The Future of Broadband in Africa

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Abstract

Broadband penetration is an important factor for economic growth by improving productivity, accelerating innovation and providing opportunity for new products and services. While the developed world discusses the merits of fixed and mobile broadband, it is clear that for Africa, fixed broadband in the form of fibre to the home, or even just plain ADSL, will only reach very few urban elites in the next decade. In Africa, mobile voice overtook fixed voice at the turn of the millennium with the introduction of prepaid services. Ten years later, mobile Internet is rapidly overtaking fixed Internet by overcoming key obstacles to fixed Internet access. Mobile Internet requires fewer ICT skills than are required to operate a computer, hardware and subscription cost are less, it is available as prepaid, and it does not even require electricity at home, something the majority of African households still struggle to access. This paper aims to provide an answer as to whether fibre to the home and other fixed Internet access still have a role to play beyond the urban elite, and what business models are likely to be successful.

The paper uses data from nationally representative ICT household surveys conducted in 12 African countries in 2012. This data is complimented by OECD broadband pricing methodology and data. In addition to the OECD basket methodology, own baskets were defined to capture the complexity of African products, and to draw out the different business models for fixed and mobile broadband.

This paper demonstrates that if fixed Internet is provided as an uncapped service at an affordable price, it has a chance to at least co-exist with mobile broadband in Africa. The availability of fixed Internet is rapidly diminishing where it is offered as a capped service and not at comparable prices to mobile. The paper also demonstrates that fixed-line telecommunication companies would be well advised to focus on data only, before mobile operators do.

Key words

OECD baskets, Africa, mobile and fixed broadband, business models.

Introduction

Broadband Internet is improving the lives of people in developing nations and facilitates access to economic opportunities and social welfare that were previously inaccessible to the poor (ITU, 2012c). For example, mobile broadband has been driving financial inclusion through mobile banking and mobile money in Africa, and it supports new ways of delivering healthcare in many developing nations (ITU, 2012c).

Several studies have demonstrated that broadband penetration and broadband quality are important factors for economic growth.[1] Due to data availability, these studies typically focus on OECD countries, and also mostly on fixed broadband.[2] Only a few studies are related to developing countries and the impact of broadband penetration on African economies has not been assessed yet.[3]

Generally, broadband access improves the productivity of businesses, supports the creation of new products and services, and accelerates innovation. Katz (2012) describes the direct and indirect economic impact of broadband deployment: directly through jobs created by deploying broadband infrastructure, and indirectly as a result of "spill-over" externalities, such as increased productivity and new products and services.

Kim, Kelly and Raja (2010) estimated that for every 10% increase in broadband penetration there would be a 1.38% increase in the economic growth in low and middle income countries. In developing regions such as Latin America, Katz (2012) assesses that increasing broadband services penetration by 1% could contribute an additional 0.0158% to the GDP growth.

However, in developing nations fixed broadband is growing slowly, providing opportunities for mobile broadband to fill this void (ITU, 2012a). Mobile broadband is thus expected to support growth in the economy more than fixed broadband has done (Mulas, 2012).

Broadband fixed or mobile?

Globally, the number of mobile broadband subscribers exceeded one billion by the end of 2011, reaching a 40% annual subscription growth in 2011 (ITU, 2012b).

Mobile broadband subscriptions have reached nearly 700 million in OECD countries, 56.6 subscriptions per 100 inhabitants in the end of June 2012 (OECD, 2013). The number of mobile broadband subscriptions grew by 18% between June 2011 and June 2012, and is now more than double that of fixed broadband subscriptions with 321 million in the OECD area (OECD, 2013). While mobile broadband mostly provides individual access, fixed access is often shared by household members or employees of a business. Mobile broadband may thus not have yet over taken fixed-broadband use for the OECD area, despite have twice as many subscriptions.

Mulas (2012) estimates that broadband is growing faster in the developing world with a compound average growth rate of over 200% since 2009. However, fixed broadband penetration remains very low in Africa with an estimated penetration of only 0.2% by the end of 2011 (ITU, 2012b).

Fixed and mobile broadband: complementarity or substitution?

Lee et al. (2011) analysed broadband diffusion in OECD countries and found that mobile broadband was complementary to fixed broadband services in the initial deployment of broadband. However, technological progress in wireless broadband increases fixed-mobile substitution. Lewin et al. (2009) argue that

[1] See, for example, Koutroumpis (2009), Katz & Avila (2010) and Rohman & Bohlin (2012).
[2] See Katz (2012) for a comprehensive summary of studies conducted in this area.
[3] See, for example, Qiang and Rossotto (2009), Friedrich et al. (2009), Digits (2011).

mobile networks are unlikely to offer a full substitute for next-generation fibre access in terms of speed and reliability, and expect fixed IP-based traffic to grow faster than mobile IP-based traffic driven by video content and cloud computing.

Generally, mobile broadband may be a substitute for fixed broadband, while fixed broadband is not a substitute for mobile broadband. This depends, however, on how mobile broadband is used. If the main use of mobile broadband is at home with a computer, then fixed broadband would be a substitute; if it is used with a tablet or laptop and at various locations, then it would not.

Business models and pricing

Biggs and Kelly (2006) argue that development of the broadband market is affected by operators' broadband pricing strategies. They identify a trend of flat rate pricing which allows users to easily compare available broadband packages and offers. Flat rate pricing bears, however, risks of network overload, harming the development of the market in the long-term (Biggs & Kelly, 2006). Broadband characteristics of being always-on, priced on a flat-rate basis, and independent of distance-pricing, are changing the nature of traditional telecommunications services pricing. Broadband products are now mainly sold as packages to customers: the market is characterised by double, triple and quadruple play providing voice, data and video communication services, mobile and fixed (Frederiksen, 2011).

Although there has been progress in terms of affordability of broadband services,[4] high prices remain a barrier to accessing telecommunications service and are often a key indicator of lack of competition in African markets.[5] The ITU estimates that in 2011 the price of fixed broadband access cost less than 2% of the average monthly income in 49 countries, mostly in the developed world. Conversely, in 18 of the least developed countries the price of broadband exceeded the average monthly income (ITU, 2012c).

The success of flat pricing as a business model in Africa is mainly constrained by low fixed-line and fixed broadband penetration, and thus low economies of scale and the high cost of international data bandwidth. One of the aspects this paper looks into is whether flat rate pricing may be a sustainable business model for incumbent fixed-line operators in Africa.

Household Internet Access

The digital divide in Africa maps the gap between those who have access to electricity in the first instance, and those who do not. Although in most of the countries analysed more than a half of the households have access to electricity, with Ghana and South Africa having more than two thirds of households connected to the grid, Tanzania, Uganda, Rwanda and Ethiopia have less than 20% of households connected to the electricity grid.

Table 1: Households with working ICT appliances				
	Electricity from Grid	Fixed-line	Computer	Internet

[4] The ITU (2012c) reports that between 2008 and 2009, 125 countries worldwide saw a reduction in access prices, some by as much as 80%. Since 2012, tariffs of fixed broadband have fallen by 52.2% on average and mobile broadband prices by 22%.

