www.analysysmason.com

Report for the Internet Society

Lifting barriers to Internet development in Africa: suggestions for improving connectivity

May 2013

Robert Schumann, Michael Kende

Ref: 35729-502d1

Contents

The analysis and conclusions presented in this report are those of the stated author and Analysys Mason Limited, and have been arrived at independently of any client-specific work. Google provided financial contribution for this study but the findings do not necessarily represent the company's view.

Analysys Mason Limited
Bush House, North West Wing
Aldwych
London WC2B 4PJ
UK
Tel: +44 (0)845 600 5244
Fax: +44 (0)20 7395 9001
london@analysysmason.com
www.analysysmason.com
Registered in England No. 5177472

Executive summary

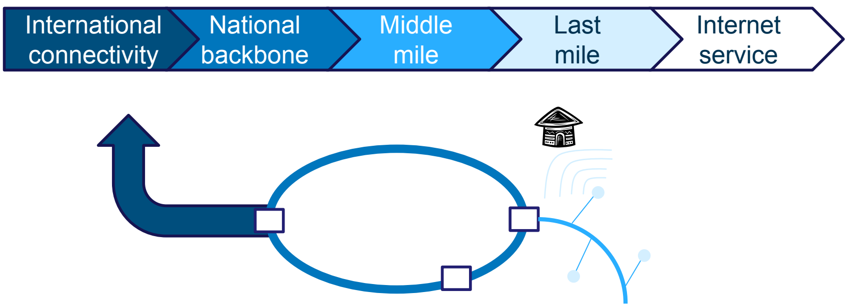
There have been significant improvements to Africa's Internet connectivity in the last five years. Enormous investment in telecoms infrastructure has characterised these improvements, especially in terms of intercontinental connectivity and terrestrial fibre networks: Submarine cable investment has amounted to around USD3.8 billion and terrestrial networks have seen over USD8 billion of investment. Internet exchange points (IXPs), used for local exchange of traffic, have become increasingly important in many countries.

However, these investments have not always translated into a corresponding improvement in the Internet access services experienced by users, through lowered prices or increased quality of service. In many countries the development of Internet access services is still held back by constraints on key inputs, notably in relation to the terrestrial connectivity between the submarine cables, the IXPs, the 'last-mile' access infrastructure – whether fixed or wireless – and the Internet service providers (ISPs) that deliver access to the end-users in Africa. As discussed in this report, policy remedies are required that remove roadblocks to new market entry and expansion, promote of investment by providing clear rules, and provide strong political leadership to achieve ICT goals.

This paper examines the factors that are obstructing the further development of the Internet ecosystem in Africa and the implications of those obstructions. It goes on to explore the possible remedies that can assist in resolving them. It follows on from a previous study on the impact of IXPs in Kenya and Nigeria, which found that IXPs can and do improve the quality of Internet services and save African operators millions of dollars per year in connectivity fees – but that a key factor in the success of IXPs is the availability of good domestic connectivity.

