadband forms only part of their service offering. Such firms include Neotel, Internet Solutions and Comtel. For these large players, offering a high quality wireless broadband product (e.g. LTE or WiMAX) to small businesses and high-usage domestic consumers offers them the opportunity to circumvent Telkom's local loop infrastructure and still present a competitive broadband offering to customers. It is possible to provide a better quality product than ADSL at competitive pricing. However, these high quality wireless connections still represent a drop in the ocean compared to Telkom's 1 million copper lines.

At the other end of the spectrum, there are a large number of small firms which concentrate on a narrow geographical area and usually operate using license-exempt spectrum. These players typically focus on a small town or a small range of suburbs. These firms have found space to enter in a niche where their low costs allow them to offer a service which is priced more competitively than mobile broadband and ADSL, or where ADSL and fibre are not available (e.g. in rural areas). The services are usually cheap but quality is sometimes compromised by the use of license-exempt spectrum, especially in urban areas, where it is heavily congested. This is discussed in greater detail below.

In between these two extremes, there are a number of firms who cover a broader geographical area with good quality broadband access and service small businesses and corporates as well as households. Some of them have access to licensed spectrum for distribution to customers which allows them to provide a higher quality of product than the small operations. These are companies such as Megasurf, Bitco, Bronberg Wisp, Snowball and Breedenet. In addition there are players who simply re-sell broadband on behalf of larger firms.

It is possible to start by providing wireless broadband to a small geographical area, say one suburb, and grow incrementally to cover a much broader area. This is the approach taken by several of the medium-sized firms. One firm explained that it started in one suburb, and expanded gradually over a 16 year period to cover three major metros and numerous secondary towns and rural areas, even building its own national backbone to support the local networks.

Costs of entry

To start a small WISP, the start-up would need premises, servers, access to a hi-site, radio equipment, access to bandwidth and a customer call centre. Premises can be rented as can access to existing hi-sites. However, hi-site rental in urban areas can be expensive as landlords see an opportunity to make money and the big competitors have already got space in all the best sites. Outside of urban areas it is typically cheaper and easier to access hi-sites as building owners tend to be happy that a new provider is entering the market. It is also possible to build your own tower, but there are limitations on how high they can be built.

The cost of servers will vary depending on the size, quality and functionality required but can be expensive. In terms of radio equipment, one firm told us that it costs about R250 000 to put up a high quality tower, and for this investment to be viable, it must sign up at least ten customers. Another firm suggested it would need to secure revenue of R50 000 per month to

cover costs in terms of investing to serve a new area. This would mean signing up around 50 home users or 15 – 30 businesses depending on their size and spend. For the most part though, it seems as if infrastructure has to be built without any prior commitment by customers, at least in the household segment where customers do not usually like to sign long-term contracts. However, the costs associated with entry need not be very high and it is also possible to use cheaper equipment, although this will result in a lower quality product. This may explain the proliferation of small wireless providers.

In terms of bandwidth, the WISP can build its own backhaul network or pay to access existing infrastructure, using either fibre or wireless backhaul. Access to fibre is typically more expensive and firms are often required to sign long-term (up to 5 years) contracts. Wireless backhaul is cheaper but provides a less reliable service. The issue of accessing backhaul infrastructure is considered in more detail below.

Another important cost item is customer service – setting up and running a 24-hour call centre to deal with customer queries can be expensive for a small WISP with few customers. There are economies of scale, so the cost of the call centre does not increase proportionally as the firm signs up more customers.

Overall therefore, there do not seem to be significant sunk costs involved in setting up a WISP, and depending on what approach is taken, the other fixed and variable costs can also be quite low. A challenge does exist, however, in terms of financing the start-up. Two firms noted that financiers are typically reluctant to finance start-up wireless ISPs (WISPs), partly due to the fact that they typically have few assets and the main value in the enterprise sits in the people running it. WISPs tend to come and go at the lower end of the market (we will come back to the reasons for this below) and this may also put off potential funders. One of the firms noted that it is difficult to access financing from banks even as a well-established player with multiple customers. As such, the availability of financing acts as a constraint on the growth of its business. In addition, a number of other challenges pose barriers to the growth and expansion of WISPs as discussed in the sections which follow.

Access to supply

In terms of the equipment required to roll out a wireless network, this seems to be fairly standard and easily available. The same equipment is used everywhere and it is mainly imported. One provider noted that their suppliers occasionally run out of stock, particularly towards the end of the year which results in them having to stock up in August and September. However, this does not seem to be a major challenge for firms.

Finding sites for towers and getting access to hi-sites is a potential problem for providers. Generally, however, this does not seem to have been a problem. It seems that if you are prepared to pay to rent space, then it is not difficult to find. One provider noted that they are often the first to provide services in an under-served area and building owners are usually happy to accommodate their equipment. The only complication in terms of finding hi-sites is that outside the major urban areas, there are not so many tall buildings which can be a challenge. There are limitations in terms of how high you can build towers which means that the signal will not travel very far. For very small entrants, the need to pay monthly rental fees to access hi-sites before they have a large number of customers signed up could be a barrier to entry, but again this is more of an issue in urban areas than elsewhere.

Access to a backhaul network can be a challenge, particularly since the big players may see wireless providers as their competition. Both fibre and wireless providers that we spoke to discussed the importance of open access infrastructure in allowing new entrants and smaller players to compete. Where there are competing infrastructure providers and open access players as well as major operators are present in the market, prices tend to be much lower.

This was illustrated by one of the fibre entrants we spoke to who claimed that there was an 87% reduction in the price of transmission between Bloemfontein and Johannesburg between 2013 and 2014 due to the construction of two new fibre links, one of which was open access. This dramatic change is illustrated in the table below. This suggests that the incumbent players (one of which was Telkom) were charging prices substantially above cost until they were faced with competition.

Table 8: Impact of FibreCo on cost of transmission between Bloemfontein and Johannesburg

Price per month for a 1Gbps connection in 2013	Price per month for a 1Gbps connection in 2014	Reduction in price
R500 000	R64 000	87%

Source: FibreCo

It is also possible to build your own wireless backhaul network to support the local network as one of the firms we spoke to had done. The provider said that it had not encountered particular problems with leasing infrastructure but ultimately it is better to have control over your own network so that you can limit any downtime to an absolute minimum. It may help that wireless providers tend to target a particular niche in the market – i.e. underserved rural areas and smaller towns, small businesses and households – and hence the major players may not see them as direct competitors. Backhaul spectrum for point-to-point links appears to be relatively easy to access and the annual fees payable are affordable. For example, a 10km link in a low density (rural) area can cost as little as R1200 per year in spectrum fees. The intervention by ICASA to lower fees for backhaul spectrum appears to have had a big impact on the ability of WISPs to build their own networks and expand their businesses.

Access to undersea cables also appears to be straightforward. One of the providers we spoke to explained that it was easy to negotiate access to the Seacom cable. It was generally noted that the cost of access fell dramatically with the introduction of the Seacom cable in 2009. Prior to this, the only cable available was the Telkom-owned SAT-3 cable. Following this, two further cables were introduced – EASSy and WACS. It is estimated that the introduction of Seacom led to an immediate reduction in bandwidth costs for a typical ISP of around 35% (Stucke, 2015b). This again highlights the importance of open access infrastructure that is available for entrants and smaller players to use.

Access to customers

Views on access to customers were mixed amongst the interviewees. Some noted that it is difficult to market yourself to customers if you are not one of the major brands such as Telkom or Neotel. Others emphasised the importance of product quality and service levels in winning the trust of customers and expanding the business. One provider noted that they run the business purely on the strength of their reputation for high quality and quick response times

when there is a fault. The provider stated that they do not advertise the product, customers approach them for a quote. They find that customers are more sensitive to quality and amount of up-time than they are to pricing. Another WISP agreed, stating that WISPs trade on their good reputation and high levels of service. If a WISP performs well it will achieve a low customer churn rate and grow by word of mouth.

It seems as if to some extent the poor quality of service provided by ADSL providers has created a niche for wireless providers, at least in terms of broadband for households and small businesses. One provider noted that often if they go into a new area it will be because one or two residents come to them as they are unhappy with the service they are getting, and from there they can approach others in the area. In some areas, like a small rural town, the wireless provider may be the only player in town, which makes it relatively easy to get customers. In an urban area there are more options and more competition but the population is denser, there are more people, and people are more willing to pay. The quality that wireless can offer is comparable to 10MB ADSL line in theory, but in practice Telkom exchanges are congested and quality is often poor, and this creates a niche for the wireless providers to take advantage by offering a better quality of product and excellent customer service.

A difficulty faced by small players is that there is an up-front cost attached to the installation of equipment at the customer's premises, which for a household usually amounts to around R2000. Typically, this is either paid up-front by the customer or financed by requiring the customer to agree to a 12 or 24 month contract and recouped through the tariffs charged. Large firms can easily finance the up-front investment and recoup the costs over time, however, it is more difficult for smaller players to do the same. With the contract option there is also a risk that the customer will default and the costs will not be able to be recouped, however, an up-front fee may be off-putting to customers. One provider, however, suggested that customers are generally willing to pay the up-front fee and this has not affected its ability to sign up customers. Another explained that it tried offering a contract option, but that the clients who did not want to pay for the device up-front were also those who typically defaulted on their contracts, so eventually it decided to only offer a month-to-month product and ask customers to buy the equipment up-front.

Incumbent's reaction to entry

As noted above, the behaviour of large incumbents does not seem to have been too much of a problem in this market, but this may be due to the small threat which the big players perceive from most wireless providers. The view in the market seems to be that the major telecommunications companies are not really interested in areas outside the major urban areas and are not good at the last mile to homes and small businesses. They may therefore be to some extent happy to leave this to WISPs. Another potential model is for the big telecommunications companies to use WISPs to assist them with the last mile. Neotel for example has in some cases chosen to partner with WISPs to roll out its network, rather than to compete with them directly. However, this is not common currently.

Policy and regulatory barriers

The lack of access to spectrum for distribution is a challenge cited by firms. As noted above, backhaul (point-to-point) spectrum appears to be relatively affordable and easy to access,

however, spectrum for distribution to customers (point-to-multipoint), which tends to be in the high-demand spectrum bands, is almost impossible to get.

Currently most WISPs are operating using the 2.4GHz, 5GHz, 17GHz and 24GHz bands which are the license-exempt bands. Because anyone with an ECNS license can use the license-exempt bands, they have become very congested, particularly in urban areas. This affects the quality of service which can be provided to customers. This is one reason why small WISPs tend to come and go in the market quite quickly, as they fail to build up a good reputation and expand their customer base. One way to mitigate this is to operate at the higher frequency end of the license-exempt band, however, this requires much more expensive radio equipment (and is not technically allowed by ICASA, although some WISPs are doing it). This is not really feasible except for backhaul or for distribution to very large customers.

The firms we spoke to reported that ICASA is a spectrum bottleneck. Companies are unable to get access to spectrum which they know is not currently in use. This influences the quality of service that wireless providers are able to provide to their customers and hence their ability to compete. The delay in spectrum allocation is not only in respect of high-demand spectrum. Some of the low-demand spectrum bands which have not been allocated are well suited to the provision of wireless broadband and if they were allocated to firms, this could help to reduce the congestion in the license-exempt bands. Firms report that applying to ICASA for additional spectrum, even outside the high-demand spectrum bands, is a lengthy and frustrating process.

One provider had managed to get access to 2GHz spectrum through the acquisition of a firm which already had the spectrum and was not using it. This has made a big difference to its business as the spectrum has better properties in terms of dealing with obstacles (such as trees and buildings) which means it will be able to connect customers who could not previously have been served. The firm noted that it has also applied for additional spectrum but has made no progress with the process, an experience which was echoed by another provider. One other WISP had managed to acquire some high-demand spectrum which it said was critical in allowing it to provide high quality services but noted that if it was not able to acquire more spectrum, as demand grows it will increasingly try to move the business towards fibre for the last mile rather than wireless. These firms are of the view that the distribution of more spectrum to wireless providers would enable the industry to grow faster and be more competitive.

Stucke (2015b) lists the spectrum which is currently unused and suggests a range of packages which could be auctioned (see Figure 12). He suggests splitting the spectrum into nine packages where three would be reserved for new entrants, one for wholesale use and one to be broken up into around 50 local packages which could be sold to small wireless providers in particular local areas. This would go some way towards alleviating the spectrum constraint. The WISPs we interviewed indicated that they would be interested in acquiring such spectrum if it were to be released.

Figure 12: Possible means of allocating unused high-demand spectrum

Freq	FDD/TDD	DL	UL	Avail BW MHz	Package 1 Reserved	Package 2 Reserved	Package 3 Reserved	Package 4 Wholesale Only - Open	Package 5 Open	Package 6 Open	Package 7 Open	Package 8 Open	No Package Yet
700 MHz	FDD	758-788	703-733	2 x 30 MHz*					2x10 MHz	2x10 MHz	2x10 MHz		
700 MHz	TDD	733 - 758		1 x 25 MHz									25
800 MHz	FDD	791-821	832-862	2 x 30 MHz		2x10 MHz	2x10 MHz	2x10 MHz					
800 MHz	TDD	822 - 831		1 x 11 MHz									11
2.1 GHz	TDD	2010-2015		1 x 5 MHz									5
2.3 GHz	TDD	2300-2400		1 x 100 MHz					1 x 20 MHz				100
2.6 GHz	FDD	2620-2690	2500-2570	2 x 70 MHz	2x20 MHz	2x20 MHz	2x10 MHz	2x20 MHz					
2.6 GHz	TDD	2570-2620		1 x 50 MHz								1 x 30 MHz	20
3.5 GHz													
Total FDD Bandwidth			130	260	20	30	20	30	10	10	10		
Total TDD Bandwidth			150	191								30	161

Source: Stucke (2015b)

The issue of dynamic spectrum sharing could possibly help to alleviate the spectrum constraint which is being explored by telecommunications regulators internationally. According to TENET which was responsible for a TV white spaces (TVWS) trial in Cape Town in partnership with ICASA and industry players, this approach "has significant potential to increase the availability and ubiquity of broadband access" (Carlson et al, 2014). Dynamic spectrum usage refers to the sharing of under-utilised spectrum between users in time, space and channel/frequency band. Geolocation databases are used to manage this and prevent interference between users. The use of TVWS for the delivery of wireless broadband is one example of this type of dynamic spectrum management. TVWS are channels left vacant by television broadcasters in order to prevent interference between channels. If access is carefully managed, these vacant spaces can potentially be effectively utilised for the provision of wireless broadband in localised areas.