[5] See for example Calandro, Gillwald, Moyo, Stork (2010) or Gillwald and Stork (2012)

Table 1: Households with working ICT appliances					
		Electricity from Grid	Fixed-line	Computer	Internet
Botswana	2011/12	60.1%	15.0%	15.7%	8.6%
	2007/8	47.5%	11.0%	4.5%	0.1%
	Change	12.6%	4.0%	11.2%	8.5%
Cameroon	2011/12	64.5%	2.2%	8.6%	1.3%
	2007/8	57.1%	1.8%	4.1%	1.2%
	Change	7.4%	0.4%	4.5%	0.1%
Ghana	2011/12	73.0%	1.8%	8.5%	2.7%
	2007/8	62.6%	2.6%	5.1%	0.3%
	Change	10.4%	-0.8%	3.4%	2.4%
Kenya	2011/12	60.1%	0.6%	12.7%	12.7%
	2007/8	46.6%	2.3%	5.5%	2.2%
	Change	13.5%	-1.7%	7.2%	10.5%
Namibia	2011/12	41.8%	11.5%	14.7%	11.5%
	2007/8	44.6%	17.4%	11.2%	3.3%
	Change	-2.8%	-5.9%	3.5%	8.2%
Rwanda	2011/12	15.6%	0.2%	2.0%	0.7%
	2007/8	4.7%	0.1%	0.3%	0.0%
	Change	10.9%	0.1%	1.7%	0.7%
South Africa	2011/12	89.2%	18.0%	24.5%	19.7%
	2007/8	77.2%	18.2%	14.8%	4.8%
	Change	12.0%	-0.2%	9.7%	14.9%
Tanzania	2011/12	19.4%	0.4%	1.6%	0.8%
	2007/8	13.4%	0.9%	1.0%	0.0%
	Change	6.0%	-0.5%	0.6%	0.8%
Uganda	2011/12	13.4%	1.5%	2.2%	0.9%
	2007/8	9.5%	0.3%	1.2%	0.0%
	Change	3.9%	1.2%	1.0%	0.9%
Nigeria	2011/12	58.4%	0.3%	6.6%	3.4%
Ethiopia	2011/12	18.1%	4.0%	0.7%	0.5%
Source: Research ICT Africa (RIA) 2011/12 surveys					

In line with global trends, most of the countries analysed, such as Ethiopia, Ghana, Kenya, Namibia, South African and Tanzania, saw a decline in residential fixed-line phones. While Cameroon, Uganda and Rwanda saw a modest increase, Botswana had an increase of 36.4% compared to 2007/8, reaching a fixed-line penetration of 15%. Also, Ethiopia had a comparatively high fixed-line penetration with 4% of households having a fixed-line phone following the roll out of a national VSAT network across the country.

Table 2: Among households with Internet connection (multiple responses)			
	Dial-up-modem or ISDN	ADSL	Mobile Internet (mobile phone or dongle)
Botswana	15.3%	4.9%	95.9%
Cameroon	33.5%	3.2%	75.0%
Ethiopia	10.6%	8.3%	81.7%
Ghana	23.8%	0.5%	88.6%
Kenya	31.8%	2.4%	82.7%
Namibia	16.3%	4.5%	97.7%

Table 2: Among households with Internet connection (multiple responses)			
	Dial-up-modem or ISDN	ADSL	Mobile Internet (mobile phone or dongle)
Rwanda	26.4%	0.0%	85.0%
South Africa	4.9%	22.0%	81.8%
Tanzania	82.3%	6.3%	80.6%
Uganda	37.3%	7.8%	88.4%
Nigeria	1.9%	7.6%	90.9%
Source: RIA 2011/12 surveys			

Only Kenya, Namibia, and South Africa had a significant share of households with Internet access. While off a relatively low base, Namibia saw the share of households with Internet access nearly quadruple with an increase from 3.3% to 11.9%, mostly due to individual mobile Internet access by households. The same effect has been experienced in Kenya, where the number of Internet connections at home increased from 2.2% in 2007/8 to 12.7% in 2011.

ADSL is only widely used in South Africa as a household Internet connection. 22% of households with a working Internet connection used ADSL, and South Africa also has the highest fixed-line penetration among the 11 countries surveyed.

Individual Internet Access and Use

Internet use has increased in all of the countries under investigation in the past four years. Growth rates in East African Internet adoption are encouraging, despite starting from a very low base. Uganda, Ethiopia and Rwanda have more than tripled their number of Internet users.

Table 3: Individual Internet use										
	No of individuals (15 yrs +) that use the Internet			Where the Internet was first used		Where the Internet was used in the last 12 months				
	2007/8	2011/12	Diff.	Computer	Mobile phone	Mobile phone	Work	Place of education	Another person's home	Internet Cafe
South Africa	15.0%	33.7%	18.7%	65.1%	34.9%	**70.6%**	35.8%	20.9%	14.3%	32.4%
Botswana	5.8%	29.0%	23.2%	70.6%	29.4%	**64.1%**	51.1%	32.2%	43.7%	58.3%
Kenya	15.0%	26.3%	11.3%	68.9%	31.1%	**77.8%**	31.4%	38.8%	38.9%	**72.4%**
Nigeria		18.4%		45.2%	**54.8%**	**74.9%**	29.3%	19.6%	30.3%	45.1%
Namibia	8.8%	16.2%	7.4%	50.1%	**49.9%**	**87.3%**	48.4%	36.0%	32.6%	22.5%
Cameroon	13.0%	14.1%	1.1%	82.1%	17.9%	29.7%	9.8%	20.1%	18.7%	**80.0%**
Ghana	5.6%	12.7%	7.1%	70.5%	29.5%	61.2%	34.6%	50.9%	34.5%	**84.7%**
Uganda	2.4%	7.9%	5.5%	28.2%	**71.8%**	**81.3%**	55.0%	51.2%	54.0%	**74.0%**
Rwanda	2.0%	6.0%	4%	70.8%	29.2%	**70.9%**	52.1%	30.7%	24.9%	50.2%
Tanzania	2.2%	3.5%	1.3%	45.8%	**54.2%**	**74.7%**	44.6%	24.4%	23.9%	62.8%
Ethiopia	0.7%	2.7%	2%	33.3%	**66.7%**	**80.9%**	17.4%	20.9%	3.5%	42.2%
Source: RIA 2011/12 surveys										

South Africa has the highest Internet penetration rate among all the countries under investigation, with 33.7% of the population aged 15 years or older using the Internet. Namibia also managed to double its number of Internet users,

which can be attributed to general economic growth, but also to falling prices of telecommunication and Internet access due to positive developments in Namibia's policy and regulatory environment. Botswana had the highest growth of Internet users compared to 2007/8. The number of Internet users also grew significantly in Uganda, Rwanda and Tanzania compared to 2007/8, when a very low percentage of the population was connected to the Internet. Ethiopia has the lowest level of Internet penetration with less than 3% of the population using the Internet. This is likely the outcome of policies that have prevented the kind of competition that drives take up in other jurisdictions. The Ethiopian market remains structured around a monopoly operator where a single operator provides fixed, mobile, and Internet services, and maintains the international voice and data gateways (Adam, 2010).