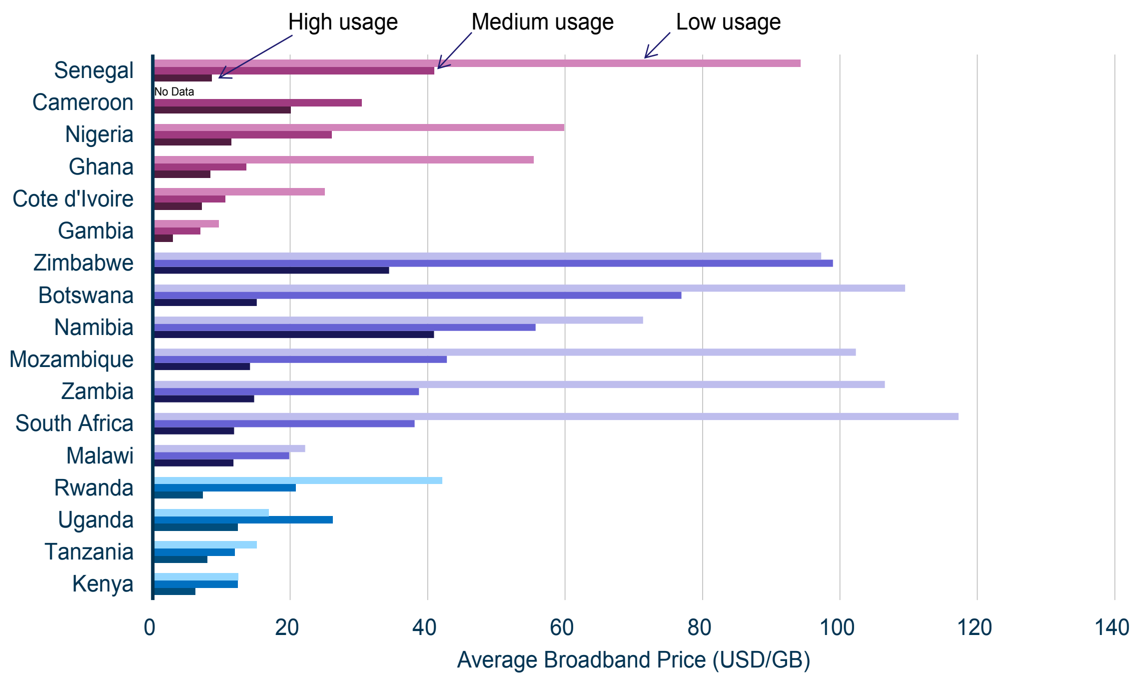
In this paper we look specifically at international connectivity, national backbone and 'middle-mile' elements of the value chain as well as any obstacles to competitive Internet access services. Our analysis and conclusions are based on desk research as well as interviews with stakeholders from across the continent.

Figure 0.1: Elements of the Internet access value chain [Source: Analysys Mason, 2013]



The report begins by examining key indicators (price, speed and usage of Internet) as well as macroeconomic and policy environment for 20 benchmark countries. The pricing of services for end users is one of the strongest measures of a successful policy environment for two reasons. First, low prices themselves are evidence of a competitive market that is relatively free of bottlenecks that could raise the cost of providing services; secondly, low prices generate a virtuous circle: lower prices attract more users, which increases scale and reduces unit costs, thereby increasing the utility of the Internet to citizens and businesses: this in turn further reduces prices for end users and encourages greater and more diverse use of the Internet. The report's price benchmark is shown in Figure 0.2, and suggests that East African countries are achieving the best outcomes by this measure.

Figure 0.2: Average price per GB of traffic for low, medium and high usage Internet access bundles. More details about the data and calculations can be found in section 3.3. [Source: Analysys Mason, Google, Telegeography, 2012]



The report provides a summary of the policies and practices implemented by some of the 20 benchmark countries in order to identify successful and unsuccessful approaches to promoting Internet use: those countries with higher prices and lower Internet use tend to be characterised by clear barriers within the sector, generally related to regulation and policy (for example, Ivory Coast operates a monopoly on the international gateway[1]; incumbent operators in Cameroon and

[1] An international gateway is the interface between a country's domestic telecommunication network and those in another country. Often this gateway is physically located at a submarine cable landing station or satellite earth station. However, when a terrestrial cable crosses a land border, an international gateway is also needed. In order to send or receive international traffic – voice or data – an operator in a country does not just need physical access to capacity, but also an international gateway license from the national regulator or Ministry providing permission to carry this traffic. In a market that has not been liberalized, all domestic operators must pay the incumbent operator to transmit international traffic, which limits competition and often results in higher prices for both outgoing and incoming calls and data traffic.

Botswana remain state-owned; and crossing borders with telecommunications infrastructure in Southern Africa has been described as bureaucratically challenging).

The report notes that there are also countries where barriers exist but Internet usage or pricing may be better than expected – examples are Senegal, which has the fourth highest Internet usage of the 20 countries surveyed here despite a virtual monopoly on Internet access services, and Zimbabwe, where Internet usage is higher than might be expected based on its GDP per capita, policy and broadband pricing. It is likely, however, that these countries could do better still, and in particular that they could achieve more widespread benefits from the Internet if they removed roadblocks, promoted investment and services, and offered high level political vision and leadership.