The TVWS trial in Cape Town took place in 2013. It aimed to show that dynamic spectrum access is workable in South Africa and in particular that it is possible to co-locate and occupy unused TV channels without causing interference. The trial accessed unused TV channels and used these to provide wireless broadband to local schools. Levels of interference were very low and a number of useful learnings came out of the trial. Wireless was able to be provided in adjacent channels and even in between two channels without causing interference, using both analogue and digital channels. It broke new ground in terms of using directly adjacent channels: previous trials by the FCC had only used channels two up or down from existing TV channels. There were further technical learnings around asymmetric interference and power thresholds necessary to prevent interference. All of these enabled the trial team to come up with a set of draft rules which regulators can use to implement dynamic spectrum access using TVWS.

ICASA was a partner in the TVWS trial and is now reportedly looking at the possibility of implementing such an approach. However, little progress has been made in practice. Internationally the approach is still being tested, with the FCC and OFTEL the most advanced in exploring the issue. One difficulty which would need to be overcome for dynamic spectrum sharing to become widely used is that there needs to be good intelligence about what free channels are available so that devices can be set to use the correct channel. This is easier in terms of TV as there is good information on what is being used by whom. In theory it should be possible to build a database of all dynamic spectrum use, as ICASA should have

information on what all licensees are doing. One stakeholder suggested, however, that it would be better for an industry body to manage this, as ICASA has not historically shown it has capacity to manage such processes. The use of license-exempt or unlicensed spectrum is currently managed by WAPA for example.

Regardless of how it is regulated, it seems likely that dynamic spectrum access will eventually become widely used internationally, if only because of the exponential growth of data demand and the spectrum constraints which exist. Proponents argue that it will reduce barriers to entry in the wireless space and allow for further proliferation of wireless providers, which should drive competition and hence quality and service levels as well as lower prices. While licensing spectrum has been effective in encouraging investment and preventing interference, it tends to encourage concentration and raise barriers to entry (Milgrom et al, 2011). Unlicensed spectrum can contribute to lowering the cost of broadband access as well as promote broader access (Carlson et al, 2014). It can reduce the number of base stations required by MNOs through the offloading of traffic onto Wi-Fi (Thanki, 2012). In addition, Cooper (2012) finds that spectrum allocated for unlicensed use has been more effective in encouraging innovative uses and that by any measure of economic performance (device shipments, users, usage, efficiency, value and innovation), the unlicensed model has out-performed the licensed model in the decade until 2012. As Milgrom et al (2011) explain "unlicensed spectrum is an enabling resource. It provides a platform for innovation upon which innovators may face lower barriers to bringing wireless products to market, because they are freed from the need to negotiate with exclusive license holders."

The views of our interviewees on the potential of TVWS and other dynamic spectrum usage approaches to revolutionise the industry were somewhat more muted. One or two of the WISPs were interested in the concept and believed that it could help to ease the spectrum constraint. However, there was some scepticism about the potential impact, partly due to the complexity of the exercise and institutional capacity constraints at the regulatory level. It was also noted that given the apparent policy paralysis in terms of spectrum, it may be unrealistic to expect the authorities to tackle this issue in the near future. However, given international trends, South Africa's limited but successful experience and the growing spectrum constraint, dynamic spectrum access is clearly an area to which policymakers and ICASA need to give serious thought.

As discussed in more detail in the fibre case study, there is also a general feeling amongst the wireless providers interviewed that direct government participation in this market needs to avoid crowding out private sector investment. For example, municipal fibre should not duplicate the networks of private players. The government-as-an anchor-tenant model was generally preferred as an approach to the issue of stimulating investment in underserved areas. One WISP also noted that it is difficult to get municipalities to consider proposals for free Wi-Fi services and they tend to put off calling for tenders to deliver these services. Meanwhile, some of the major projects which have gone ahead (e.g. in Tshwane) have done so without full tender processes. WISPS are clearly well-placed to provide these services, and it may be worthwhile for the relevant department to issue guidelines for municipalities on how to go about procuring these services.

Finally, one provider also noted the high compliance costs associated with the reporting requirements imposed on licensees by ICASA. It seems that a large number of different

reports are requested, often duplicating the same information, and which are intended for different departments of the regulator. A move to streamline this process would significantly reduce compliance costs for firms.

Summary on barriers to entry in fixed wireless

From the discussion above, it is clear that the barriers to setting up a small WISP are not particularly high, and this is reflected in the large number of WISPs which are operating in South Africa currently. However, it is much more difficult to grow into a large, sustainable WISP which offers high-quality services and can be an effective competitor in the market. The biggest challenge to doing so, particularly in urban areas, is the congestion of the license-exempt spectrum bands and the difficulty of obtaining licensed spectrum for providing last-mile connections. Policymakers and the regulator should address this as a matter of urgency.

WISPs are uniquely positioned to service under-served areas cheaply with high-quality broadband and high levels of customer service. They also provide valuable competition to poor-quality existing broadband options in urban areas (several WISPs told us that new customers regularly tell them that the poor quality of internet and customer service that they receive from Telkom is what led them to switch).

In this context, it is clear that wireless should be a key component of achieving the aims of SA Connect, and the regulatory barriers should therefore be resolved as swiftly and effectively as possible, both through allowing WISPs to access more licensed spectrum (both high-demand and low-demand) and continuing to explore and innovate around the issue of dynamic spectrum usage. Finally, centrally determined guidelines around the model for the provision of free Wi-Fi to underserved parts of the population should be drafted and enforced, such that municipalities are encouraged to use the most cost-effective means of providing access to citizens, without crowding out efficient private sector investment.

6 Mobile - Cell C

6.1 Background to Cell C

Cell C entered the South African mobile telephony market in October 2001 as the third Mobile Network Operator ("MNO"), 7 years after the incumbent operators, Vodacom and MTN. The minister of communications had approved a third operator in 1999 but entry was delayed due to legal challenges with awarding the license to Cell C.[73] Cell C was operational 21 weeks after the license was granted. The fourth MNO player, Telkom (Mobile), entered in 2010. South Africa presently has four MNOs, independent retail services providers (e.g. Altech) and four MVNOs (Virgin Mobile, MRP mobile, Me & You and FNB Connect).

Cell C is owned by three shareholders, namely Oger Telecom South Africa (a subsidiary of Saudi Oger), Lanun Securities SA (Lanun) and (CellSAF) (Pty) Limited respectively holding 60%, 15% and 25% shares. CellSAF is the BEE partner. In 2015, Blue Label Telecoms, made an offer to purchase a 35% stake in the business and the Cell C management made a binding offer on behalf of the employees for a 30% stake of the business. These transactions are still under consideration by the Cell C Board.[74]

Entry by a MNO is at multiple levels of the value chain, operating the network and providing retail services. As the challenger firm, Cell C had to launch a nationwide network in short space of time to be considered as an alternative to the existing players that already had national presence. As it would be difficult to roll out a network in the time required, Cell C entered into a roaming agreement with Vodacom. This allowed Cell C to make use of Vodacom's network while it built its own infrastructure. The roaming agreement was evergreen, but the major metropolitans would be excluded after a period of 3 years (ending 2004). Cell C fell behind its rollout plan, claiming that the delays were caused by challenges in obtaining wayleaves.

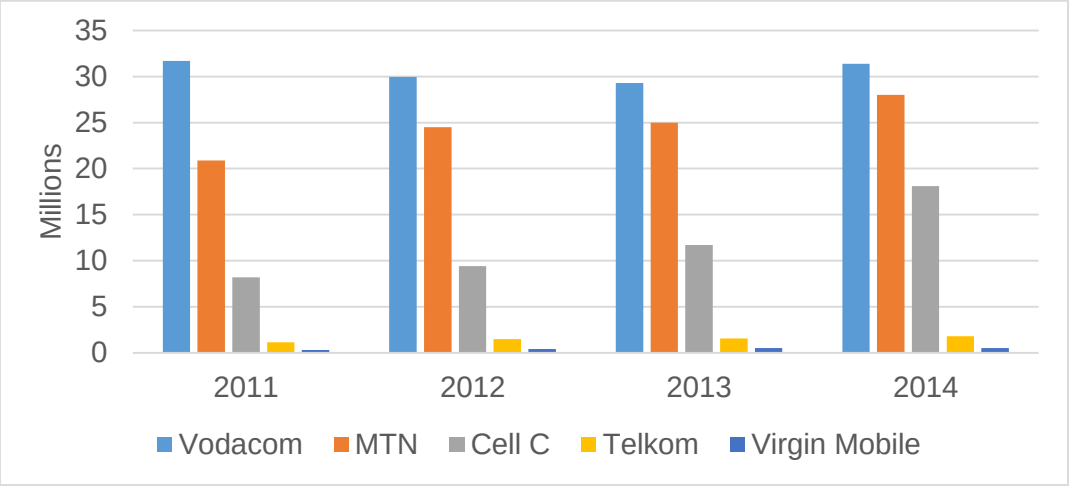
Cell C made an operating profit for the first time in 2008, however, it was not able to maintain the operating profit.[75] There is limited data available on Cell C's financial performance, as such it is not possible to ascertain if or when the business achieved overall profits. However, in September 2015 the CEO announced that Cell C had been operationally profitable for a few quarters. [76] Telkom Mobile is also still making losses after five years of operating.

Cell C started by targeting the prepaid segment of the market, even though it also provided post-paid services. As of March 2015, Cell C has 20.4m subscribers, a 25% share of the market. These numbers have grown significantly from about 2.9 million in 2005. Cell C has

[73] NectCom, a bidder for the third South African cellular license, accused ICASA (then SATRA) of not following due process in awarding the license to Cell C. The matter was settled out of court but the details of the settlement were not made public.
[74] Prior to this proposed restructuring Telkom made an offer to purchase Cell C from its shareholders. The two parties negotiated the terms of the acquisition over a period of a few months but later walked away from the deal.
[75] First Avenue Investment Management. (2012). SA mobile telecoms – a price war? Available Online: http://firstavenue.co.za/2012/11/
[76] Van Zyl., G. 2015. "Cell C is 'profitable' – CEO", Fin24Tech, 23 September 2015. Available Online http://www.fin24.com/Tech/Mobile/Cell-C-is-profitable-CEO-20150923 [Accessed 24 November 2015].

only really been able to grow its subscriber base following the recent mobile termination intervention by the regulator (Figure 13).

Figure 13: Growth of subscriber numbers



Source: Mybroadband

A large proportion of Cell C's customers are pre-paid. Efforts to penetrate the post-paid market have not been successful. To date Cell C has only managed to acquire 2.2 million (0.7m in 2005) post-paid customers compared to Vodacom's 4.9m and MTN's 5.4 million. The other providers of mobile services that are not reflected in Figure 13 are the Mobile Virtual Network Operators (MVNOs). Virgin Mobile has 500 000 subscribers, Me &You, 6000 customers, and FNB Connect has 100 000 customers.[77] There is a fourth MVNO, Mr Price Mobile, however the subscriber numbers are unknown.

There are various measures of the performance of a mobile network including, price, data speeds, latency, call set up success rates, and call drop rates. Price is not discussed in this section as it is discussed in detail section 6.4. Cell C has been investing in their network over time. However, the other networks outperform Cell C on the measures of the quality of the voice and mobile data networks. Though there are no big variances between the network operators in terms of call set up success rate, Cell C has the lowest success rate at 97%, while Vodacom has the highest rate at 99% success rate (table 9).

[77] 2 Oceans Vibes News (2015).'You'll Never Guess Who Came Out On Top Of S.A. Mobile Providers' [Online] Available: http://www.2oceansvibe.com/2015/11/17/youll-never-guess-who-came-out-on-top-of-s-a-mobile-providers-graphs/#ixzz3yzYv9VDF

Table 9: Voice network quality

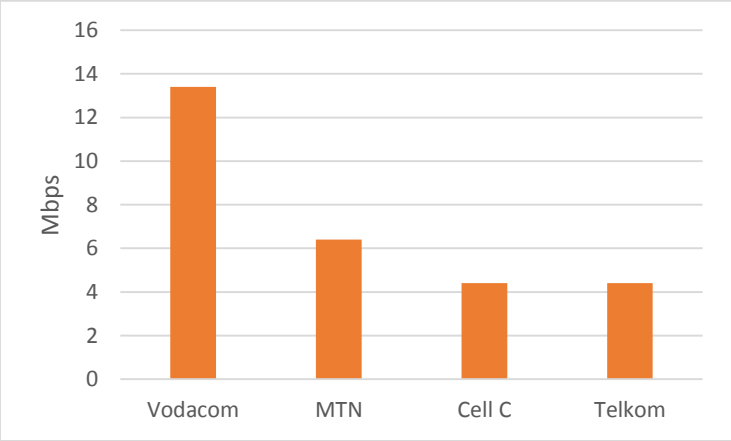
Rank	Call setup success (97% – 99%)	Least dropped calls (0.6% – 2%)	Overall voice quality rank
1	Vodacom	Vodacom	Vodacom
2	Telkom	Telkom	Telkom
3	MTN	MTN	MTN
4	Cell C	Cell C	Cell C

Source: Mybroadband

Similarly, the variance between dropped call rates, which measure the number of calls that are dropped as a proportion of the total number of calls made on a network, of the different operators are within 2%. Cell C again has the highest at 2%. The call setup success rate and the dropped call rate together are used to rank the quality of the voice networks and Cell C has the lowest ranking with a relatively poorer voice network quality than the others.

The quality of the mobile data network is becoming more important as customers are demanding more and faster data over time. Cell C has relatively lower download and upload speeds. The average speeds as recorded by MyBroadband in 2015 show that the challenger operators are delivering lower speeds than the incumbents.

Figure 14: Average mobile data speeds (2015)



Source: MyBroadband

Entry by Cell C has facilitated services competition by allowing MVNOs to use its network. So far there are 4 MVNOs that use the Cell C network. Though MVNOs have had limited impact on competitive outcomes in mobile telephony, in other countries there have been some positive outcomes that have arisen from services competition.

Though Cell C is not an entrant, having been in the market for 14 years, it still poses an interesting case study about opportunities for expansion, network effects and the ability for challenger firms to compete; as well as a successful story of regulating for competition. Throughout the rest of the case study we refer to Cell C and Telkom Mobile as challenger firms.