While the first wave of Internet adoption rode on the back of desktop computers at the workplace, schools and universities, or public access facilities such as Internet cafes, the second wave is sweeping across Africa through the use of mobile phones. Although Internet penetration in most countries is still very low, more than 70% of Ugandan and 67% of Ethiopian Internet users first used the Internet on a mobile phone. In Tanzania, Namibia and Nigeria, about half of the population first used the Internet on a mobile phone.

The growing importance of the mobile phone to access the Internet is also emphasised by responses to the question "Where did you use the Internet in the last 12 months?" Either complementarily to computer access or exclusively, above 80% of Internet users in Namibia, Uganda and Ethiopia access the Internet via a mobile phone. For South Africa, Kenya, Nigeria, Tanzania and Rwanda, 70% of Internet users access the Internet with a mobile phone. In most countries, besides Cameroon and Ghana, the mobile phone has overtaken the Internet cafe, historically the most common way to access the Internet in African countries.

The increase in Internet use intensity can also be considered a positive sector development. Daily use rose over the past four years compared to once-a-week and once -a-month use, in particular in Rwanda and Ethiopia.

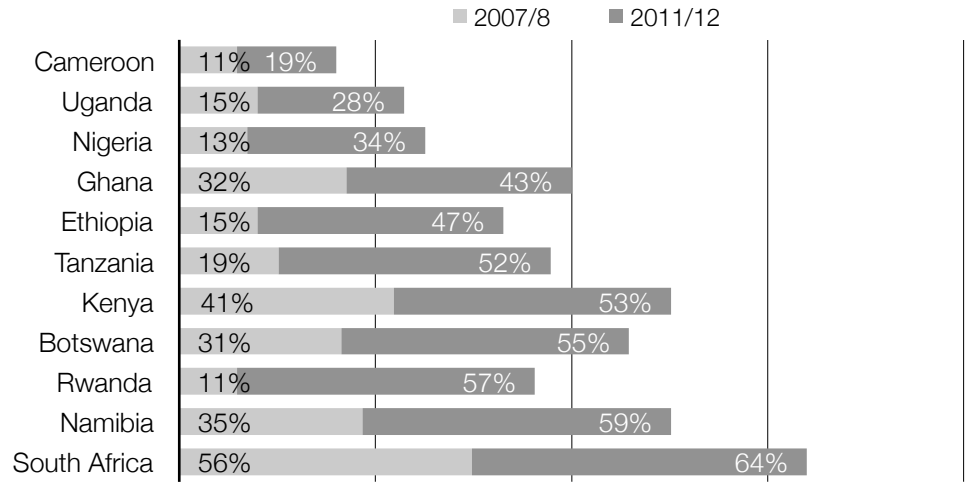

Figure 1: Frequency of daily Internet usage in the last 3 months (Source: RIA, 2011; RIA, 2007).

Linked to the increase in use density, Figure 1 depicts the magnitude of the new wave of Internet users. In Ethiopia, almost half of Internet users started browsing the web during the last year. By contrast, the share of early Internet adopters (share of Internet users that started using the Internet 4 years ago or earlier) is larger in Botswana, Tanzania, South Africa and Ghana.

While Namibia reflects early adopters already forming a wider base compared to the other countries, Rwanda's continued low rate of adoption of mobile Internet suggests that the country is stuck mostly with the first wave of Internet adopters. This could be the result of a number of factors including lack of 3G/4G, data access quality via mobile, high mobile data pricing, and educational limitations.

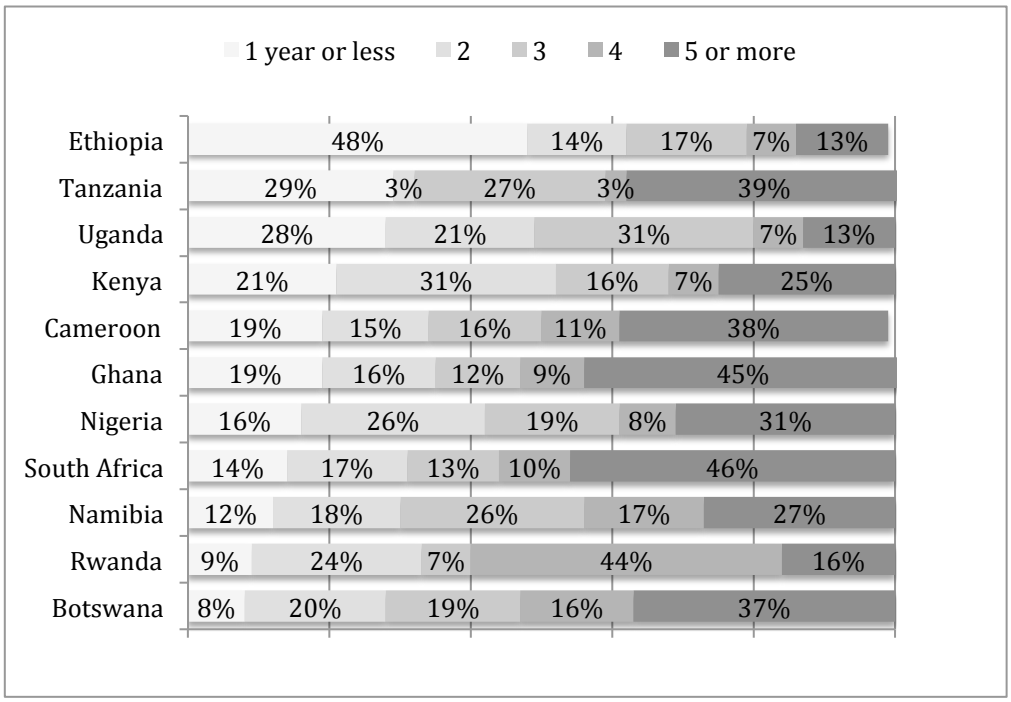

Figure 2: Share of Internet users by years since first using the Internet

In Namibia and South Africa social networking has already overtaken e-mailing as a communication tool. Instead, in all the other countries surveyed, Internet users still use e-mail more than social networks. In Tanzania, for instance, while 86% of Internet users have an email address, only 63% are signed up for social media. This trend is similar across all countries given the fairly recent rise of social networking applications such as mobile adapted Facebook Zero, which allows for free communication, and the Opera browser. By contrast, e-mail users are charged per megabyte. Taking into account that social media enhances the communication experience through ICT because language is less of a barrier and it requires fewer ICT skills and technical training, the trend is clearly towards social networking applications overtaking email as a communication tool of choice.