Recommendations

Our conclusions and recommendations are presented in terms of solutions that can offer one of three types of improvement:

- **Removing roadblocks.** Policy-makers should remove roadblocks that deter investment in and use of terrestrial fibre, including: lack of liberalisation; high cost of licences; challenges accessing rights of way for deployment within countries and across borders; and high taxes on equipment and services.
- **Promoting investment.** Governments should promote private-sector investment in infrastructure to the extent possible, offering regulatory certainty to give confidence to investors and allowing or promoting infrastructure sharing in order to lower costs. Where private-sector investment is not likely, governments may need to use their own resources – financial and infrastructural – to ensure services are delivered, potentially using public/private partnerships (PPPs).
- **Leading at the highest levels of government.** Development and usage of communications infrastructure should be made a high-level priority, with an agency invested with oversight of all aspects of the value chain, including research and innovation, taxation, state investments in infrastructure and/or operators, and regulation. Such an agency should have the authority to address any conflicts within the government that result in any roadblocks or reduced investment.

Specific policy suggestions in these broad areas are shown in the table below.

Category	Specific lessons
Remove roadblocks	• Liberalise the regulatory regime by allowing competition and lowering barriers to entry, particularly in the markets related to submarine cables and international gateways • Reduce bureaucracy and costs of rights of way, including across borders • Reduce the sector-specific tax burden
Promote investment and	• Offer investors greater policy and regulatory certainty

Figure 0.3: Policy lessons drawn from this study [Source: Analysys Mason, 2013]

services	• Infrastructure sharing should be incentivised, or obliged where appropriate and proportionate • Government should invest judiciously, ideally in open-access PPPs, and not in infrastructure that competes with the private sector
Offer high-level political vision and leadership	• Good political leadership and a clear ICT strategy are key • Holistic view of the Internet access value chain, involving a wide range of stakeholders, to identify obstacles and remove conflicting policies around tax, investment and promotion of ICT • Policies should not have the effect of distorting the market by favouring individual operators or restoring *de facto* monopolies

Note: this study was commissioned by the Internet Society (ISOC), a non-profit organization that provides leadership in Internet-related standards, development and policy, and a key independent source on these issues.

1 Introduction

There have been significant improvements to Africa's Internet connectivity in recent years. There has been enormous investment in telecoms infrastructure, especially in terms of intercontinental connectivity. However, these investments have not always translated into a corresponding improvement in the Internet access services experienced by users with regards to lower prices or better quality of service. In many countries the development of Internet access services is still held back by constraints on key inputs, notably the terrestrial connectivity between the submarine cables, the Internet exchange points (IXPs), and the Internet service providers (ISPs) that deliver access to the end-users in Africa.

Improvements

The dramatic increase in the number and capacity of submarine cables used to connect Africa to other regions has helped to support an increase in the number and usage of IXPs in Africa (used for local exchange of traffic and access to content).

Investment in new submarine cables to Africa in recent years has totalled over USD3.8 billion, adding over 24Gbit/s of new capacity to the 13Gbit/s in place prior to 2011.[2] An especially positive aspect of this investment is that the additional submarine capacity has been spread across countries on both coasts; as a result, seven countries that had no submarine cable landing stations in 2010 now have at least one; 11 countries that already had submarine cables landing in 2010 now have at least one more. The figure below shows the density of cable landings by country for 2012. Although landlocked countries cannot themselves host landing stations, most of them have invested in one or more of these cables, with varying benefits depending on ease of access to their neighbours' landings.

2 Based on data derived from http://manypossibilities.net/african-undersea-cables/. See the recent Internet Society paper, October 2012, *How the Internet continues to sustain growth and development*, also written by Analysys Mason. http://www.Internetsociety.org/how-Internet-continues-sustain-growth-and-innovation.