6.2 Barriers to entry/expansion

Barriers to entry can be classified into three main types: structural (or natural), strategic, and regulatory (or legal).[78] We start the discussion with structural barriers, which arise from the nature of the technology, resources, or inputs required to establish a business. We note however that some of the barriers that are discussed below will affect entrants to varying degrees depending on whether entrants seeks to compete on infrastructure or just on services. For example MVNOs do not face the same cost of entry as MNOs. Though the South African policy stance is to have services competition rather than infrastructure competition and there are policies that have been drafted to put this into effect, we shall see how the extent to which these policies are implemented affects the challenges that challenger firms face.

Cost of entry

To enter as an MNO in South Africa, a firm would be required to build a national network, which is capital intensive. This is particularly challenging when there is a long lead time between entry by the incumbent and the challenger firms. Customers will not shift to the challenger network regardless of the prices if the network cannot offer good coverage (often determined by the offering of the existing players due to the necessity of roaming initially whilst expanding the network).

Network operators also incur substantial fixed costs for call centres, sales, a prepaid platform, license fees, billing and advertising. Cell C has 4500 base stations that are live and each was built at an estimated cost of R1.5 million, resulting in a total cost of about R6.8 billion for the radio access network (RAN). Over and above the RAN, an MNO would require transmissions, a backup system, and a billing platform. Cell C sold its billing platform for R100 million a few years ago.

Entrants are expected to offer national coverage to be able to compete effectively with the incumbents, which is not always possible in the first few years of entry. Vodacom and MTN may also enjoy scale advantages as the incremental cost per user is lower for the incumbents that have a substantially larger subscriber base than Cell C.

Alternative approaches to building a national network is concluding roaming arrangements with existing MNOs, co-locating on base stations and high sites, and wholesale access. Cell C has rolled out infrastructure but roams on the Vodacom network in areas where it does not have network. With regards to greenfield rollout, there is an additional challenge of acquiring permission. It has been submitted that getting approval can take up to 2 years.

The regulations that are there to facilitate facilities leasing have not been effectively enforced and Cell C has submitted that the incumbent operators often apply a one-for-one approach to leasing which means that the challenger operators are only allowed to lease a facility if they can offer the incumbent operator another facility to trade. This naturally disadvantages smaller operators with fewer sites. This means that the services competition that is envisioned by the national policies is not taking place and through the implementation of these one-for-one

[78] Banda et al 2014

policies the incumbent firms are ensuring that the status quo with respect to infrastructure competition, continues.

Though the cost of entry in mobile telephony is high, these are not necessarily sunk costs. Applying the strict definition of sunk costs, the firm could recoup a substantial portion of the costs of entry should the operator exit. However, the operator would not be able to recoup advertising and the regulatory costs. Cell C has submitted that advertising is very important for MNOs and the incumbent firms have deeper pockets. In 2013, Vodacom and MTN spent R746 million and R490 million on adverting, respectively.[79] Both operators were in the top 10 advertisers across all media for that year and had increased advertising expenditure from the previous year. In 2012, Vodacom advertising expenditure amounted to R439 million, representing a 70% increase between 2012 and 2013. Similarly, MTN increased advertising expenditure from R350 million. If Cell C were to match the advertising budgets of the incumbents, then it would spend a disproportionate percentage of its revenue on advertising. Cell C revenue was estimated at R10 billion versus, MTN SA's R39 Billion and Vodacom SA's R57 billion.

Spectrum

Once a mobile firm has deployed infrastructure then spectrum is required for the last mile connection, from the base station to the mobile device.[80] The spectrum allocations of the operators is provided in Table 7 above.

Cell C has submitted that its spectrum in the 900MHz band is not contiguous and this negatively affects its ability to provide services in that band.[81] However, Cell C and MTN have similar allocations in the 900 MGHz band and both are non-contiguous. MTN submitted that the non-contiguous allocations does not currently disadvantage it *vis a vis* Vodacom. This is because the operators are using the 900MGHz for both GSM voice and LTE. Both Cell C and MTN were able have a 3G channel for data and are using the rest of the band for voice. The non-contiguous spectrum will only disadvantage MTN and Cell C when they no longer want to put voice traffic in that band and rather want to use the band exclusively for data. The non-contiguous allocation in the 900 MHz means that MTN and Cell C are forced to have 2 smaller 5MHz channels, while Vodacom can have a 10 MHz channel. In SA operators are still drawing most of their revenue from voice traffic so it is unlikely that MTN and Cell C will use the 900 MGHz band exclusively for data in the near future.

In terms of the International Telecommunications Union ("ITU") regulations from the world radio conference, which South Africa adheres to, there is spectrum that has been identified for each generation of technology –e.g. 2G, 3G and 4G. Spectrum has been identified for 4G (or LTE) use, however, it has not yet been assigned to mobile operators. In the meantime, mobile operators are refarming their 3G spectrum to be able to provide 4G. Mobile operators can increase the capacity of their networks (and consequently data speeds) by using more

[79] Nielsen Ad Dyanmix data
[80] GSMA meeting notes
[81] Cell C meeting notes

spectrum, using better technology or building more base stations. As spectrum assignment has been delayed, the operators have pursued the latter options.

Vodacom was the first operator to launch LTE in South Africa in October 2012[82], followed by MTN in December 2012[83], Telkom and Cell C in March 2015[84] and September 2015[85] respectively. The mobile operators are all currently refarming spectrum to provide the LTE services as they wait for the assignments.

In 2011, ICASA published an invitation for spectrum applications. However, soon after, the Department of Communication asked ICASA to withdraw the invitation and wait for a policy directive before proceeding with the spectrum assignment process. ICASA paused the invitation process indefinitely. In September 2015 it issued an information memorandum for public comment with details of its new proposal for assigning the spectrum. In the meantime, DOC/DTPS is yet to finalise the national spectrum policy directive. The process is being held back by the delayed digital migration, discussed in the background section.

New licenced players like Smile Telecoms have also yet to be allocated spectrum. Smile submitted its first application for spectrum in March 2009 and the application has not yet been processed by the regulator.[86]

Access to customers

Mobile operators can incur substantial costs in acquiring new subscribers. In South Africa the mobile penetration rate is estimated at 146%, which means that market share is mostly acquired through customer switching. Operators spend money on advertising, hiring sales staff and offering commissions as incentives, subsidizing handsets and discounting deals to lure customers from each other. These are all generally referred to as customer acquisition costs.

Cell C has over the years grown its subscriber base but the highest growth came after the regulatory decision to lower call termination rates and create asymmetry in the rates to favour smaller operators. The lower termination rates and discounting by Cell C has resulted in increased subscribers for Cell C in the pre-paid market but in the post-paid market growth has been relatively sluggish. Contract cancellation fees have been cited as contributing to low post-paid churn (switching). In response to this, Cell C launched a contract buyout strategy in 2015 to try to acquire more postpaid customers. Contract customers typically enter into 24 month contracts with their service provider and should the customer wish to switch to another provider then the contract has to be terminated at a cost. The different MNOs have varying policies on the cost of cancellation of contracts but all typically request the customer to pay back the phone subsidy and the usage bill for the month that the contract is cancelled (Table 10).

[82] http://mybroadband.co.za/news/cellular/61756-vodacom-launches-lte-in-south-africa.html
[83] http://mybroadband.co.za/news/broadband/65938-mtn-lte-launched.html
[84] http://businesstech.co.za/news/telecommunications/69731/telkom-launches-lte-advanced/
[85] http://www.techcentral.co.za/cell-c-launches-lte-with-aggressive-prices/59998/
[86] Smile submission on the published application for additional spectrum by MTN, dated 13 June 2013.

Table 10: Cost of contract cancellation

MNO	Cost of cancellation
Cell C	device subsidy x months remaining +usage bill
Telkom mobile	device subsidy x months remaining +usage bill +R800
Vodacom	full monthly fee x months remaining x 75% +usage bill
MTN (as reported)	device subsidy x months remaining +usage bill+ next month's subscription fee
MTN (customer reports)	Service fee x months remaining +usage bill + R1710

Source: MyBroadband

There have been complaints that the cancellation costs are high and as a result deter switching between the operators for post-paid services. The operator is entitled to get the remaining share of the phone subsidy and the usage back, however there have been questions raised by the additional costs charged by Telkom (R800) and MTN (next month subscription fee/R1710).[87] Whether the cancellation costs are a real barrier to switching will be determined by the success or failure of the contract buyout programme. The idea behind the contract buyout approach is that Cell C internalizes the cost of switching to an amount up to R10 000 on behalf of the customer that switches to Cell C. The buyout programme was launched in May 2015 but so far Cell C has not been willing to share data on the success of the programme. A month after the launch of the promotion, the operator was quoted as saying that the uptake by customers was greater than expectations.[88] However, Vodacom reported a reduction in the post-paid churn rate for the quarter ending June 2015.[89] MTN reported a reduction in the post-paid customer base but attributed this to handset supply chain challenges.

On-net, off-net price differentials

Another challenge that Cell C has identified in terms of access to customers is the price differential between off-net (between different networks) and on-net (between same network) calls referred to as 'closed network pricing'.

Vodacom and MTN have built "communities of interest" through their MTN Zone[90] and Vodacom 4 less packages. These packages offer dynamic discounting for on-network calls. The discount received by the customer depends on the time of day and customer location but can be up to 100%. These dynamic discounts incentivise customers to have their family and friends on the same network. This is discussed in detail below. MTN and Vodacom enjoyed first mover advantages in constructing extensive networks, which allowed them to aggregate

[87] Data collected by My Broadband suggests that there may be some variance between MTN's published cancellation policy and what customers have indicated that they have to pay.
[88] http://mybroadband.co.za/news/cellular/129750-cell-c-r10000-contract-buy-out-phenomenal-success.html
[89] Vodacom Grroup Limited Quarterly update for the perios ended 30 June 2015.
[90] http://www.techcentral.co.za/mtn-chops-prepaid-prices/38572/

and simultaneously intermediate users while setting prices in a relatively weak regulatory environment.

Incumbents' reaction to entry

Strategic barriers to entry may arise from the established positions of incumbent businesses, and their intentional acts to discourage prospective entrants. This may include advertising heavily to raise customer loyalty and brand reputation, and raising switching costs by, for example, offering long-term contracts with penalties for early termination.

Cell C has lodged a complaint with the Competition Commission, alleging that Vodacom and MTN have abused their dominance by discriminating between the effective prices charged for on-net and off-net calls which has a detrimental effect on the ability of challenger operators to acquire customers.[91] Cell C alleges that both MTN and Vodacom provide substantial discounts for on-net calls and charge high premiums for off-net calls. The complaint alleges that the conduct amounts to excessive pricing in contravention of section 8(a) of the Competition Act ("the Act"), exclusionary conduct in contravention of section 8(c) or requiring or inducing a supplier or customer not to deal with a competitor in contravention of section 8(d)(i).

The incumbent firms could argue that closed network pricing is a competitive tool to differentiate their products in an otherwise competitive market. However, such practices have been found to be anti-competitive in other jurisdictions. For example, the French Competition Authority found that Orange France and France Telecom were guilty of anti-competitive price discrimination by applying price differentials between on-net and off-net calls. Similarly, the French Authority found that Orange Caribes and France Telecom had contravened the Competition Act by applying price differentials for on-net and off-net calls. In the latter case the decision found that the differentials were not objectively justifiable by the differences in cost of the two types of calls.

The reason that on-net discounting is particularly problematic in South Africa is that the challenger firms are not able to respond with similar strategy or lower average rates. As the challenger firms have lower subscriber numbers it is not in the interests of the customer to switch to a dynamic discounting package with a smaller customer base as the customer will not be able to reach as many people as cheaply (network effects). The effect is also dependent on differential traffic levels and mobile terminations rates. Customers on the Cell C network tend to call to other networks more than on their own network by virtue of the network's smaller size. To be able to effectively respond to the on-net discounts the challenger firms would have to subsidise cross-network calls, which would be much more costly for them than for the incumbent firms.

Policy and regulatory barriers

Regulatory barriers arise from legislation. Potential regulatory barriers could be quality standards or environmental controls that new entrants are required to meet. In the context of Cell C, the slow pace of regulation has limited its ability to grow the business. Cell C has noted that the lack of enforcement of the Electronic Communications Act and in particular the

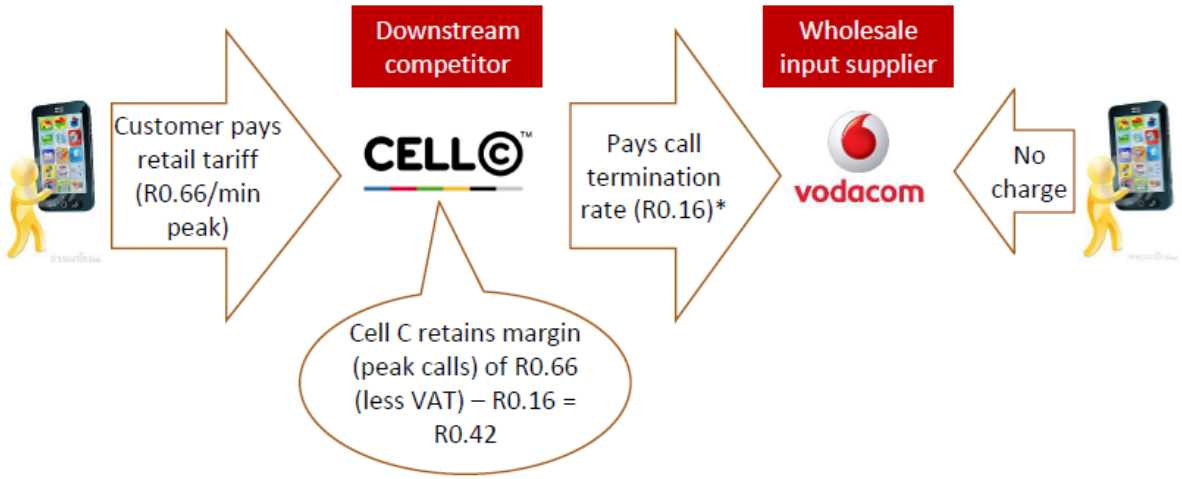
[91] Cell C (2013). Cell C lodges competition complaint against Vodacom and MTN [Online] Available: http://www.cellc.co.za/explore/newsroom/cell-c-lodges-competition-complaint-against-vodacom-and-mtn

facilities leasing regulations has limited its growth. There is a lack of effective enforcement of access regulations and, as a result Cell C has been lodging complaints with the competition authorities (with longer time frames). Cell C has made submissions to ICASA stating that the incumbent operators more often than not deny applications to share sites and in the instances that sharing is granted it is priced at exorbitant levels.