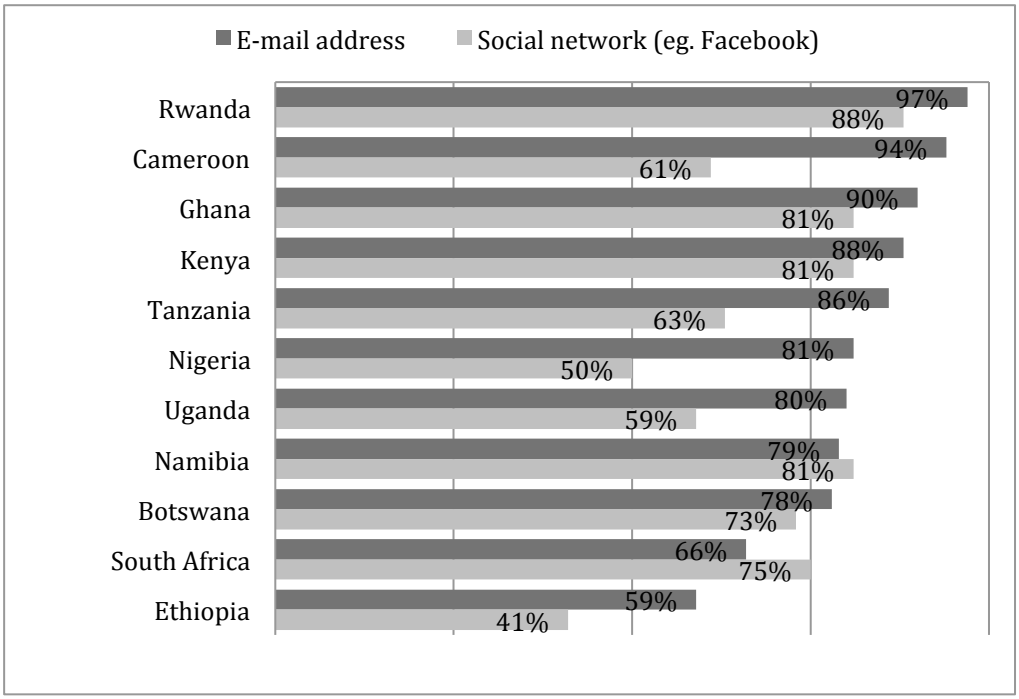

Figure 3: Share of Internet users with an email address compared to Internet users that are signed up for an online social networking application such as Facebook.

If social networking contributes to accelerating Internet adoption primarily through mobile platforms, then one would expect mobile Internet users to be younger. In addition, it is also expected that mobile Internet users have less income compared to desktop or laptop users since set-up costs (i.e. connectivity and device costs) for mobile Internet are cheaper than fixed Internet costs.

Broadband pricing strategies

This section uses price baskets to analyse broadband prices for all products available in a country. Only the cheapest products were selected after the basket cost was calculated. The baskets were designed to reflect 24 months of use and included any installation fees and modem or router costs. In addition, the cost of a landline was included in cases where it is required for fixed broadband. The idea behind this is to simulate the choices a consumer has when selecting Internet access for home, on the assumption that no services currently exist. The following fixed (wired) broadband baskets were compiled:

- Monthly cost of 1 GB use per month with at least 256kbps connection for a period of 24 months.
- Monthly cost of 5 GB use per month with at least 256kbps connection for a period of 24 months.
- Monthly cost of uncapped use per month with at least 256kbps connection for a period of 24 months.

Only ADSL lines were used for the fixed broadband baskets, and only prices from incumbent fixed-line operators. Resellers were not included in the price comparisons. The minimum speed used for the basket is in accordance with ITU broadband definitions. Many operators do not offer 256kbps speed any

longer. The 256kbps speed seems to be vastly out-dated by the 50 Mbps offered in metropolitan areas via LTE. However, advertised speeds rarely translate into actual speeds and only indicate the speed that is technically possible between the end user's device and an operator. Actual speeds depend on many factors that vary from location to location.

Table 4: Monthly cost (USD) of fixed line and fixed (wired) broadband for a 24 month period - cheapest product available in each country

Countries	Operator	1 GB	5GB	unlimited	Notes
		min. 256k	min. 256k	min. 256k	
Botswana	BTC	66.59	133.32	N/A	512k connection with 5GB cap
Cameroon	Camtel	59.44	59.44	59.44	Uncapped at 256k
Ethiopia	Ethio Telecom	22.75	39.81	N/A	5GB product has 2 mbps speed
Ghana	Vodacom	40.82	40.82	103.41	Lowest bundle is 15GB
Kenya	Orange	37.94	37.94	37.94	Uncapped at 256k
Mozambique	TDM	62.06	62.06	N/A	Unlimited product only available at 128k, lowest 256k product has 16GB cap
Namibia	Telecom Namibia	48.67	48.67	48.67	Uncapped at 384k
Nigeria	Nitel	N/A	N/A	N/A	No information available on web, no response to calls or email
Rwanda	Rwandatel	N/A	N/A	N/A	
South Africa	Telkom	51.45	51.45	64.87	1 mbps is the minimum speed for ADSL from Telkom
Tanzania	TTCL	19.20	19.20	19.20	Uncapped at 256k
Uganda	MTN	23.79	53.66	N/A	No technology specified: ADSL and Wimax have same price

For comparative purposes, the mobile broadband baskets were designed to match the fixed broadband baskets. The baskets were calculated for post- and prepaid products.

- Monthly cost of 1 GB use per month with at least 7.2 Mbps connection for a period of 24 months.
- Monthly cost of 5 GB use per month with at least 7.2 Mbps connection for a period of 24 months.
- Monthly cost of uncapped use per month with at least 7.2 Mbps connection for a period of 24 months.

Table 5: Monthly cost (USD) of mobile broadband for a 24 month period - cheapest product available in each country

Countries	Post-paid			Prepaid		Comments
	1 GB	5GB	uncapped	1 GB	5GB	
	min. 7.2 Mbps	min. 7.2 Mbps	min. 7.2 Mbps	min. 7.2 Mbps	min. 7.2 Mbps	
Botswana	26.70	133.51	N/A	78.81	381.08	No uncapped service
Cameroon	50.81	50.81	50.81	40.87	100.51	
Ethiopia	21.12	64.26	N/A	N/A	N/A	No uncapped service and no prepaid data services
Ghana	14.36	36.10	N/A	6.21	36.10	No uncapped service
Kenya	7.30	7.30	7.30	8.68	34.05	
Mozambique	30.44	68.04	N/A	25.07	57.28	No uncapped service

Table 5: Monthly cost (USD) of mobile broadband for a 24 month period - cheapest product available in each country						
Countries	Post-paid			Prepaid		Comments
	1 GB	5GB	uncapped	1 GB	5GB	
	min. 7.2 Mbps	min. 7.2 Mbps	min. 7.2 Mbps	min. 7.2 Mbps	min. 7.2 Mbps	
Namibia	51.29	51.29	122.94	38.48	143.66	Uncapped is LTE with 50 Mbps
Nigeria	20.10	51.84	N/A	20.10	51.84	No uncapped service
Rwanda	29.38	29.38	29.38	11.85	25.76	Unlimited Internet mean s 2 GB a day, if more is used user will be charged
South Africa	12.07	26.61	32.80	12.64	21.85	Uncapped only 3GB at full speed than 256k
Tanzania	13.00	16.20	22.60	13.00	16.20	
Uganda	18.67	37.78	37.78	14.49	40.81	