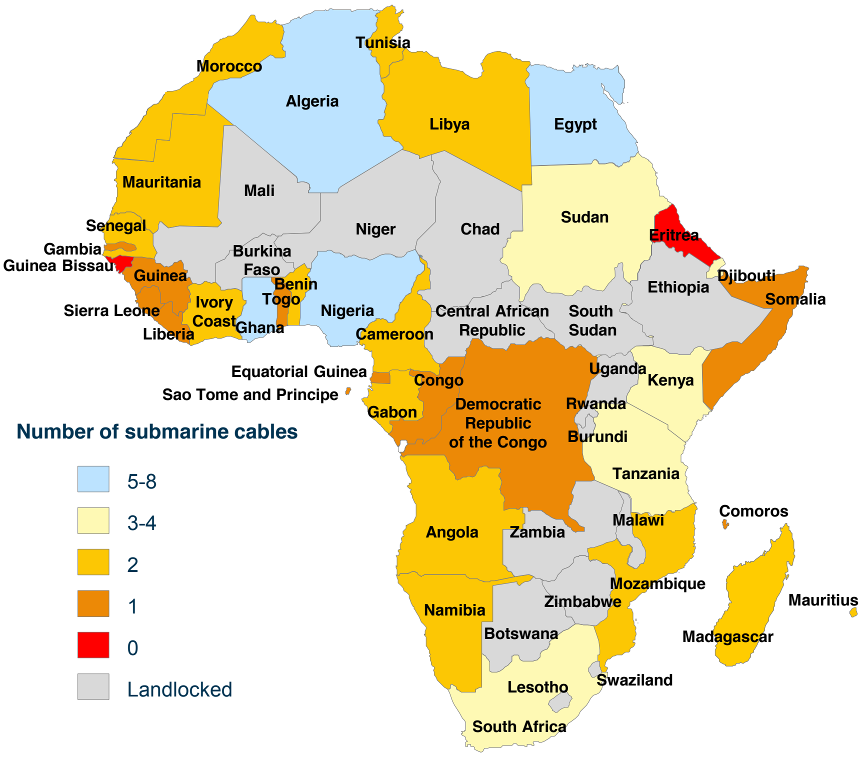


Figure 1.1: Number of submarine cables landed in each country[3] [Source: Analysys Mason, 2012]

On the terrestrial side, it was recently estimated[4] that nearly 100 route-kilometres of new fibre network enters service each day in Africa, and there has been over USD8 billion investment in long-haul terrestrial networks[5]. This surge in network reach will have increasing impact on telecommunications services in coming years – although due to limited fibre breakout points there are many places, particularly in rural areas, that will host but not benefit from this increase in capacity.

Challenges still to be overcome

Despite the investments described above, a number of challenges remain:

- There are 16 landlocked countries in Africa, which by definition cannot benefit directly from a submarine cable landing station. Landlocked countries can however benefit from the presence of (multiple) cables landing in different neighbouring countries, by owning a stake in a cable landing station in a neighbouring country, through improved terrestrial connectivity, and by developing a virtual cable landing station at their border.

- Two coastal countries have no submarine cables, and others with only one or two submarine cables may not fully benefit from competition on those cables.

---

3 Submarine cable landings in Morocco are in the Northern part of the territory.

4 African Bandwidth Maps, 2012, *Africa's Fibre Reach Increases By 32 Million, To 40% Of Population* http://www.africabandwidthmaps.com/?p=3144

5 Africa Bandwidth Maps, 2010.

- While investment in additional capacity and cable landing sites typically improves the situation for coastal countries, there is also a very significant challenge in ensuring that the benefits of international connectivity are accessible to the businesses and populations across Africa. This paper is therefore focussed primarily on the domestic and cross-border terrestrial cables that can be used by coastal and landlocked countries to access submarine cables in neighbouring countries.
- There is significant evidence that there are insufficient cross-border terrestrial connections in Africa, and that those that are available are not fully exploited. A report[6] in 2011 found that of the 47 mainland borders between SADC countries, 38 (81% of them) were crossed by at least one fibre link. Only 24 of those neighbour links carried Internet traffic exchanged directly between the neighbours and there are eight further non-neighbour exchanges of traffic (e.g. Tanzania exchanging traffic with South Africa). Traffic between most SADC countries must therefore be exchanged indirectly – sometimes via a hub like South Africa, but in practice often via major Internet hubs in Europe, Asia or the United States.