6.3 Gains from regulating for competition

Though there are issues with certain aspects of regulation in mobile telephony, the mobile termination rates (MTRs) decision of 2011 provides a useful illustration of the benefits of regulation for competition. Operators pay a fee to terminate (connect) a call to another network. For example when a Cell C customer makes a call to someone on the Vodacom Network, then Cell C has to pay a fee to Vodacom to terminate the call (Figure 15).

Figure 15: Mobile termination



Source: Own illustration

Mobile termination rates were not regulated at the time that MTN and Vodacom entered the market for mobile telephony and this remained the case until the March 2011 when the regulations developed by ICASA came into effect. The Telecommunications Act, no. 103 of 1996 (TA) and interconnection guidelines governed interconnection between parties in South Africa until 2010. The interconnection guidelines required that major operators set their call termination rates at the long run incremental cost (LRIC) of call termination, however none of the mobile operators were declared as major operators (Hawthorne, 2014). This left the determination of the rates to the mobile operators. Between 1993 and 1999, the termination rate was set by the mobile operators at 20 cents for mobile to mobile calls, this was increased to R1.23 during peak hours and R0.73 for off peak over a three year period, incidentally starting the year that the minister of communications approved a third cellular licence. The gradual increase of the mobile termination rates has been alleged to be a strategy by the

mobile players to disadvantage the new entrants,[92] however, the incumbent firms have argued that the increases were in response to changes in market circumstances (Table 11).[93]

Table 11: Mobile call termination rates history – 1993-2010 (regulated)

1993- 1 July 1999	**R0.20** – mobile to mobile; **R1.09** – fixed to mobile	
	Peak	**Off-peak**
1 July 1999	R0.50	R0.30
1 July 2000	R0.80	R0.45
1 July 2001	R1.19	R0.65
Mar / Sep 2002	R1.23*	R0.73*
January 2003	R1.28**	R0.75**
- Prior to March 2010	R1.25	R0.77
1 March 2010	R0.89	R0.77

** According Telkom's SEC prospectus filing, 2003, Cell C was initially paid a lower call termination rate*

*** According Telkom's SEC prospectus filing, 2003, Cell C, MTN and Telkom were paid the same termination rate from this point until 2010*

MTN and Vodacom were investigated for collusion in the 1990s by the Competition Board, but the case was not pursued by the Competition Commission when it took over from the Board. The termination rates reduced gradually from 2010. Initially the decline was driven by political pressure and later ICASA's regulations (Table 11 and 12).

Table 12: Mobile call termination rates history – 2011-2016 (regulated)

	Asymmetric allowance	**Established SMP operators rate (Vodacom, MTN)**		**Asymmetric rate (Cell C, Telkom Mobile)**	
		Peak	**Off-peak**	**Peak**	**Off-peak**
1 March 2011	20%	R0.73	R0.65	R0.88	R0.78
1 March 2012	15%	R0.56	R0.52	R0.64	R0.60
1 March 2013	10%	R0.40		R0.44	
1 March 2014	220%	R0.20		R0.44	
1October 2014	155%	R0.20		R0.31	
1 October 2015	150%	R0.16		R0.24	
1 October 2016	146%	R0.13		R0.19	

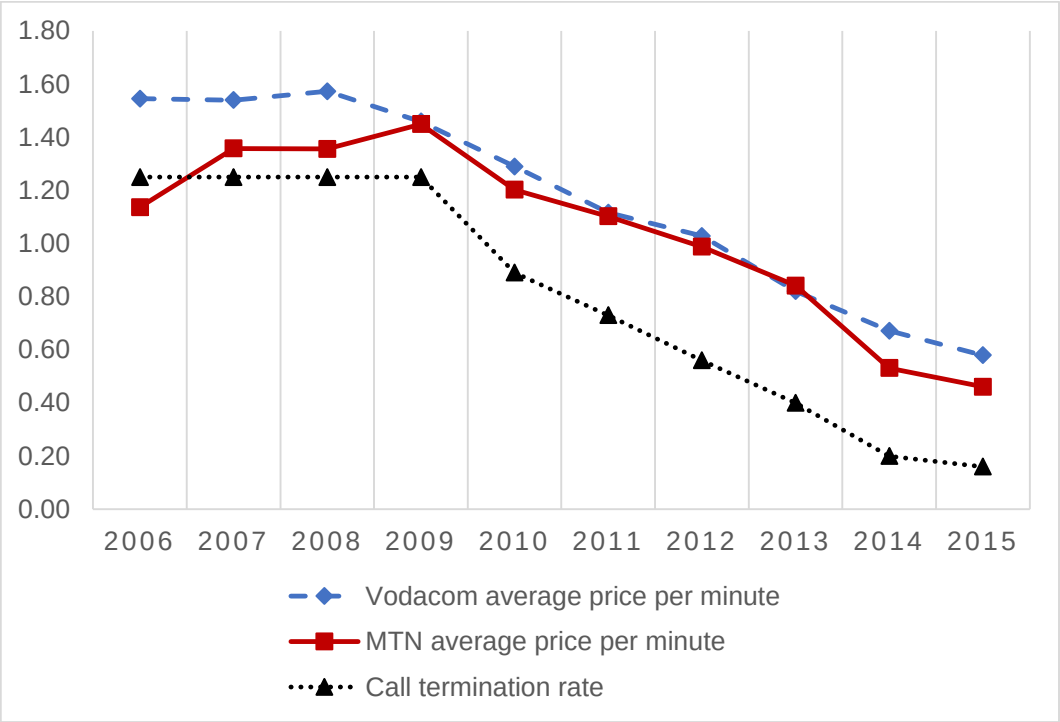
Source: Compiled by the authors

At the time that the ICASA decision came into effect the impact of the termination rates was uncertain. The operators had warned that the lower termination rates would not necessarily translate into lower prices but would lead to lower profitability and in turn lower investment, less access to mobile networks and reduced employment. Contrary to the predictions of the operators, the prices dropped following the lower termination rates. Retail prices have declined in SA to 79c (Vodacom) as a result of lower call termination rates. There was a 75%

[92] Lewis, D., (2012). Thieves at the dinner table: enforcing the competition Act, a personal account.
[93] MyBroadband (2014). Secret Vodacom and MTN Pricing Agreement Warning. [Online] Available: http://mybroadband.co.za/news/cellular/114623-secret-vodacom-mtn-pricing-agreement-warning.html

pass through of the termination rate reduction of R1.05. Figure 16 illustrates the reduction in prices if the incumbent operators and it is clear that the operators have dropped prices as the termination rates have fallen.

Figure 16: Retail prices and call termination rates

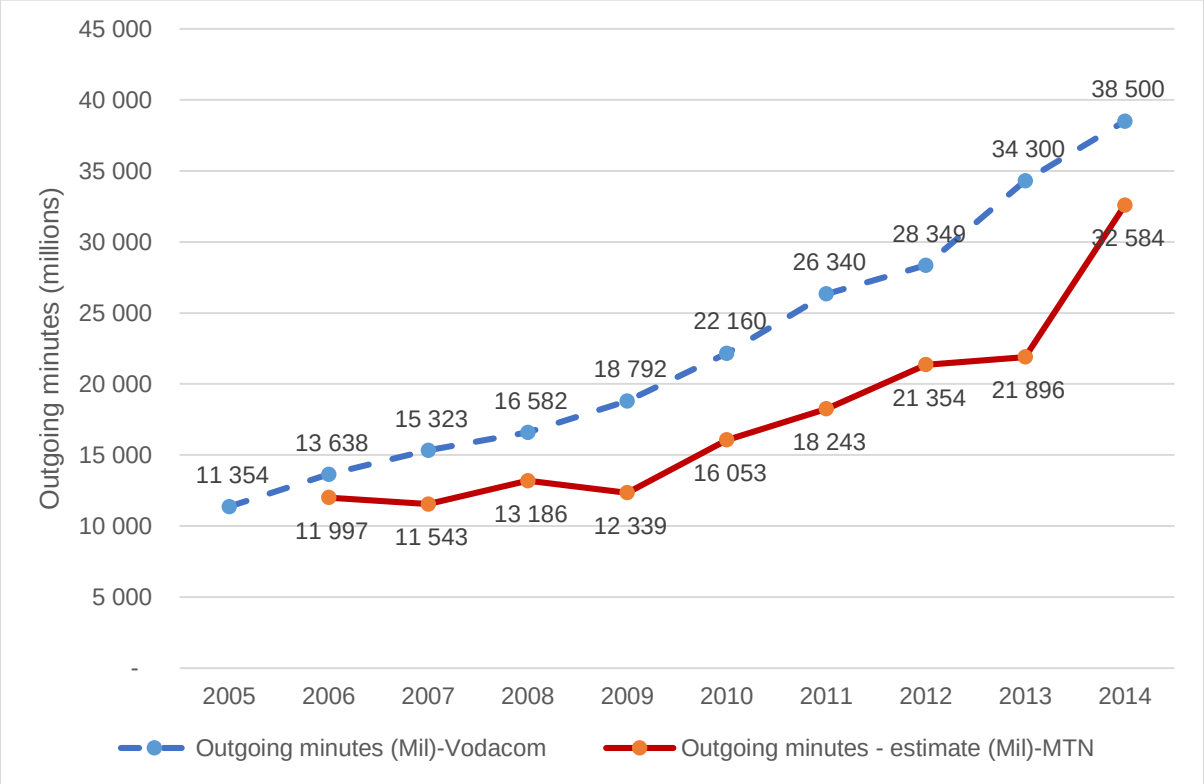


Source: Calculated from MTN and Vodacom annual reports

** 2015 data is estimated from Vodacom's interim results (as at September 2015) and MTN's interim results as at June 2015. Total minutes were annualised by multiplying interim results by 2.*

The volumes of minutes have increased significantly as the prices have fallen. Vodacom's volumes in minutes have increased to 38.5 billion minutes and customers have realised a saving of 79c per average call (Figure 17). If the average saving per call is applied to the Vodacom volume of minutes recorded in 2014, then Vodacom customers have saved approximately R30 billion in calls.

Figure 17: Growth of outgoing minutes

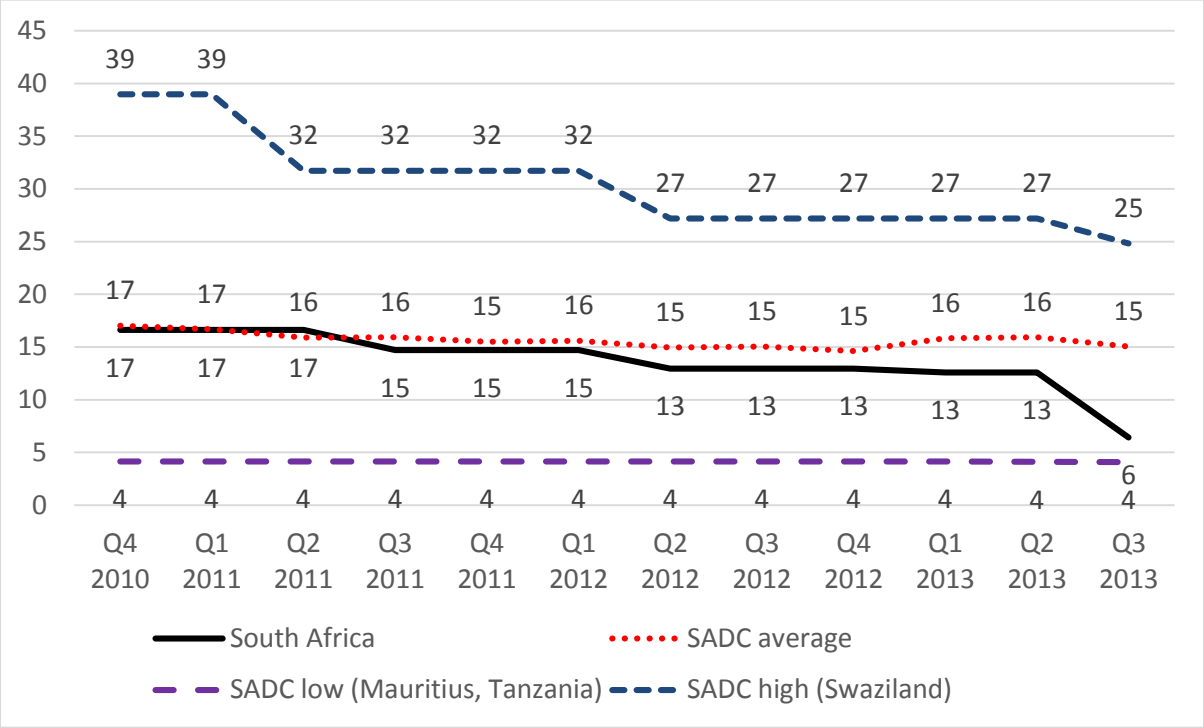


Source: Calculated from operator annual reports

This is a significant consumer surplus even though the calculation is based on only one of the operators.[94] If the surplus arising from MTN, Telkom Mobile and Cell C are accounted for this figure would be significantly higher. South Africa's retail prices are now in line with the lowest SADC retail prices (Figure 18).

[94] MTN discontinued reporting of volume of minutes and Cell C and Telkom (Mobile) do not report these numbers.