Tables 4 and 5 display the cost of the defined usage baskets in USD for prices collected in February 2013. In Ethiopia and Uganda ADSL is not offered uncapped. Ghana has the highest uncapped ADSL price in the sample, and none of the operators offers an uncapped mobile broadband package. This is interesting as Ghana has among the lowest prepaid mobile prices on the continent. Namibia has the most expensive uncapped mobile broadband, but it is also the fastest by far at 50 to 100 Mbps, even with actual speeds unconfirmed. It is also much more generous in terms of fair use policy than, for example, MTN South Africa's uncapped mobile broadband that reduces the speed to 256kbps after 3 GB usage in a month. The Namibian 4G offer drops to 512Kbps for the 3G packages and to 1Mbps for the 4G package after 10 GB of use.[6]

Figures 4, 5 and 6 display the same data in comparative graphs in order to facilitate a comparative analysis of the pricing strategies of operators across all the countries under investigation.

[6] http://www.netman.com.na/netman_4g_packages.php and http://www.netman.com.na/pdf/MTC_Fair_and_Acceptable_Use_Policy.pdf.

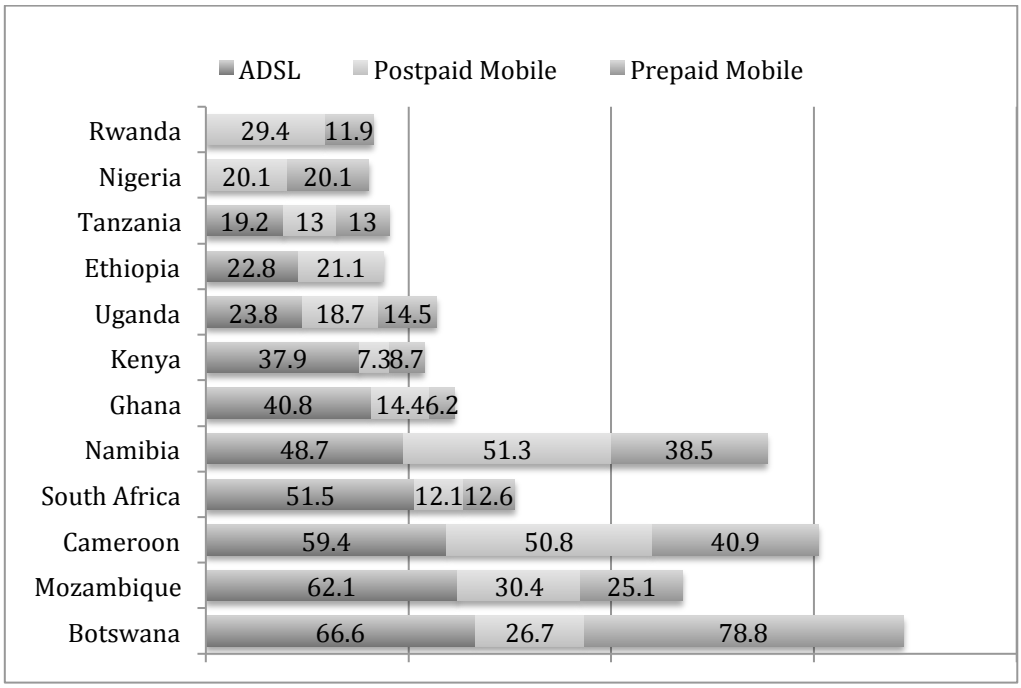

Figure 4: 1 GB per month basket. Cheapest products (in USD per month) available in each country.

Figure 4 (above) shows that for the 1GB per month basket, prepaid mobile is cheaper overall than post-paid mobile broadband. Conversely, in countries where ADSL is available, the 1 GB basket for ADSL is more expensive than the mobile broadband baskets, except in Namibia where ADSL is priced competitively, unlike post-paid mobile broadband which overtakes ADSL in terms of prices. Botswana, a land-locked country, is the most expensive among the countries analysed for 1GB ADSL and prepaid baskets. However, for residential users with a salary, post-paid mobile is not only faster and more convenient, but it is also cheaper below the 5GB threshold.

In countries with a higher level of Internet use such as Botswana, South Africa, and Kenya, the 1GB prepaid basket is more expensive than the 1GB post paid basket. In Tanzania and Nigeria the cost of the 1GB prepaid and post-paid mobile broadband baskets is the same.

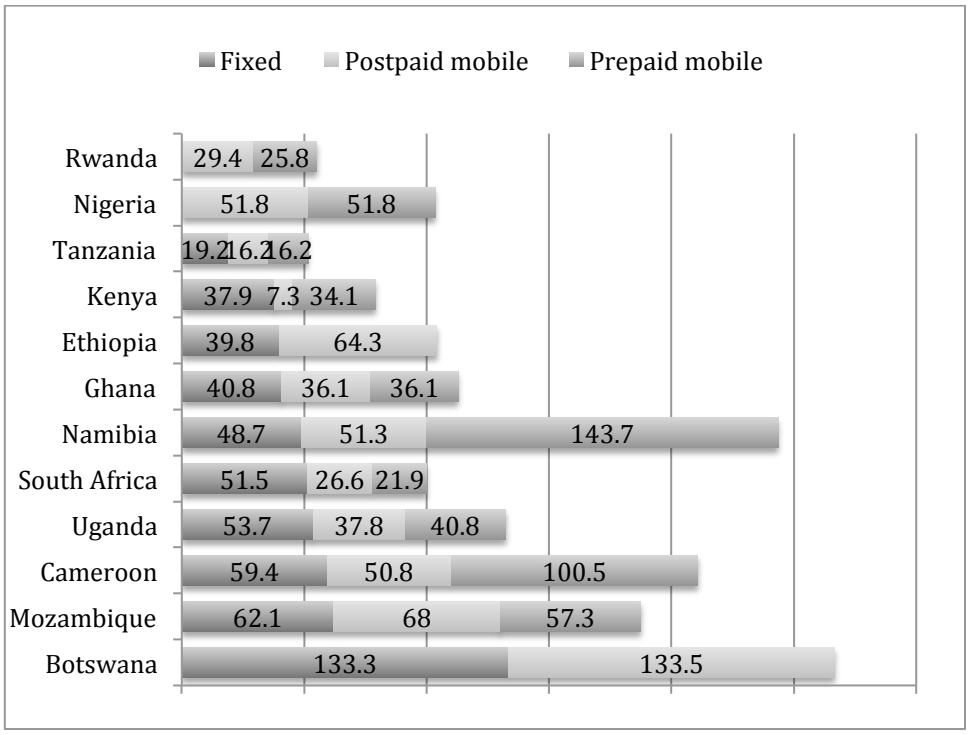

Figure 5: 5 GB per month basket. Cheapest products (in USD per month) available in each country. Botswana prepaid mobile not displayed: 381.1 USD

Contrary to the lower usage basket, when comparing 5GB baskets across selected African countries, only in a few countries are prepaid products cheaper than post-paid and ADSL, except in Kenya, Namibia, Uganda and Cameroon, where prepaid is more expensive than post-paid. The 5GB ADSL basket is usually more expensive than mobile broadband, except in Mozambique, where post-paid is more expensive, and in Namibia which has a competitive ADSL offer for the 5GB basket as well. In Ethiopia, a land-locked country like Botswana, the monopoly incumbent operator Ethio Telecom seems to encourage the use of ADSL, offering an ADSL service which is almost two thirds of the cost of post-paid 5GB basket. ADSL prices in Nigeria were not available from the incumbent fixed line operator's website Nitel. Post-paid and prepaid have the same price, both for the 1GB basket and for the 5GB basket. Nigeria's operators appear to focus entirely on the mobile or fixed-wireless market.