IXPs and their role in reducing 'tromboning'

The limited availability of terrestrial bandwidth, both domestic and cross-border, constrains the benefits of the new submarine cables. This gives rise to a vicious circle: monopoly power leads to high prices, and rationing of access; few users can afford the service, meaning that economies of scale are not achieved and prices remain high. This environment also limits the development of IXPs (since international capacity may end up cheaper than local capacity), which could otherwise act to reduce reliance on the submarine cables by increasing local exchange of traffic. The absence of IXPs tends to cause ISPs to engage in 'tromboning', a practice by which ISPs use international connections to exchange domestic traffic, resulting in higher costs and lower service quality.

A recent Internet Society paper analysed the benefits of IXPs in Kenya and Nigeria[7] and found that some of the most significant benefits came from eliminating tromboning. In particular the price of international capacity and the latency of exchanging traffic and accessing domestic content were all markedly reduced.

Supporting the development of IXPs allows them to build critical mass, which may lead to them becoming attractive to ISPs across the wider region, leading to a virtuous circle where more content is made available through the IXP, further increasing usage. In some cases this could lead to the emergence of regional hubs where market conditions and economies of scale allow sub-continental markets in capacity – benefiting everyone in the region by attracting operators and content.

6 M. Jensen for Internet Society, October 2011, "Transnational broadband interconnection"

7 Analysys Mason, April 2012, *Assessment of the impact of Internet Exchange Points (IXPs) – empirical study of Kenya and Nigeria*. http://www.Internetsociety.org/ixpimpact

A key link in the development of this virtuous circle is the presence of good national (or regional) connectivity services. Where good national connectivity is not available it can cost more to carry traffic domestically (e.g. from Johannesburg to Cape Town or Abuja to Lagos), than it does to carry it intercontinentally (e.g. from Cape Town or Lagos to London). High prices for such domestic services, and poor availability of flexible cost-effective services like Ethernet, tend to limit the development – and therefore the benefits – of the IXP.

Satellite connectivity

While there has been major recent investment in telecoms infrastructure, many communities remain isolated in terms of network infrastructure. As many as 36% of Sub-Saharan Africa's population live more than 50km from a node on a fibre network[8] (existing or under construction), although this is down from 44% in 2010. Satellite connectivity therefore remains a key part of the solution.

Development of satellite services is on-going. Medium Earth Orbit (MEO) satellites can offer high-capacity links to remote areas with lower latency and lower operating costs than traditional geostationary satellite links, which in turn may make satellite an attractive alternative to long-haul fibre or microwave networks in some areas. Meanwhile high-throughput geostationary satellites with multiple spotbeams promise to lower the cost of satellite connectivity on smaller links to individual mobile base stations and end-user terminals. This type of capacity may allow in-country operators to grow demand sufficiently to make those areas economical to connect via terrestrial links in the future. As such satellites will play a key role in expanding Internet reach in Africa. To truly bring the Internet to Africa, however, will require a longer-term investment in high-capacity terrestrial connectivity in order to allow content to be created, stored and delivered locally.

Focus of this study

Internet access can be divided into three components:

- **Connectivity**, which involves the submarine cables and IXPs needed for domestic networks to exchange traffic with each other and the rest of the world
- **Distribution**, which effectively extends the reach of the submarine cables and IXPs to inland cities and other countries, where access can be provided by the ISPs (also referred to as backhaul or internal transit)
- **Access**, which involves the ISPs that are used by end-users to reach the Internet.