Figure 18: South Africa vs SADC retail prices

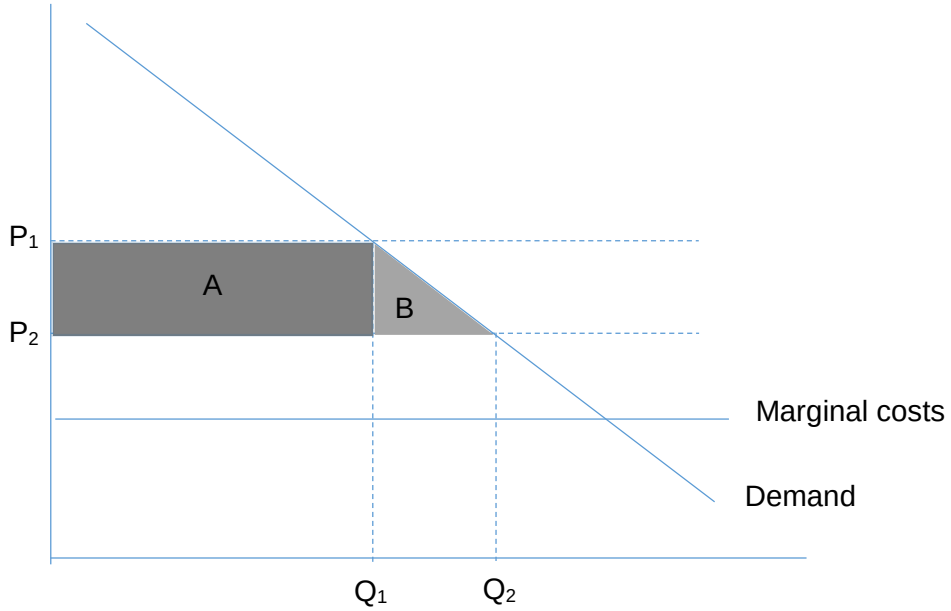


Source: Research ICT Africa

Estimated consumer gains from mobile termination rate reductions (2010 - 2015)

In order to estimate the consumer gains from mobile termination rate reductions, we could assume that all of the price reductions and volume growth over a period of time were attributable to the call termination rate reduction (this assumption is discussed in more detail below). We would need an estimate of the voice price reduction in each year (P_1 and P_2 on 9 below), and growth in the volume of minutes consumed between one year (Q_1) and the next (Q_2). We could then calculate the transfer from producers to consumers, Area 'A' on the figure below, as follows: $(P_1 - P_2) * Q_1$. If we further assume that demand is linear, we are able to calculate the additional consumer surplus resulting from the reduction in deadweight loss to consumers, Area 'B' on the figure, as follows: $(P_1 - P_2) * (Q_2 - Q_1) / 2$. Area 'A' plus Area 'B' equals the total improvement in consumer surplus arising from lower prices and greater volumes.

Figure 19: Calculation of welfare benefits from price reductions



We collated Q_1 and Q_2 from Vodacom and MTN's annual reports for 2009 – 2014, and from their interim results for 2015 (multiplied by 2 in order for an annual estimate).[95] For P_1 and P_2, we calculate blended prices from outgoing revenues, divided by volumes of outgoing minutes, using the same sources. Vodacom reports outgoing minutes and outgoing voice revenue, from which a price can be directly calculated. MTN reports monthly minutes of use per subscriber (MOU), and numbers of subscribers, and outgoing voice revenue. Total outgoing voice minutes of use can be calculated from the volume of MOU multiplied by the number of subscribers, multiplied by 12.

Using this approach, we calculate that consumers have benefited from price reductions and increased voice usage to the value of approximately R47bn over the last six years (see calculations on **Error! Reference source not found.**3 below).

[95] We note that MTN may have changed either its definition of outgoing minutes, or number of subscribers, or both in that the MOU increased dramatically from 71 in 2013 to 97 in 2014, after being very stable at between 69 and 71 between 2010 and 2013.

Table 13: Welfare improvement due to call termination rate intervention

	2010	2011	2012	2013	2014	2015*
Vodacom						
Price differential (R) (P_2-P_1)	0.17	0.17	0.09	0.21	0.15	0.09
Volume of minutes (m), previous year (Q_1)	18,792	22,160	26,340	28,349	34,300	38,500
Consumer savings (Rbn) - Area A (P_2-P_1) x (Q_1)	3.18	3.85	2.31	5.90	5.10	3.55
Additional minutes (m), current year (Q_2-Q_1)	3,368	4,180	2,009	5,951	4,200	2,500
Consumer savings (Rbn) - Area B (P_2-P_1) x (Q_2-Q_1) / 2	0.29	0.36	0.09	0.62	0.31	0.12
MTN						
Price differential (R) (P_2-P_1)**	0.25	0.10	0.11	0.15	0.31	0.07
Volume of minutes (m), previous year (Q_1)**	12,339	16,053	18,243	21,354	21,896	32,584
Consumer savings (Rbn) - Area A (P_2-P_1) x (Q_1)	3.05	1.60	2.08	3.13	6.80	2.29
Additional minutes (m), current year (Q_2-Q_1)**	3,714	2,190	3,110	543	10,687	4,015
Consumer savings (Rbn) - Area B (P_2-P_1) x (Q_2-Q_1) / 2	0.46	0.11	0.18	0.04	1.66	0.14
Annual consumer savings (Rbn)	**6.98**	**5.93**	**4.65**	**9.69**	**13.87**	**6.10**
Total consumer savings (Rbn)						**47.2**

Source: Analysis based on MTN and Vodacom annual reports and interim results.

** 2015 data is estimated from Vodacom's interim results (as at September 2015) and MTN's interim results as at June 2015. Total minutes were annualised by multiplying interim results by 2.*

*** Volume of outgoing MTN minutes calculated by multiplying minutes of use per month by number of reported subscribers, by 12.*

Note that it might be the case that not all of the price reductions and volume growth are attributable to call termination rate reductions. For example, some of the increase in volume growth may be attributable to economic growth and/or increased mobile penetration over time. Prices may have declined somewhat, even absent the call termination rate intervention, due to increased economies of scale, for example. Furthermore, Telkom Mobile entered the market in 2010, and may have played an important role in reducing prices, even absent the call termination rate intervention.

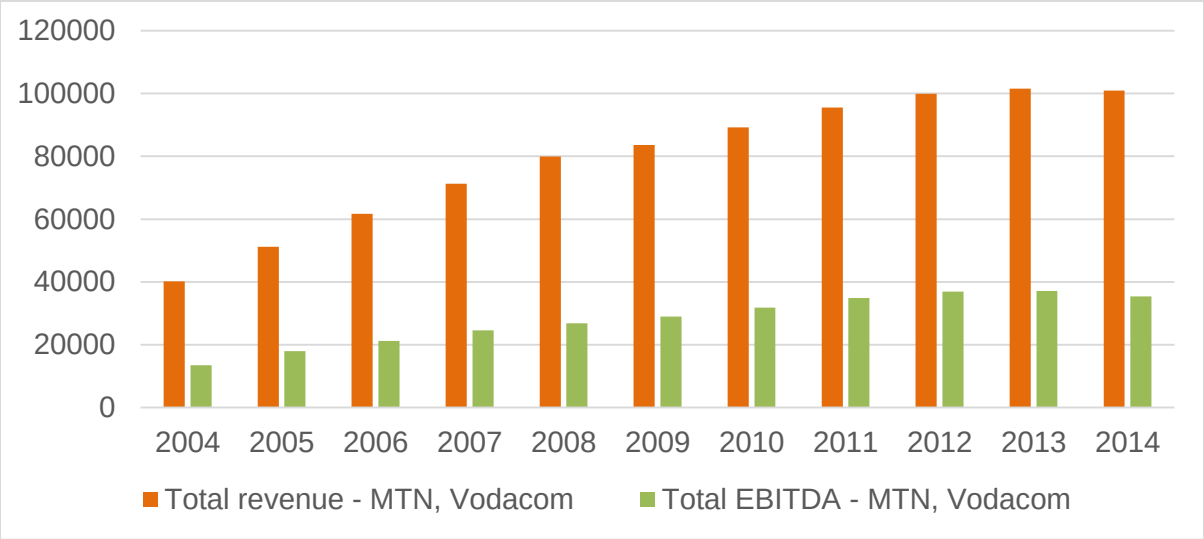
Nonetheless, it appears as though prices were fairly stable prior to the call termination intervention in 2010, if not in fact increasing over time, which suggests that prices were not declining prior to the call termination rate intervention (see Figure 16). In addition, it isn't clear that Telkom would have been able to effectively compete absent the call termination rate

reductions. Economic growth was low over this period of time, and per capita income growth was very low in South Africa, which suggests that an increase in overall consumption demand per person is unlikely. While mobile penetration did increase over the period, this is unlikely to have accounted for the dramatic growth in volumes, from 19bn minutes in 2010 on the Vodacom network for example, to 39bn minutes in 2015.

Finally, note that the estimate of consumer benefits, of R47bn, is almost certainly biased downwards since we exclude Cell C, Telkom Mobile and fixed to mobile calls from the fixed line operators in South Africa (including Telkom), all of which also experienced lower retail prices and most of which experienced considerable growth in voice usage volumes.

Despite the warnings by the operators, MTN and Vodacom's revenues and profitability have not declined to the extent claimed prior to the call termination rate intervention (Figure 20).

Figure 20: MTN & Vodacom's revenues



Source: compiled from annual reports

Cell C and Telkom (Mobile)'s revenues grew over the period. Though employment in the incumbent operators fell in the same period as the decrease in mobile termination rates, the increase in Telkom staff members outweighs the incumbent losses. Cell C also expanded its subscriber base and network and more than likely increased employment numbers.

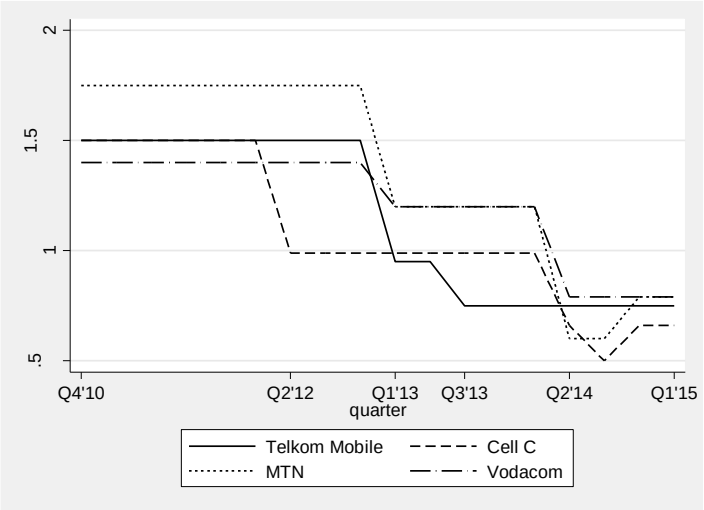
The mobile termination rates decision illustrates the benefits of regulating for competition. When the termination rates were dropped Telkom Mobile and Cell C were in a better position to compete with MTN and Vodacom. Pricing trends of the different operators show that the price reductions were initiated by the challenger operators and the incumbents reduced prices to meet competition (Figure 21 below). The MTR decision thus stimulated rivalry by assisting entrants to overcome structural and strategic entry barriers and the outcome was lower prices for the consumer.

Vodacom, recently reported that the effective rate of their bundles was 7c per minute, which is below the termination rate of 16c per minute (at the time of the announcement the termination rate was 20 cents per minute).

6.4 Competition between mobile operators – voice services (prepaid)

A key question that arises continuously in markets for telecommunications services is the extent to which operators compete with one another. In South Africa, two large firms dominate the market: MTN and Vodacom. At the same time, more recently, price competition has broken out among the operators, led at first by Cell C and Telkom Mobile, followed much later by MTN and Vodacom (Figure 21).

Figure 21: Lowest available off-net prepaid price (Peak), South Africa, 2010 - 2015



Source: Analysis of Research ICT Africa dataset

As a consequence, South Africa's lowest available off-net price has fallen from being ranked in the middle of African countries (see Figure 22) to being ranked among the lowest priced African countries (see Figure 23).

An important question is whether competition among operators is effective, i.e. whether Cell C and Telkom Mobile provide effective rivalry to the incumbents, MTN and Vodacom, and if not whether pro-competitive remedies ought to be imposed on these operators. ICASA, for example, has proposed that wireless local loop unbundling be imposed on the mobile operators (see, for example, ICASA, 2011).

Figure 22: Lowest off-net prepaid price (peak), SA & other African countries, 2010