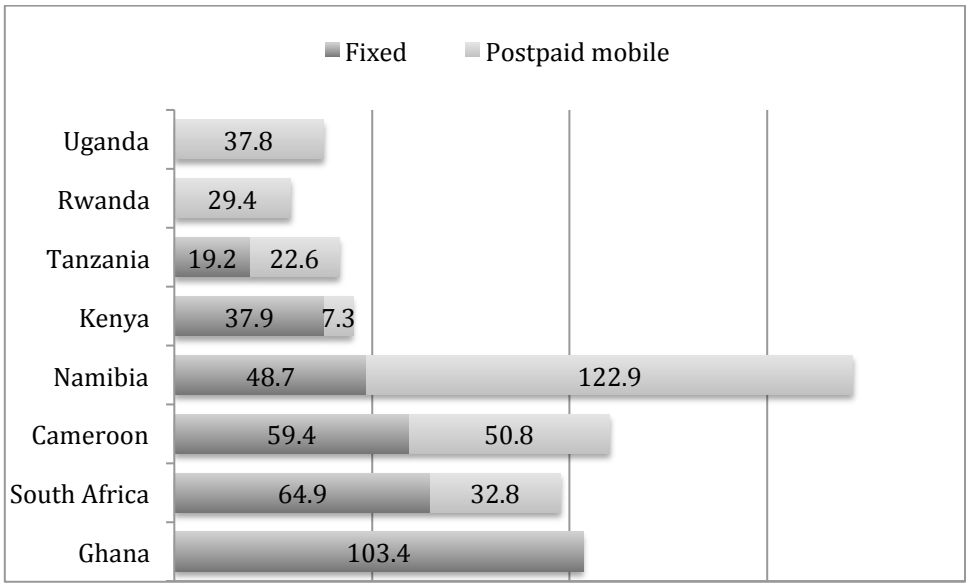

Figure 6: Uncapped per month basket. Cheapest products (in USD per month) available in each country.

Almost all the countries analysed offer uncapped services either as ADSL or post-paid mobile broadband, except Mozambique, Ethiopia and Botswana. In Mozambique, the fixed line operator TDM offers uncapped ADSL only at 128kbps and it has therefore not been considered in the price comparison, which requires a minimum speed of 256kbps. In South Africa, Cameroon and Kenya, post-paid mobile broadband is cheaper than ADSL. Therefore, for residential users in these countries, there is no reason to select the ADSL option from a pricing perspective. In those countries, the fixed-line incumbent operators would be well-advised to review their ADSL products and price design unless they have decided to ignore the residential market. No ADSL pricing was available from Rwandatel's website. This is similar to Uganda which has only a post-paid mobile broadband uncapped offer. Rwanda has a high population density and a small surface area compared to other countries surveyed. Therefore, deploying fibre to the home should theoretically be cheaper in Rwanda than it is in Namibia, for example.

Telkom South Africa appears to have neglected its ADSL products since its main challenger is the post-paid broadband offered by its subsidiary 8ta. The mobile arm of Telkom, 8ta, offers prepaid mobile broadband at a maximum speed of 21 Mbps and only costs ZAR 199 (USD 24) per month. MTN is the only mobile operator in South Africa that offers uncapped mobile broadband, though with limitations. After 3 GB usage in a month, the maximum download speed is reduced to 256kbps. ADSL is therefore mostly attractive to those who prefer uncapped usage at higher speeds than 256kbps.

Ghana has the most expensive rates for uncapped ADSL, and Vodacom Ghana's website does not specify the speed of its ADSL offering. None of the operators offer uncapped mobile broadband.

In Kenya, the most convenient offer in terms of price is mobile uncapped post-paid broadband from Yu mobile. Uncapped mobile broadband in Africa is always subject to fair usage policies, which means different things for different operators. Yu Mobile does not specify on its website what these terms of use are. Yu mobile also offers a one day uncapped bundle for prepaid

users at 39 KES or USD 0.47. This is an attractive offer for a student who dedicates a day to research, for example. ADSL may also still remain attractive in Kenya since Orange Kenya includes a free fixed-line which may operate as a prepaid service, and can be recharged with top ups. Fixed voice as an added value service to fixed broadband seems to indicate a general trend, instead of the other way around.

In Namibia, ADSL is priced competitively compared to mobile broadband. Post-paid mobile broadband is available in metropolitan areas as LTE with 50 Mbps. These access speeds cannot be matched by Telecom Namibia's ADSL, although ADSL would still be the cheaper option. Further, MTC plans to offer fibre-to-the-home, a service that may render Telecom Namibia's fixed-lines and ADSL redundant.

Tanzania's ADSL products are slow and more expensive than mobile broadband, except the uncapped basket. Mobile broadband costs about USD3 more than ADSL for uncapped use, with the added benefit of mobility. Mobile broadband therefore represents an attractive alternative.

Business strategies for fixed-line operators

Fixed-line operators need to invest in new technologies, VDSL or fibre to the home, if fixed broadband is to stand a chance against mobile broadband. The response of fixed-line incumbents is often to change tack and offer mobile services rather than investing in fixed broadband infrastructure. However, other options exist that may be even more profitable. More importantly, these options would also be more beneficial in terms of broader economic development goals and hence should attract the attention of policy makers, given that most of the fixed-line incumbents are still state owned.

From a development policy point of view, the least desirable option would be for African fixed-line operators to focus on the corporate market only, a strategy already adopted by some incumbents but also by new entrants such as Neotel in South Africa. While this may be a profitable strategy, it leaves the residential market to mobile operators, hence reducing competition.

An alternative for fixed-line operators would be to focus only on data services through flat rate pricing, and ignoring traditional voice revenues altogether. Such a next generation business model could prove to be profitable. Converting all existing fixed-lines into data lines would increase broadband penetration drastically in Botswana, Namibia and South Africa. These countries already have a sizeable fixed-line penetration. Flat rate pricing also solves the billing problem, which mobile operators are good at but fixed-line incumbents are not.