This study focuses on distribution issues, namely the terrestrial connectivity needed to connect submarine cable landing stations, IXPs, and ISPs at the national and regional level, in order to create a more efficient ecosystem for exchanging and distributing traffic. It does not consider "last

8 Hamilton Research, 2012, *Africa Bandwidth Maps*

mile" access to customers. We examine policies and outcomes across Africa in terms of three regional groupings: West Africa, East Africa, and Southern Africa. We identify best practices; and make recommendations, based on a number of interviews with stakeholders and our own primary and secondary research.

Methodology

The content of this report is based on desk research and on interviews with a variety of stakeholders from across the continent (see Annex A for a list of contributors), representing governments, operators, and large and small users of capacity.

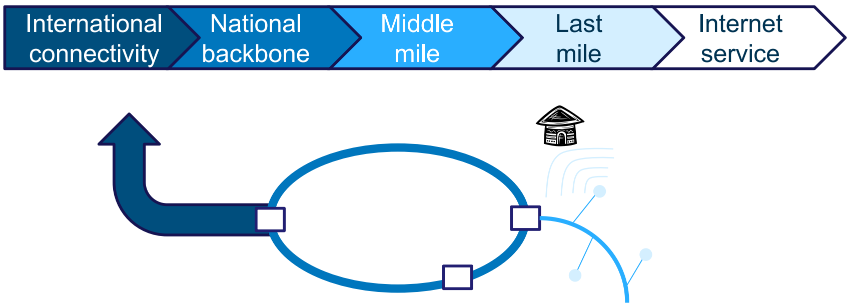
2 The Internet access value chain

This section presents an overview of the inputs into an Internet access service to frame later discussion (in Sections 4 and 5) of where bottlenecks may arise, and their potential to increase cost or reduce availability and quality of Internet access. In Section 2.1 we give an overview of the value chain and in Section 2.2 we consider the relative costs of various elements and how this has influenced telecommunications investments up to now. While there may be issues relevant to every part of the Internet access value chain in different countries, in subsequent sections of this report we focus mainly on issues relating to international connectivity and the national backbone.

2.1 Overview of the value chain

The following chart shows the elements of the Internet access value chain that are discussed further below.

Figure 2.1: Elements of the Internet access value chain [Source: Analysys Mason, 2013]



International connectivity

International connectivity is clearly fundamental to connecting users to the wider Internet. Until 2009 more than ten countries in and around East Africa had to use satellite to connect as there were no submarine cables connecting that coast to the global Internet. Satellite is convenient and ubiquitous, but has a higher unit cost than submarine connectivity and has higher latency and jitter. These factors contribute to a lower quality of service than that delivered by submarine or terrestrial fibre connectivity.

Terrestrial infrastructure supports a potentially higher-quality and lower-cost international connectivity service, but tends to require major infrastructure networks, including cross-border connections to neighbouring countries (whether via fibre or microwave), transit through those countries, access to submarine cable landing stations, and capacity rights on submarine cables. Due to the magnitude of investment required for this infrastructure there are entry barriers that may confer market power on incumbent operators – and in some cases this market power is formalised through monopoly rights granted to operators of international infrastructure. Such market power can lead to above-cost prices for international connectivity.

Other factors related to international connectivity that impact the price and quality of Internet access services include:

- **The degree of traffic localisation.** This refers to exchange of traffic between operators (for example at an IXP), local caching of content such as the Google Global Cache, and presence of content delivery networks (CDNs) such as Akamai or BitGravity. The presence of a large amount of locally-hosted content and locally-relevant content – such as educational and e-government services – lowers average cost of Internet service, improves quality of user experience, and consequently increases demand for the Internet.

- **The proximity of large regional or international Internet hubs.** Several key hubs, supplied with high-capacity connectivity, have emerged where many international carriers and many content providers interconnect. London, New York, Amsterdam, and Hong Kong are examples of such international hubs where transit services to the rest of the Internet can be bought relatively cheaply. In Africa, Johannesburg and Nairobi are emerging as regional hubs but most African operators are still connecting to the global Internet via off-continent links to Europe, North America or Asia.

It is worth noting that international connectivity is of such vital importance that fully redundant connections must be provided or there is a risk of complete loss of access to the Internet if one connection fails.