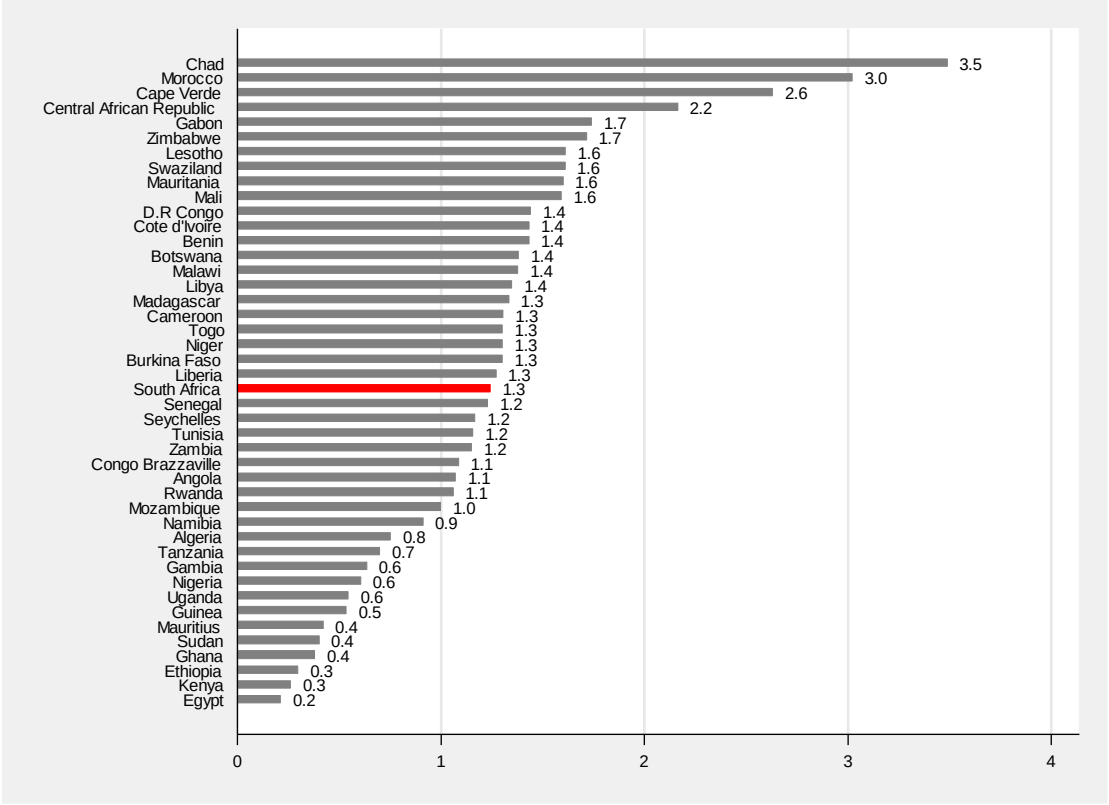
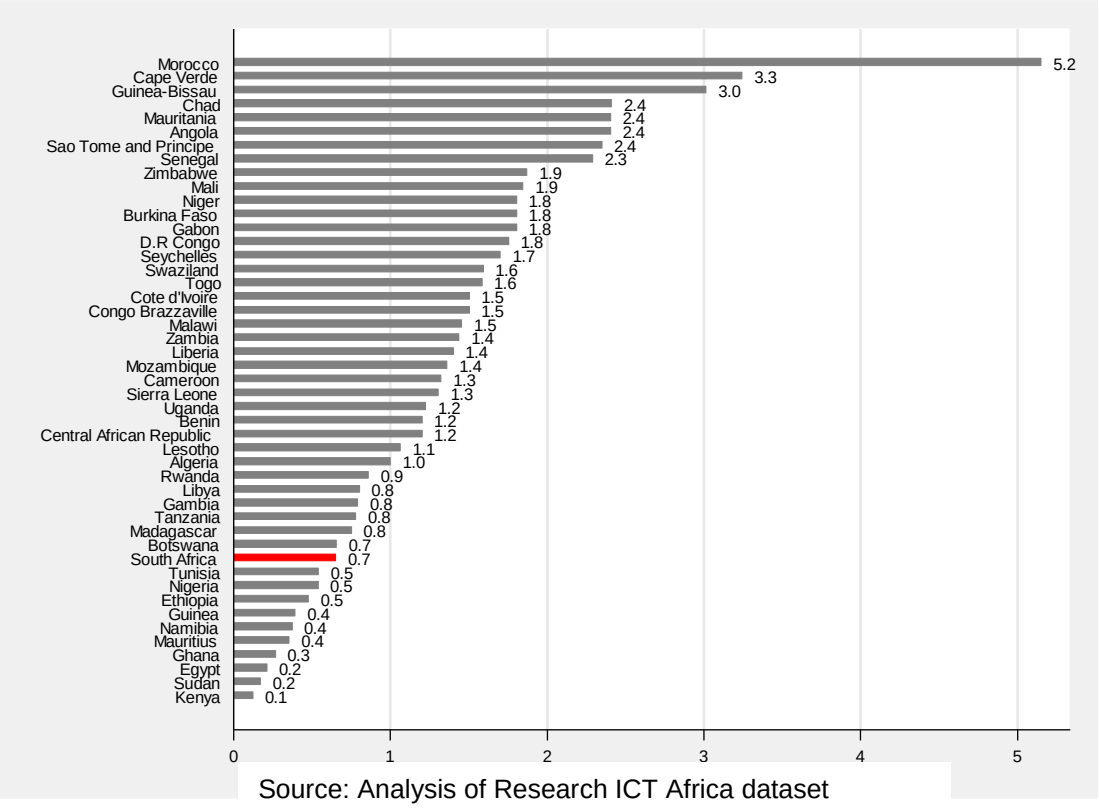


Figure 23: Lowest off-net prepaid price (peak), SA & other African countries, 2015



Source: Analysis of Research ICT Africa dataset

This question is addressed here by estimating of elasticities of demand for prepaid services, using a multinomial logit model (following McFadden, 1973).

A number of academic papers have been written on the demand for telephony services, many of which concern fixed to mobile substitution (Vogelsang (2010) provides a useful review of this literature). Studies on own price elasticities of demand show relatively inelastic demand for mobile services (elasticities of between −0.183 and −0.5) (Vogelsang, 2010), which suggests that there is competition among mobile operators (since operators are not pricing at monopoly levels).

6.4.1 Description of datasets

The All Media Products Survey (AMPS) is used to estimate elasticities. AMPS is a survey of more than 25,000 consumers on a rolling 12 month basis, and contains a number of variables on telecommunications service choices and use, and demographic information. The AMPS survey disproportionately samples Whites, Indians, Coloureds (see Table 20 in Appendix E) and higher income groups (Table 21 in Appendix E). The results presented below are unweighted, and therefore do not compensate for this sample bias.

Prepaid customers and voice services are analysed here. Prepaid customers account for approximately two thirds of the AMPS sample (see Table 14). The variability in consumer choices of operators (Table 15), voice prices and demographic factors, including age, gender and income (Table 16), will be exploited to estimate elasticities of demand for voice services.[96] The analysis presented below pools the results of the AMPS surveys in 2010 - 2013.[97]

The overall number of mobile subscribers grew between 2010 and 2013, as did the proportion of people that belonged to a network (see Table 8 in Appendix E). Nonetheless, the market shares of connected prepaid subscribers did not change significantly over the sample period. Vodacom's prepaid market share remained approximately constant at 45% over the period, while MTN's market share declined slightly from 42.5% in 2010 to 41.7% in 2013 (see Table 15).

Table 14: Prepaid, post-paid and hybrid customers (AMPS, 2010 - 2013)

Package	2010	2011	2012	2013	Total
Contract	3,821	2,702	2,835	2,863	12,221
	15.19	10.77	11.30	11.26	12.13
Pre-paid	16,196	17,191	17,286	17,824	68,497
	64.37	68.54	68.88	70.10	**67.98**
Hybrid	0	1,216	1,545	1,633	4,394
	0.00	4.85	6.16	6.42	4.36
None	5,143	3,974	3,431	3,106	15,654
	20.44	15.84	13.67	12.22	15.54
Total	25,160	25,083	25,097	25,426	100,766

Source: Authors calculations

[96] Note that the income variable was in fact categorical in the questionnaire. This was converted to a continuous variable by using the mid-point within each category.

[97] The AMPS datasets are available from DataFirst at the UCT School of Economics, here.

Table 15: Operator market shares, prepaid customers (AMPS, 2010 - 2013)

		2010	2011	2012	2013	Total
Telkom Mobile	Subscribers	0	0	89	115	204
	Market share	0.00	0.00	0.51	0.65	0.30
Cell C	Subscribers	1,983	2,200	2,001	2,241	8,425
	Market share	12.24	12.80	11.58	12.57	12.30
MTN	Subscribers	6,875	7,057	7,221	7,405	28,558
	Market share	**42.45**	**41.05**	**41.77**	**41.55**	**41.69**
Virgin Mobile	Subscribers	40	32	47	40	159
	Market share	0.25	0.19	0.27	0.22	0.23
Vodacom	Subscribers	7,298	7,902	7,928	8,023	31,151
	Market share	**45.06**	**45.97**	**45.86**	**45.01**	**45.48**
Total		16,196	17,191	17,286	17,824	68,497

Source: Authors calculations

The average ages and incomes of each of the operators varies considerably. Consumers that choose no service are significantly older (43 – 46 over the period) and poorer (monthly incomes of between R6 000 and R7 000) than consumers that choose a mobile service (Table 16). Cell C's customers are on average younger than MTN and Vodacom's customers, and Vodacom's customers are on average older than those of the other operators.

Table 16: Average age and income by operator chosen (AMPS, 2010 - 2013)

	Average Age	Average Income
2010		
0. No service	43	6,044
1. Telkom Mobile		
2. Cell C	33	10,260
3. MTN	**35**	8,881
4. Virgin Mobile	37	14,939
5. Vodacom	38	10,969
2011		
0. No service	45	6,734
1. Telkom Mobile		
2. Cell C	34	10,651
3. MTN	**36**	9,432
4. Virgin Mobile	38	13,917
5. Vodacom	39	11,441
2012		
0. No service	46	7,109
1. Telkom Mobile	38	13,333
2. Cell C	35	10,962
3. MTN	**36**	9,281
4. Virgin Mobile	37	16,826
5. Vodacom	39	11,417
2013		
0. No service	46	7,429
1. Telkom Mobile	38	14,727
2. Cell C	35	12,426
3. MTN	**37**	9,833
4. Virgin Mobile	43	14,840
5. Vodacom	39	12,129

Source: Authors calculations

Prepaid voice prices are used from ResearchICTAfrica and from the press. Each of these prices is then matched to the relevant year for the relevant operator in the AMPS dataset.

There is a considerable debate about prepaid prices in South Africa. We have used the lowest available off-net price for Telkom Mobile, Virgin Mobile and Cell C, since these networks have relatively smaller market shares and most calls are therefore likely to be off-net (see Table 17). For MTN and Vodacom, we used blended average outgoing voice prices, calculated from their annual reports. This was necessary because most calls on the MTN and Vodacom networks are likely to be on-net and will benefit from dynamic discounts. While Vodacom reports an average prepaid price, MTN does not. In order to ensure that the datasets are comparable, we used blended prepaid and contract prices for both MTN and Vodacom. Since the bulk of customers and minutes are on prepaid, it is likely that this will provide a reasonable proxy for blended prepaid prices.

Table 17: Voice prices for Telkom Mobile, Cell C, MTN, Virgin Mobile and Vodacom

	Telkom Mobile	Cell C	MTN	Virgin Mobile	Vodacom
2010	1.22	1.5	**1.3**	1.66	**1.46**
2011	1.22	1.33	**1.19**	1.49	**1.29**
2012	1.22	0.99	**1.06**	1.49	**1.12**
2013	0.75	0.99	**0.88**	0.99	**1.03**

Source: Analysis of operator annual reports, Research ICT Africa price data

6.4.2 Results

The multinomial logit model estimates the demand for a product or service relative to an outside option, such as not buying the service at all. In this case, the demand for prepaid services is being estimated, and the outside option is to not buy a prepaid service (i.e. the consumer may buy a contract or hybrid service, or not buy a service at all). A more fully developed approach would be to nest options for consumers, in two stages: in the first stage, consumers decide on whether to buy a prepaid, contract or hybrid package, and in the second stage choose an operator. The prices for contract and hybrid products is not currently available, and so this deeper 'nested logit' approach will be estimated in future research. Further extensions also require attention, including taking into account the role of internet access on consumer choices, and other factors that might influence consumer decisions.

The results presented here are nonetheless useful, and provide an indication of the extent of competition in the market. The conditional logit estimation results are shown on Table 16 below. The main point to note is that the estimated price parameter has the expected sign (negative) and we can reject the null hypothesis that it is equal to 0 at least at the 1% level of significance. Similarly, we can reject the null hypothesis that the estimated parameters for the operator dummies are 0 at least at the 1% level of significance (their interpretation, in respect of elasticities is provided below).

The estimation results are robust to the specification of the model. Three models are specified on Table 18: the first contains the impact of consumer choice of operator only, the second includes the interaction of price on age, income and gender, and the third includes interaction terms for age, gender and income on operator choice. These interaction terms account for any impact that age, gender and income separately have on price and operator choice. For

example, it might be the case that younger people have a preference for Cell C or that older people are less price sensitive. These interaction terms are intended to account for these variations in the dataset.

The coefficient on price terms is consistently of the correct sign (negative) and is statistically significant at the 0.1% level of significance. The coefficients on all of the interaction terms are also statistically significant, save for the impact of gender on Telkom Mobile and Virgin Mobile, which might be a result of the relatively small sample sizes of the latter two variables.

Own-price elasticities for Model 1 are reported on the diagonal of the table below, and cross-price elasticities are provided in the other cells. The co-efficient on price is similar for models 1 and 3, and it turns out that the sum of the price coefficients on model 2 (once the coefficients on the interaction terms are multiplied by the age, income and gender variables) add up to almost the same price coefficient as that estimated in models 1 and 3. This means that the elasticities calculated are robust to each of the specified models. Note that an important feature of the multinomial logit model is the Independence of Irrelevant Alternatives assumption. This means that any other operator entering the market would take market share equally from each of the existing operators. One outcome of this is that the cross-price elasticities of demand for any given operator are identical with respect to each other operator.

Own-price and cross-price elasticities of demand are reported on Table 19 below. For example, if Vodacom were to raise its prices by 1%, this would cause a reduction in the probability of Vodacom being chosen by consumers of 0.813%. The first important result is that MTN and Vodacom's own-price elasticities of demand (-0.771 and -0.813) are considerably less elastic than Telkom Mobile and Cell C's elasticities of demand and Virgin Mobile (all less than -1). This suggests that MTN and Vodacom's customers are not especially sensitive to price, particularly when compared to Virgin Mobile and Cell C's customers.

Table 18: Estimation results – conditional logit

Choice	Model 1	Model 2	Model 3
Price	-1.050161*** (.0479776)	-.4827299*** (.0528734)	-1.042042*** (.0494006)
Telkom Mobile	-3.182073*** (.0881308)	-.019227*** (.0004125)	-3.024409*** (.2117479)
Cell C	.6506713*** (.0598034)	-.2364435*** (.0152101)	1.623075*** (.0731146)
MTN	1.77517*** (.0549797)	.0000483*** (1.11e-06)	2.730372*** (.0640731)
Virgin Mobile	-3.112795*** (.1043433)	-3.238473*** (.0892503)	-2.902318*** (.2379283)
Vodacom	1.985768*** (.0605193)	.5698769*** (.0613892)	2.384942*** (.0692084)
Price x Age		1.716919*** (.0564087)	
Price x Male		-3.24833*** (.1057651)	
Price x Income		1.899082*** (.0621075)	
Age x Telkom Mobile			-.0210548*** (.0040656)
Age x Cell C			-.0347232*** (.0008242)
Age x MTN			-.0277533*** (.0005682)
Age x Vodacom			-.0195624*** (.0045635)
Age x Virgin Mobile			-.019132*** (.0005492)
Male x Telkom Mobile			-.0558133 (.1425528)
Male x Cell C			-.2092982*** (.0277825)
Male x MTN			-.3511365*** (.0205167)
Male x Vodacom			-.4332951*** (.1608649)
Male x Virgin Mobile			-.2687459** (.0202419)
Income x Telkom Mobile			.0000768*** (5.22e-06)
Income x Cell C			.0000576*** (1.60e-06)
Income x MTN			.0000421*** (1.40e-06)
Income x Vodacom			.0000822*** (5.58e-06)
Income x Virgin Mobile			.0000607*** (1.37e-06)

Source: Authors' calculations
(Standard deviations in parentheses)
*** Significant at the 0.1% level
** Significant at the 1% level
* Significant at the 5% level

Secondly, by far the greatest competitive constraint is brought by MTN and Vodacom, followed by Cell C. An increase in price of 1% by Telkom, Cell C, or Virgin, for example, would result in an increase of 0.394% of the probability of subscribers choosing MTN, and a 0.475% increase in the probability that subscribers choose Vodacom. This compares, for example, to a 1% increase in prices by MTN or Vodacom resulting in an increase in the probability that consumers choose Cell C of only 0.124%, and an increase in the probability that consumers choose Virgin Mobile or Telkom Mobile of only 0.003%.