A further option is to aim at premium content TV and replace copper with fibre. Fibre to the home (FTTH) may be able to compete if it can match satellite TV content-wise. Figure 16 displays monthly subscriptions in USD for the 12 countries analysed in this paper. DSTV is virtually unchallenged in Africa and has a factual monopoly in, for example, South Africa and Namibia.

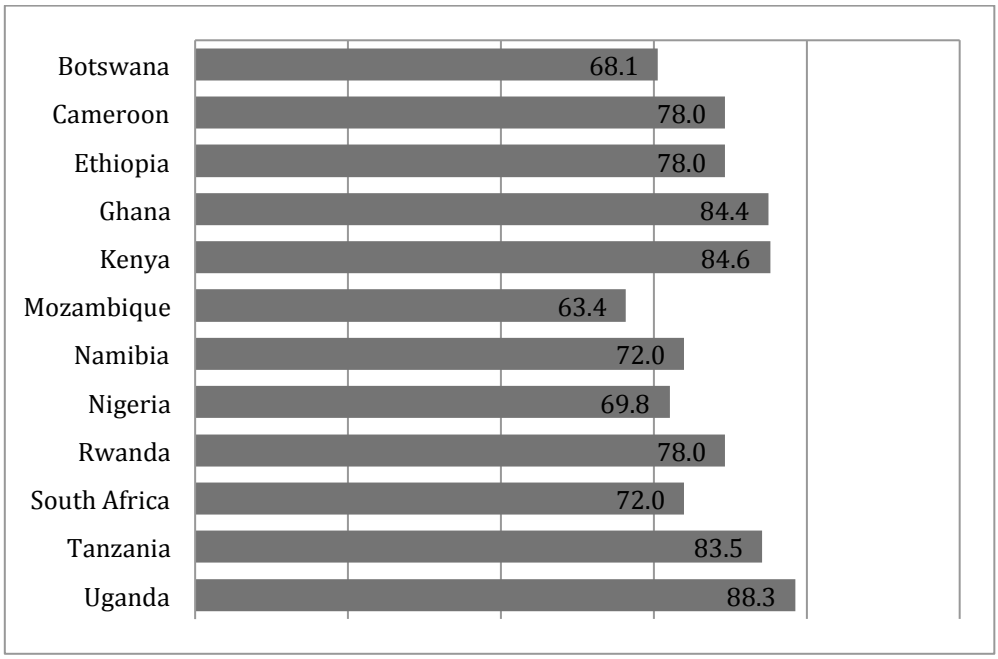

Figure 16: DSTV Premium Package in USD per month

The competition for premium TV content would also reduce prices, bringing them closer to European levels instead of the current USD80+ commanded by DSTV. This in itself has a positive impact for consumers. Current prices can thus not be used for a break-even analysis of FTTH. However, an average ARPU of USD50, offering premium content and uncapped fast Internet may be enough for FTTH to be a profitable venture, at least for metropolitan areas. FTTH is likely to offer faster and better Internet access to households than mobile broadband.

Is Telecom Namibia's flat rate business model sustainable?

This section simulates the revenue and customer developments if Telecom Namibia (TN) were to offer a data and voice flat rate, i.e. not charge for voice on national networks at all, and simply offer its customers a flat rate for data with built-in VoIP functionality. This strategy would build on Telecom Namibia's current revenue trends and develop it further. Figure 17 shows that post-paid voice revenue declined from N$240 million in 2009 to N$183 million in 2011. Data revenue increased at the same time from N$297 million to N$452 million.

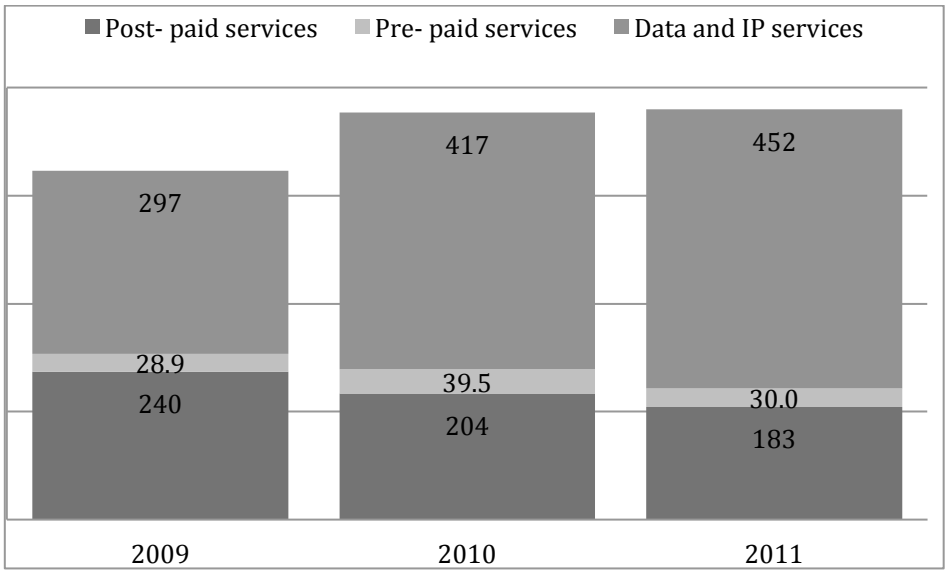

Figure 17: Telecom Namibia's revenues by segment in million N$ (Source TN, 2011)

Table 6 presents a scenario of converting all Telecom Namibia's fixed-lines to ADSL with built in VoIP and a data flat rate, without charging for voice services. It is based on a price drop of about 90% compared to the pricing in 2012. While entry-level monthly access charges are kept at roughly the current voice rate (N$75), it would be a radical price drop for data.

The conversion would push Namibia's broadband connectivity to among the highest rates in Africa, and would contribute to additional GDP growth and employment in Namibia.

The scenario presented in Table 6 yields N$876 million (USD107 million) in revenue based on 150,000 ADSL connections instead of 150,000 DELs. This is N$211 million more than the voice and data revenue for the financial year ending in March 2011 (N$665 million), or a 32% increase. This does not, however, take price elasticity into account.

Table 6: Data and voice flat rate simulation based on current user numbers

Technology	Current prices N$24 months (Speedlink Business)	New price N$	Price drop	No of current lines	New revenue in million N$
512kbps Speedlink Home	599	75	87%	20,000	1.5
1Mbps Speedlink Home	699	150	79%	20,000	3.0
4 Mbps Speedlink Business	3099	350	89%	10,000	3.5
10 Mbps Speedlink Business	7499	650	91%	100,000	65.0
Total per month					73
Total per Year					876
	* Based on 10Mbps product of TN				

With free VoIP calls between fixed-lines and VoIP international calls, in addition to unlimited data download for about 90% less than ADSL pricing, the demand for such fixed connectivity is likely to increase considerably. A 512kbps ADSL connection currently costs N$599 on a 24-month contract on

Speedlink Home. In the scenario depicted in table 6, the cost is N$75 without any contractual obligation. Contractual obligations would only be required in order to subsidise hardware, not to retain customers, since the service offering would be very competitive. This is equivalent to a price drop of 87%.