National backbone

National backbone refers to high-capacity inter-city links that operators use to connect different service areas, to deliver traffic to national aggregation points (such as IXPs), and to connect to borders and/or submarine cable landing stations for onward international connectivity. National backbones may be provided by optical fibre or microwave infrastructure. A substantial fraction of the cost of deploying national fibre backbone infrastructure resides in the civil works required to dig and bury ducts to carry optical fibre. In addition, it is typical to have to seek a permit to access rights-of-way from each municipality that is passed, adding further cost, time, and in many cases, uncertainty. The high sunk cost of these civil works means that there is a major barrier to entry for new national backbone operators and thus the potential for existing backbone operators to gain significant market power, even in countries that have liberalised this market.

A further important aspect of national backbones is the technology offered to users. Legacy systems using SDH technology may be cost-prohibitive to smaller users, who may prefer more scalable commodity technologies like Ethernet or IP/MPLS. Incumbent backbone operators may struggle to fund a transition to new technology or to adapt to the more varied products available in new networks.

Middle mile

The 'middle mile' refers to infrastructure that carries traffic from telephone exchanges or mobile base stations to central switching locations. Microwave links are commonly used to connect rural base stations or to connect a few individual base stations to a nearby fibre aggregation or satellite node. Where traffic is higher, in urban areas or at aggregation nodes, fibre is used. The cost per kilometre of this fibre tends to be greater than that of national backbone fibre because it traverses more densely populated areas where other infrastructure is already present that must be taken into account (for example roads, pavements, existing underground ducts, buildings).

Last mile

The last mile is the final link from the network to the user; in Africa it is commonly provided over wireless networks. Major costs for the last mile include base station site installation and rental and radio equipment, and on-going maintenance and operations. Poor power supply and the threat of theft and vandalism means that there are high costs for fuel and security, which are exacerbated by the geographically dispersed nature of sites used in the access network.

Internet service

This does not refer to a physical link in the chain from the user to the international hubs, but rather the service provided by an ISP, bringing together the elements described above into a packaged offering for the end-user. ISPs are likely to purchase national backbone and international connectivity services, and they may do so in different proportions depending on the type of customer served, the quality of service and the degree to which they localise content using IXPs. In some cases, the ISP may own the last-mile infrastructure, as in the case of a fixed wireless or mobile operator offering Internet services. For the ISP to be able to provide service and access domestic and international connectivity, a critical cost component is the cost of routers and other equipment; implicitly, equipment costs are also factored into the cost of providing wholesale connectivity.

2.2 Relative costs of parts of the value chain

Analysys Mason has previously undertaken research[9] on the costs of various elements of the value chain. It is widely accepted that moving from satellite to submarine cable has a profound impact on the unit cost of delivering broadband, and this is reflected in the chart below.

9 Analysys Mason, 2011, *Driving broadband connectivity in Africa: regulatory issues and market challenges*, http://www.analysysmason.com/Research/Content/Viewpoints/RDRK0_driving_broadband_Africa_Dec2011