This means that Cell C, while it does play a role in competing with Vodacom and MTN, plays a considerably more limited role than MTN and Vodacom competing with one another does. There are very low cross-price elasticities of demand between any of the operators and Telkom Mobile and Virgin Mobile, which means they play a very limited role in constraining MTN and Vodacom.

Table 19: Voice prices for Telkom Mobile, Cell C, MTN, Virgin Mobile and Vodacom (conditional logit model 1)

	Telkom Mobile	Cell C	MTN	Virgin Mobile	Vodacom
Telkom Mobile	-1.156	0.124	0.394	0.003	0.475
Cell C	0.003	-1.141	0.394	0.003	0.475
MTN	0.003	0.124	**-0.771**	0.003	0.475
Virgin Mobile	0.003	0.124	0.394	-1.477	0.475
Vodacom	0.003	0.124	0.394	0.003	**-0.813**

Source: Authors calculations

6.4.3 Summary of competition between mobile operators

It appears as though price competition has broken out among the mobile operators, particularly for prepaid services. In order to assess the extent to which the mobile operators do indeed constrain one another, we have estimated the demand for prepaid mobile services, using the All Media Products Survey (AMPS) dataset on consumer choices, and using publicly available prepaid prices from operator annual reports, press articles and data collated by Research ICT Africa.

The results of this analysis suggest that MTN and Vodacom have considerably lower own-price elasticities of demand (i.e. their customers are less price sensitive) than Cell C, Telkom Mobile and Virgin Mobile have, which suggests that MTN and Vodacom wield greater market power than Cell C, Telkom Mobile and Virgin Mobile. Secondly, consumers respond to price increases mostly by switching to Vodacom and MTN (there are considerably higher cross-price elasticities of demand associated with these two operators than with the others), suggesting that while the incumbent operators constrain one another to some extent, the other operators do not constrain MTN and Vodacom significantly. A price increase by MTN or Vodacom results in only a small number of subscribers moving towards Cell C, and almost none moving towards Telkom Mobile or Virgin Mobile.

This suggests that, while competition has broken out for prepaid voice services, there is considerable scope for reducing MTN and Vodacom's market power, and improving particularly Cell C and Telkom Mobile's ability to constrain MTN and Vodacom, including through stronger regulation of network open access conditions (such as site access, roaming, and MVNO access). The assessment has only been done for prepaid services, and we would expect much more stickiness or less switching and hence less competition in postpaid.

7 Summary of the barriers to entry in telecommunications in South Africa

There are a number of issues that have emerged from the study and they all impact the research questions. The key barriers to entry/expansion that have been highlighted by the studies are access to facilities, the slow pace of regulation and strategic responses by the incumbents.

The findings of the study on access to facilities have highlighted a number of issues. First, the challenges that have arisen in segments where there has been a “champion” or first mover that is entrusted with ensuring access. The DFA experience has illustrated the difficulties faced by entrants to gain access to Telkom’s poles and ducts and to link to their exchange. In the instances where access has been granted firms have submitted that the pricing has been exorbitant. This increases the costs of the entrants thereby limiting their ability to provide certain services and undermines the objective of services competition. Second, rights of way approvals delay infrastructure roll out, which is discussed in more detail below.

The slow pace of regulation (both in terms of drafting and implementation) is not only a barrier to entry and expansion in the competition sense but is inhibiting the ability of telecommunications operators to deliver on the SA Connect goals. In particular, the delays in the finalization and/or effective implementation of regulations regarding LLU, facilities leasing, spectrum allocation, and rapid deployment guidelines means that firms’ broadband roll-out endeavors are either delayed by rights of way applications, are made more expensive (and less efficient) by lack of access to appropriate spectrum and duplication of infrastructure due to lack of access to the local loop and other facilities that should ideally be shared. The delays in wayleave applications were illustrated by the DFA case study, where one of the disputes about rights of way ended up in the courts. Cell C’s infrastructure roll out in the early years was also delayed by rights of way applications.

The lack of access to the local loop means that firms have to invest in the expensive layer of broadband, the link to the customer (homes). This is money that could be spent on ensuring broadband roll out in the more rural areas. All this highlights the important role that government together with the regulators can play to resolve these issues and in turn facilitate the required infrastructure roll out to achieve the SA Connect goals.

The studies have also illustrated that entry has a positive impact on competition outcomes in the market. The fall in mobile voice prices following the reduction in mobile termination rates were driven by the challenger operators, Cell C and Telkom (Mobile). Other episodes of entry have delivered substantially improved economic outcomes. When Seacom entered the market for undersea cables in 2009 the cost of bandwidth for typical Internet Service Providers (ISPs) fell by 35%. Prior to Seacom’s entry the only cable available was Telkom’s SAT-3 cable. Another example is the 87% reduction in the price of transmission over long distance fibre between Bloemfontein and Johannesburg, between 2013 and 2014 due to the construction of two new fibre links by Fibre Co (open access) and the NLD Consortium. The mobile termination rates decision have also highlighted the benefits of regulation that is geared towards facilitating competition. The reduction in mobile voice prices would not have been possible without ICASA’s decision to reduce the mobile termination rates.

Services competition has been limited by the slow pace of regulation. It is important that regulations and policies for wholesale access are promulgated and implemented in order to

allow for services competition. Local loop unbundling is still important for facilitating greater broadband rollout. If firms only have to roll out fibre to the cabinet then significant portions of the last mile rollout budgets could be allocated to rural or underserved urban areas. In terms of the mobile operators, site access, Radio Access Network sharing, and national roaming regulations need to be promulgated and effectively enforced.

History has shown that the implication of having a champion rather than plurality is poor competitive outcomes and higher prices and poor quality of service to consumers. Telkom in particular has had a bad track record in dealing with rivals (in terms of providing access) with negative implications for competitive outcomes, for consumers and for the efficiency of the economy as a whole. The announcement of Telkom as a the 'lead agency' for the roll out of broadband to underserviced areas also brings into question the future role of Broadband Infraco, whose mandate is defined as the Broadband Infraco Act as expanding the availability and affordability of access to electronic communication in underdeveloped and underserviced areas.

The impact of government intervention and participation in the sector on competition has been both negative and positive. The positive intervention has been the mobile termination rates decision in 2011 and the political pressure applied on the operators in 2010. Though the 2011 intervention came at a high cost in terms of ICASA resources, it has delivered positive outcomes. On the other hand, the negative impact of government intervention has been seen in the slow pace of network access regulation, municipalities' approach to wayleaves the slow provision of AC power to MSANs and base stations sites, slow environmental impact assessment approvals and delays in issuing spectrum policy and assigning spectrum to operators. In addition, poorly conceived and implemented municipal broadband rollouts result in expensive duplication of networks.

8 Policy recommendations

Services competition is very important for outcomes in telecommunications. When there is infrastructure-based competition, incumbent firms are likely to be advantaged over entrants and can out-invest entrants. The South African record has shown that when there was a monopoly in the fixed market and a duopoly in the mobile market, prices were high and the expected investments did not materialize. This emphasizes the importance of open access, particularly at the wholesale level, to encourage entry and competition. Competition is not only important for outcomes in terms of price and quality but also for delivering to under-serviced areas at competitive prices. Drawing on the findings of the study, there are a number of policy recommendations which would facilitate competition and delivery on the SA Connect goals.

First, the competition issues that have been raised by the study such as the on-net/off-net price discrimination case must be resolved by the competition authorities, in a timeous manner. The complaint was lodged in 2013 and the Competition Commission has still not made a decision on whether or not to refer the case. The delays in the investigation process with the lengthy Tribunal and appeal proceedings mean that the outcomes to the market are delayed. The powers of competition enforcement by the regulator need to be ensured for more timeous conclusion of regulatory matters. We further note that the regulator (ICASA) may have been in a better position to address the issue as ex-ante regulator. This way firms do not have to rely on lengthy and contested ex-post interventions.

Second, the role of government participation in the sector is important for resolving a number of the challenges that have been discussed. Government is in a position to be an anchor customer by aggregating its demand from local municipal offices, clinics, police stations, and department offices. This will improve the business case for fibre rollout in rural and underserved areas. Treasury could set aside a fund that can be accessed on condition that government entities coordinate in rural towns to extend fibre optic networks. All new roll out projects should be awarded on the basis of a competitive tender process in order to get competitive pricing. Contracts should be awarded on the condition that open and fair access will be provided to all service providers seeking to make use of the infrastructure. Roll out projects must make use of existing infrastructure as far as possible to reduce cost and avoid duplication.

In terms of the question of Telkom as a broadband champion, Telkom's position as a lead agency is useful in so far as it relates to opening up its existing infrastructure. Open access conditions should be imposed on Telkom to give access to its fixed line infrastructure on fair terms. New rollout can make use of some of this existing infrastructure but should be funded on a competitive tender basis. It is critical that fixed lines open access conditions are imposed on the lead agency, which should be seen as an infrastructure provider. Telkom OpenServe is a good step in this direction.

Broadband Infraco (BBI) has not been a significant positive competitive force in the industry, despite having the second largest fixed network. BBI's assets should be managed more effectively and perhaps there is a need to assess whether or not BBI should be privatised (on condition that open access is provided to its infrastructure.

Third, with regards to the proposal for a new National Spectrum Management Agency to manage spectrum allocations, we note that the delays in the allocation of spectrum have been a result of lack of independence rather than lack of capacity at ICASA. ICASA should be left with the responsibility of managing spectrum allocation and assured of more independence. To achieve the independence, ICASA should be directly funded by the industry levies, as per international best practice. The councilors should be appointed by the head of state and not the line minister to create separation between the ministry and the regulator. The number of councilors should be reduced as this aids in the turnaround times for decisions, per international best practice.

As far as possible spectrum should be assigned to operators that will use it efficiently. The proposal to set up a national body to hoard spectrum for the use of a publically owned network may not necessarily deliver the expected outcomes and South Africa's history suggests that this is unlikely to result in an efficient of effective solution.

Fourth, there are a number of steps that can be taken to lowering barriers to entry and expansion, which will also facilitate universal access to broadband. The study has shown that fixed wireless can be an alternative to fibre in the rural areas where rolling out fibre may not be economically feasible. To ensure quality and reliability of the fixed wireless, we can make use of TV white spaces. ICASA should be given the funding to develop regulations for the use of TV white spaces on an ongoing basis.

In terms of spectrum allocations, consideration should be given to assigning Time Division Duplex (TDD) spectrum to new entrants and possibly some Frequency Division Duplex (FDD) spectrum. If FDD spectrum is allocated to new entrants then this could be could be used as leverage to get better MVNO roaming arrangements with the MNOs.

Regarding access to facilities, the rapid deployment guidelines must be finalized to facilitate rights of way applications for rollout. Access to municipal, provincial and national government infrastructure should be governed by one policy (ducts, poles, rights of way) which should specify a reasonable time period for granting rights of way.

In terms of local loop unbundling, the budget that has been allocated to Telkom as the "broadband champion" (R1 billion) should be earmarked to fund unbundling the local loop and this can be overseen by a team created within ICASA. Telkom has indicated that it would be costly to fully create the local loop, which is very important for fibre to the cabinet roll out as well as giving access to poles and ducts required by third parties.

To facilitate services based competition in mobile telephony, infrastructure sharing should be closely regulated; this includes site access and radio access network sharing. The current regulations are also insufficient and should be extended to include services based sharing (bitstream access, national roaming, MVNO access and wholesale data). At the moment, the ECA only makes reference to physical infrastructure and not services based sharing. The dispute resolution process through the complaints compliance committee should also be improved.

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Appendix A: Neotel's entry experience: in brief

Neotel entered the telecommunications market as the second national operator in 2006 after being awarded its licence in 2005. It faced three significant hurdles very early on which fundamentally changed its pre-entry business case and affected its ability to be competitive in the fixed line market.

These hurdles were: the transfer of state assets to BBI, the change in market structure after the Altech judgment, and a lengthy delay in local loop unbundling. All of these challenges imposed significant costs on the new entrant and delayed Neotel's ability to competitive service offering and earn significant revenue.

The transfer of state assets to Broadband Infraco

State network assets belonging to Transnet and Eskom were initially meant to be contributed to the SNO. Instead, they were transferred to Broadband Infraco. The results was that Neotel had to lease these assets from BBI for its first 4 years of operation at a cost of ~R400mn/annum. This slowed Neotel's growth, partly because they were paying a fixed amount for an asset that was declining in quality and because this money would have been better spent building their own network.

Rollout of national long distance network and effects of the Altech judgment

Upon entry, Neotel was the only telecommunications company other than Telkom licensed to roll out and operate a physical network. This changed with the introduction of the ECNS license after the Altech judgment, which removed restrictions on self-provision of infrastructure. This changed Neotel's business case fundamentally. Their decision to enter was based on protection afforded by the previous state of affiars and the change in the competitive landscape reduced their incentive to invest in a new network of significant scale. Though Neotel currently has a fibre network of 21 000 route kilometres (some of which they own and some of which they lease), this still pales in comparison to Telkom's 144 000km network.

Impact of delays in LLU

Approximately 60 – 70% of Neotel's capital expenditure is employed in deployment of last mile infrastructure. These costs could have been largely avoided if Neotel had access to Telkom's copper network. In addition, they could have spent their funds in alternative ways; for example to build data centres and invest in more competitive service offerings, which would also have allowed them to start earning revenue much sooner.

Neotel's current business and views on competition

Neotel recorded revenue of ~R4bn in 2014. Wholesale revenue contributed R1.5 bn (31%), direct sales of broadband contributed R60mn (15%) and the rest of the revenue was from enterprise services. Neotel's revenue reflects an explicit decision to focus on the enterprise segment. This decision was based both on factors that made the enterprise segment attractive (higher take-up of broadband, higher and more stable spend) and factors that made the consumer segment unattractive; including high levels of competition from Telkom and mobile network operators, low levels of broadband penetration, and continued slow growth expected in the foreseeable future. Entering the ISP space may have been easier, but it is a highly competitive environment.