Table 7: Data and voice flat rate simulation (assuming price elasticity)					
Technology	Current prices N$24 months	New price N$	Price change	Lines	Revenue in N$ million
512kbps Speedlink Home	599	75	87%	37,496	2.8
1Mbps Speedlink Home	699	150	79%	35,708	5.4
4 Mbps Speedlink Business	3099	350	89%	18,871	6.6
10 Mbps Speedlink Business	7499	650	91%	191,332	124.4
Total per month					139
Total per Year					1,670
	* based on10Mbps product of TN				

Table 7 shows the results assuming price elasticity, i.e. an 87% drop in access prices results in an 87% increase in subscribers. Price elasticity is supported by additional benefits such as free unlimited voice calls to the national network. Current revenue would more than double in this scenario, and TN would have 283,000 customers instead of only 150,000 as a result.

The scenario deals only with revenues and not with the cost of providing ADSL services. Such a strategy could, however, prove to be more profitable for Telecom Namibia than defending the fixed-voice market, a battle that is already lost. A data-only approach and a fast roll out of ADSL to 150,000 households would yield significant economic impetus and help Namibia gain international competitive advantage.

Closing the fixed-line gap in Namibia would not require policy change or subsidies, but a change in the business strategy of Telecom Namibia. Telecom Namibia could serve Namibia better while becoming more profitable if they were to adopt a flat rate business model. Telecom Namibia's existing copper cable network to residential homes is a highly under-utilised national asset.

Conclusions

What is clear from this analysis is that, in the African context, taking into account the fast uptake of data services and the decline of fixed subscribers, fixed lines may be offered as an additional service to ADSL services; contrary to Europe were ADSL has been a reason not to cut the cord and it is provided as an added value to fixed lines. The voice battle between residential wired and mobile was lost in Africa in the last decade. Whether fixed-line operators will also lose the data battle will be determined by their business decisions in the next two to three years. Wired broadband is losing ground quickly to mobile broadband in Africa. Fixed-line operators mostly offer ADSL, which can no longer compete with mobile broadband speeds.

A vital piece of information missing from this analysis is quality of service for ADSL and mobile broadband in Africa. Download and upload speeds are location specific for both services, and also depend on the number of users at a particular location.

It is clear, however, that fixed-line operators need to invest in new technologies such as VDSL or fibre to the home, if fixed broadband is to stand a chance against mobile broadband. Instead, the response by fixed line operators is often to ignore these options and to start mobile services as well. However, other options exist and may even more profitable. More importantly, these options would be more beneficial to broader economic development goals and hence should attract the attention of policy makers, given that incumbent fixedline operators or mostly fully or majority state owned.

Fixed line operators need to revise their strategies. This is not something that should only be left to CEOs but should involve shareholders and policy makers equally. There is no time to wait, and merely jumping on the mobile bandwagon may not address longer term connectivity issues that face Africa nor be the most profitable avenue to take.

Carrier pre-selection and local loop unbundling will, for most African countries, not increase competition by much as new operators will not want to enter a market which is partially dying. Structured separation, and marking the national backbone and end-user leased lines as a separate business based on open access principles may remove the biggest competitive bottlenecks in Africa at present.

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Appendix
Household Survey

The RIA e-Access & Usage survey delivers nationally representative results for households and individuals. Using Enumerator Areas (EA) of the national census sample frames as primary sampling units and sampling households from created listings for each EA. The random sampling was performed in four steps for households, and five steps for individuals.

- Step 1: The national census sample frames were split into urban and rural Enumerator areas (EAs).
- Step 2: EAs were sampled for each stratum using probability proportional to size (PPS).
- Step 3: For each EA a listing was compiled, serving as sample frame for the simple random sections.
- Step 4: 24 Households were sampled using simple random samples for each selected EA.
- Step 5: From all household members 15 years or older, or visitor staying the night at the house, one was randomly selected based on simple random sampling.

The desired level of accuracy for the survey was set to a confidence level of 95% and an absolute precision (relative margin of error) of 5%. The population proportion, P, was set conservatively to 0.5, which yields the largest sample size (Lwanga & Lemeshow, 1991). The minimum sample size was determined by the following equation (Rea & Parker, 1997):

$$n = \left(\frac{Z_a \sqrt{p(1-p)}}{C_p} \right)^2 = \left(\frac{1.96\sqrt{0.5(1-0.5)}}{0.05} \right)^2 = 384$$

Inserting the parameters for the survey yields the minimum sample size for simple random sampling. Due to the sampling method chosen for the survey, the minimum sample size has to be multiplied by the design effect variable (Lwanga & Lemeshow, 1991). In the absence of empirical data from previous surveys that would have suggested a different value, the default value of two was chosen for the design effect (UNSD, 2005). This then yields a minimum sample size of 768 for households and individuals. The actual sample size is slightly larger than the minimum requirement to compensate for clustering effects, and to have a wide enough spread of EAs throughout a country.

Table 1: Survey summary	
Target Population	All households and all individuals 15 years or older.
Domains	1 = national level
Tabulation groups	Urban, Rural
Oversampling	Urban 60% Rural 40%
Clustering	Enumerator Areas (EA) national census
None response	Random substitution
Sample frame	Census sample from NSO
Confidence level	95%
Design factor	2
Absolute precision	5%
Population proportion	0.5, for maximum sample size
Minimum sample size	768
Household	Constitutes a person or group of persons, irrespective of whether related or not, who normally live together in the same housing unit or group of housing units and have common cooking arrangements.
Head of household	A head of a household is a person who economically supports or manages the household or, for reasons of age or respect, is considered as head by members of the household, or declares himself as head of a household. The head of a household could be male or female.
Member of a household	All persons who lived and ate with the household for at least six months including those who were not within the household at the time of the survey and were expected to be absent from the household for less than six months. All guests and visitors who ate and stayed with the household for six months and more. Housemaids, guards, baby-sitters, etc. who lived and ate with the household even for less than six months.

Weights were constructed, for households and individuals. The weights are based on the inverse selection probabilities[7] and gross up the data to national level when applied.

Household weight: $HH_w = DW \frac{1}{P_{HH} * P_{EA}}$

[7] See UNSD (2005) page 119 for a detailed discussion on sampling weights.

Individual weight: $IND_w = DW \frac{1}{P_{HH} * P_{EA} * P_I}$

Household selection probability: $P_{HH} = \frac{n}{HH_{EA}}$

EA selection probability: $P_{EA} = m \frac{HH_{EA}}{HH_{STRATA}}$

Individual selection probability: $P_I = \frac{1}{HH_{m15+}}$

DW = design weight compensation for over-sampling of major urban and other urban EAs and under-sampling of rural EAs;

HH_{EA} = number of households in selected EA based on information of last census or updated listing by field team;

HH_{STRATA} = number of households in strata (major urban, other urban, rural);

HH_{m15+} = number of household members or visitors 15 years or older;

m = target number of EAs for each strata, (major urban, other urban, rural);

n = target number of households in EA.