Neotel has made inroads the provision of wireless broadband (its WiMax offering). Their proprietary wireless technology, Ubiquiti, allows them to provide wireless broadband at the same price as fixed line broadband, but with much better performance. Neotel's churn rate amongst its broadband customers is practically zero. Their most serious constraint in growing this business is access to additional spectrum.

Obtaining wayleaves present a significant challenge to Neotel, particularly on national long distance routes that use the SANRAL roadside reserve. In order to obtain approval, they are required to conduct a geotechnical survey and must obtain water use licenses for each stream, river, waterway, or similar water resource that they will cross. From Johannesburg to Durban, 450 such approvals had to be obtained. This is a significant administrative burden that adds costs and time to the roll-out process.

Conclusion

Neotel faced serious challenges very early on which impeded its ability to become an effective competitor to Telkom in its fixed line business. Somewhat inadvertently, Neotel also learnt that competing in the telecoms infrastructure space requires deep pockets and patient capital (deeper pockets and even more patient capital than it expected, in this case).

Perhaps Neotel's entry experience can be considered more unfortunate than most, given the fundamental changes in market structure that occurred post-entry. However, many of these challenges were directly related to incoherent and ineffective policy-making. Instead of facilitating sustainable entry by the SNO with the aims of encouraging dynamism, innovation and consumer choice in the telecoms market, a sequence of decisions (the BBI infrastructure and the failure to implement LLU in particular) protected and entrenched the dominance of the incumbent.

Appendix B: Profile of interviewees for DFA case study

Richard Came

Richard Came is an ICT entrepreneur and Chairman of the FTTH Council. He is a co-founder and former director of Dimension Data where he was responsible for group strategy and marketing. Came has been involved in a number of IT infrastructure businesses, including metropolitan and long-haul fibre player, Dark Fibre Africa, last-mile fibre player, Conduct Telecommunications (since sold to DFA), and project management and specialist fibre-optic firm, MCT Telecommunications. He is also the Chairman of Tradebridge, a holding company for several e-commerce businesses and founder investor in FTTH player Vumatel.

Dark Fibre Africa (DFA)

DFA finances, builds, installs, manages, and maintains a metropolitan and long-haul dark fibre network in South Africa. It started rolling out a fibre-optic network in 2007. Remgro Limited is the largest institutional investor in DFA.

FibreCo Telecommunications

FibreCo is an independent, carrier-neutral national fibre network operator. FibreCo plans to build a 12 000 km fibre-optic network linking major cities and towns in South Africa, which will be the largest open access long-haul fibre-optic network in the country. Currently, it owns and operates a fibre-optic network of 2 400km connected Johannesburg, Bloemfontein, Cape Town and several smaller towns on this route.

FTTH Council Africa

The FTTH Council was established in 2010 as an independent, not-for-profit organization. It is a member of the Fibre Council Global Alliance. The Council's objectives are to engage with governments, policymakers, and other stakeholders to deliver high speed fibre connectivity to all citizens. They facilitate dialogue between government and private sector players and represent the interests of their members in policy engagement's and regulatory matters.

Jo-Ann Johnston

Jo-Ann Johnston is the Chief Director responsible for Strategic Initiatives within the Department of Economic Development and Tourism in the Western Cape Provincial Government. Amongst other programmes in her portfolio, she is responsible for the Western Cape Broadband Strategy.

Neotel

Following its founding in 2006, Neotel entered the telecommunications market as South Africa's second national operator, in direct competition with Telkom. This Tier 1 licensee is considered to be one of South Africa's leading providers of telecommunication services. Neotel's wireless infrastructure network covers the main metropolitan areas of Johannesburg, Cape Town and Durban. The company caters for wholesale, enterprise and home markets and offers a range of data, voice and internet services.

Appendix C: Profile of wireless interviewees

WAPA

The Wireless Access Providers' Association of South Africa (WAPA) is the industry association for wireless internet providers.

Bitco

BitCo, established in 2006, is an independent, licensed telecoms operator offering both fibre and wireless internet services. With a national presence, BitCo's network extends over most parts of Johannesburg, Nelspruit, Bloemfontein, KwaZulu-Natal and Rustenburg. The company has grown from 14 employees in 2011 to 90 employees today in its Johannesburg based offices. BitCo services both business and home markets of which businesses make up the larger proportion of its revenue. The company also offers wholesale services to other ISPs. BitCo invests in advanced technologies and systems to deliver a 99% uptime guarantee to its clients and positions itself as a premium operator within the telecoms market.

Megasurf

MegaSurf began servicing the Cape Town area in 1999, covering the Strand, Gordon's Bay and Somerset West. In 2005 the company expanded its operations and network to cover the Pretoria, Potchestroom, Vredefort, Sasolburg, Koppies, Harrismith, Secunda, Delmas and Springs area. MegaSurf's wireless network coverage extends to remote geographical areas that lack access to reliable connectivity. The company offers a range of products from capped to uncapped wireless internet packages and services for both homes and businesses of any size. With its own national backhaul network and a total of 20 employees, the company focuses on providing a high quality product and excellent customer service.

HeroTel

Over the past 2-5 years, HeroTel has been partnering with independent Wireless Internet Service Providers (WISPS) around South Africa to provide high speed wireless internet. HeroTel is the parent company to Bronbergwisp, Snowball and Cloud Connect, which have 100, 45 and 30 employees respectively. Bronberg Wisps' wireless network covers the whole Tshwane metro, while Snowball and Cloud connect extend over major areas of the Western Cape. The WISPS focus on home user markets and small to medium business, but also service a few big corporations. Bronberg Wisp is the contractor involved in the Project Isizwe initiative, centred on the rolling out of free Wi-Fi in the City of Tshwane.

BreedeNet

BreedeNet was established in September 2005, purely operating from the Western Cape. From 2008 the company grew beyond the Western Cape and expanded its network into the Northern Cape, Free State and the Eastern Cape with the aim of providing wireless internet services to rural areas. BreedeNet has two network partners in the Eastern Cape and another two in the Western Cape and has a further 20 agents working for the company. The business market makes up the bulk of their customer base followed by home users. The company has been responsible for connecting 5000 customers.

Project Isizwe

Project Isizwe, a not for profit organisation, funded by the City of Tshwane, was founded on the idea of addressing digital inequality by rolling out free WiFi access to low income communities. Project Isizwe's model reduces the high cost of broadband which otherwise excludes a large proportion of the population. This broadband initiative offers four main channels in Mamelodi, Soshanguve, Atteridgeville and Pretoria CBD and has more than 600 Free Internet Zones (FIZ). Since its inception in November 2013, the number of unique users of these FIZ has exceeded 500 000 and continues to grow.

TENET

The Tertiary Education and Research Network of South Africa (TENET) secures internet and IT services for South African universities and associated research and support institutions. It has its own network which is used by these institutions and is an associate member of WAPA. TENET was a key partner in the TV White Spaces (TVWS) trial in Cape Town together with CSIR Meraka, e-Schools Network, WAPA and Google.

Dominic Cull

Dominic Cull of Ellipsis Regulatory Solutions has extensive experience in advising on the commercial and regulatory aspects of new technology; broadcasting, and electronic communications ventures for local and international companies and policy and regulation in the ICT and telecommunications sectors. He also acts as Regulatory advisor to the Internet Service Providers' Association (ISPA) and Wireless Access Providers' Association (WAPA).

William Stucke

William Stucke is a consultant with substantial experience in in Internet related matters, including policy, telecommunications and wireless. He is also an ex-ICASA Councillor and has written extensively on the subject of spectrum usage and valuation, TV white spaces and dynamic spectrum assignement.

Appendix D: Methodology (conditional logit)

Demand for fixed lines and mobile voice services will be estimated using a discrete choice framework. There are several behavioural modelling approaches to estimating discrete choice models of demand for consumer level data (Davis & Garces, 2010). These include multinomial logit, conditional logit, generalised extreme values (including nested logit), mixed logit and probit.

Some of these models have closed form solutions, including multinomial logit and nested logit, while other models, including mixed logit and probit, require simulation (Train, 2009).

The most widely used model for estimating discrete choice models of demand is the conditional logit model, an extension of the multinomial logit (MNL) model (Mcfadden, 1973). A MNL model will be estimated as follows:

Consumer i's utility derived from product j is given by:

$$U_{ij}(p_j, r_j, z_i; \theta) = V_{ij}(p_j, r_j, z_i; \theta) + \epsilon_{ij}$$

where p_j and r_j are the price and intrinsic value, respectively, of product *j* and z_i is a vector of characteristics of consumer *i*. There is a vector of parameters to be estimated, θ, and a stochastic error term e_{ij} .

All estimates are relative to the outside option, which is choosing no service at all. We further assume that:

$$V_{ij}(p_j, r_j, z_i; \theta) = r_j - \alpha p_j + \sum_n \gamma_{jn} z_{in}$$

where α is the price co-efficient and γ is the vector of co-efficients for consumer characteristics. Consumer *i* will choose product *j* over product *k* if $U_{ij} \geq \max_{j=k, k \in C_i} U_{ik}$ where C_i is the choice set. This occurs with the following probability:

$$P_{ij} = Pr[V_{ij} + \epsilon_{ij} \geq max_{j \neq k, k \in C_i} V_{ik} + \epsilon_{ik}]$$

We assume that e_{ij} are independently and identically distributed (IID) across individuals and alternatives and follow a type I extreme value distribution and have a scale parameter σ. This means that the choice probability can be solved using the logit formula, given by:

$$P_{ijt} := Pr[j|p_i t, .] = \frac{exp(V_{ijt})}{\sum_{k \in C_i} exp(V_{ikt})}$$

where p_j is the vector of prices for each product *j* that consumer *i* may choose from.

In order to estimate the probability equation above, log-likelihood will be used. The probability that a consumer selects the choice observed is: $\Pi_j P^{y_{ij}\, ij}$, where $y_{ij} = 1$ if consumer *i* chose product *j* and $y_{ij} = 0$ otherwise.

The log likelihood function can be written as:

$$\mathcal{L}(\alpha, r, \gamma) = y_{ij} \sum_{i}^{N} \sum_{j} log(P_{ij})$$

where the values *α*, *r* and *γ* maximise the estimator *L*.

The main problem with the multinomial logit (MNL) model is the unreasonable Independence of Irrelevant Alternatives (IIA) assumption. This assumption means that a product's market share is determined by its characteristics. An implication of this is that the introduction of a new product that is a direct substitute for one of the existing products in the product set will reduce the market shares of all other products in proportion to their market shares, including any product that is a direct substitute. This seems

unreasonable since we would expect the new product to take significantly more market share from its direct substitute than from distant alternatives. The multinomial logit model is nonetheless a commonly used approach to estimating demand. An alternative approach is to use the mixed logit model, which allows for unobserved heterogeneity between consumers to enter the model.

A key outcome of the demand estimation process is the ability to calculate price elasticities of demand. For the multinomial logit model, the elasticity of demand for product *j* with the respect to price of product *k* for consumer *i*, is denoted as follows:

$$\varepsilon_{ijk} = \frac{\partial P_{ij}}{\partial p_{ik}} \frac{p_{ik}}{P_{ij}}$$

where the probability that consumer *i* chooses product *j* is captured as P_{ij} .

Next, we calculate the partial derivative of the probability, P_{ij} , that consumer *i* chooses product *j* with respect to the price of product *k*, p_{ik} as follows:

$$\frac{\partial P_{ij}}{\partial p_{ik}} = \begin{cases} -\alpha P_{ij}(1 - P_{ij}) & \text{if } k = j \\ \alpha P_{ij} P_{ik} & \text{otherwise.} \end{cases}$$

Which allows us to calculate elasticities:

$$\varepsilon_{ijk} = \begin{cases} -\alpha p_{ij}(1 - P_{ij}) & \text{if } k = j \\ \alpha p_{ik} P_{ik} & \text{otherwise.} \end{cases}$$

Appendix E: Data tables

Table 20: Share of AMPS respondents, by race (2010 - 2013)

Race		2010	2011	2012	2013	Total
Black	Respondents	12,882	12,868	12,956	13,184	51,890
	Share of total	**51.20**	**51.30**	**51.62**	**51.85**	**51.50**
Coloured	Respondents	3,600	3,592	3,566	3,612	14,370
	Share of total	14.31	14.32	14.21	14.21	14.26
Indian	Respondents	1,630	1,637	1,678	1,720	6,665
	Share of total	6.48	6.53	6.69	6.76	6.61
White	Respondents	7,048	6,986	6,897	6,910	27,841
	Share of total	28.01	27.85	27.48	27.18	27.63
Total		25,160	25,083	25,097	25,426	100,766

Table 21: Share of AMPS respondents, by income category (2010 - 2013)

Income category (Rands)		2010	2011	2012	2013	Total
250-	Respondents	5,374	4,772	4,389	4,203	18,738
	Share of total	21.36	19.02	17.49	16.53	18.60
2750-	Respondents	3,999	3,957	4,142	4,077	16,175
	Share of total	15.89	15.78	16.50	16.03	16.05
5500-	Respondents	5,959	5,950	5,761	5,786	23,456
	Share of total	23.68	23.72	22.95	22.76	23.28
10500-	Respondents	4,299	4,206	4,188	4,176	16,869
	Share of total	17.09	16.77	16.69	16.42	16.74
18000-	Respondents	5,529	6,198	6,617	7,184	25,528
	Share of total	**21.98**	**24.71**	**26.37**	**28.25**	**25.33**
Total		25,160	25,083	25,097	25,426	100,766

Table 22: Operator shares of survey respondents (including no service)

		2010	2011	2012	2013
No service	Respondents	5,143	3,974	3,431	3,106
	Share of total	20.44	15.84	13.67	12.22
Telkom Mobile	Respondents	0	0	135	151
	Share of total	0.00	0.00	0.54	0.59
Cell C	Respondents	2,578	2,778	2,576	2,881
	Share of total	10.25	11.08	10.26	11.33
MTN	Respondents	8,094	8,322	8,725	8,876
	Share of total	**32.17**	**33.18**	**34.77**	**34.91**
Virgin Mobile	Respondents	102	88	90	87
	Share of total	0.41	0.35	0.36	0.34
Vodacom	Respondents	9,243	9,921	10,140	10,325
	Share of total	**36.74**	**39.55**	**40.40**	**40.61**
Total	Respondents	25,160	25,083	25,097	25,426