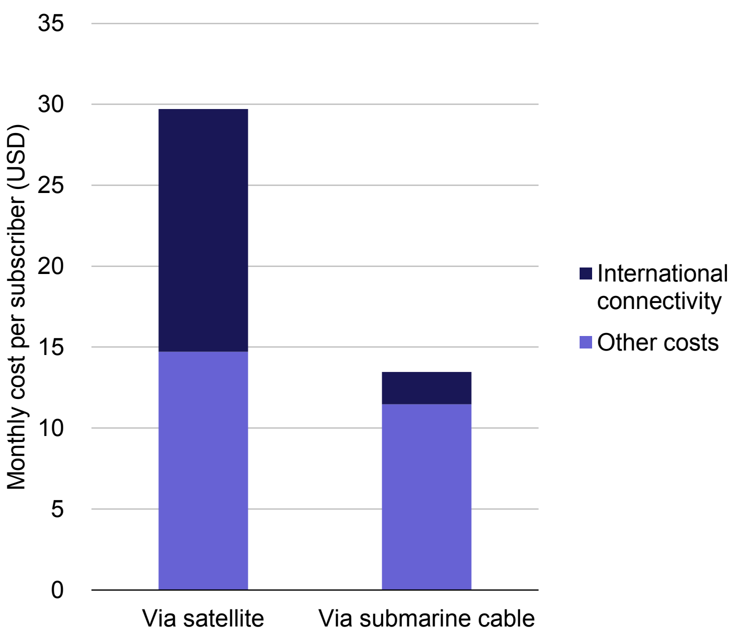


Figure 2.2: Indicative impact of submarine cable connectivity on the cost[10] of providing broadband [Source: Analysys Mason, 2011]

Prior to the arrival of submarine cables, substantial investment to upgrade capacity in other parts of the value chain (backbone, middle mile and last mile) was unlikely to deliver commensurate returns on investment. The substantial international connectivity costs mean that new investments in other parts of the value chain are unlikely to reduce the price sufficiently to promote mass-market adoption and deliver a return on the investment.[11]

The cost bottleneck shifts once submarine cables are deployed. Figure 2.3 compares the cost of providing broadband for a niche wireless operator (typically a data-only operator targeting a small segment of the market), a wireline operator, and a mass-market mobile operator offering voice and data. This chart indicates that the cost of the last mile in this chart can be as much as 45-60% of the total cost of offering broadband.

10 Costs depicted in this section are for a mass-market wireless operator in an illustrative coastal country in Africa. Note that these represent single year network costs per average subscriber; operators are likely to add retail costs and profit margins onto this in order to arrive at a price for the service. See Analysys Mason, 2011, *Driving broadband connectivity in Africa: regulatory issues and market challenges*. http://www.analysysmason.com/Research/Content/Viewpoints/RDRK0_driving_broadband_Africa_Dec2011/

11 The exception to this rule is an IXP, which facilitates local exchange of traffic, thereby reducing or eliminating domestic tromboning over expensive international links. For instance, when the Kenya Internet Exchange point opened in 2000, the latency and cost benefits were significant due to the reduced need for international satellite connectivity. See Jensen, M, 2009, *Promoting the use of Internet Exchange Points (IXPs), A Guide to Policy, Management and Technical Issues*, http://www.Internetsociety.org/promoting-use-Internet-exchange-points-guide-policy-management-and-technical-issues.

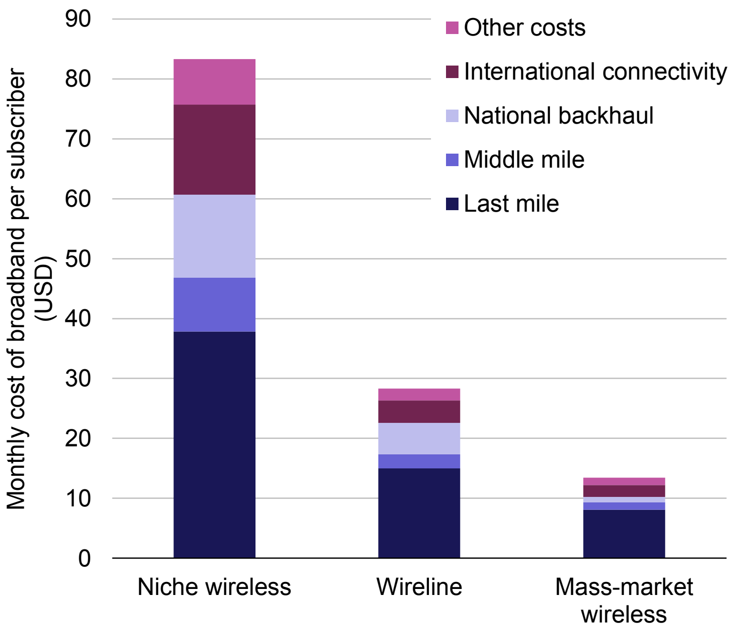


Figure 2.3: Illustrative cost of providing broadband in Africa with various technologies [Source: Analysys Mason, 2011]

While bottlenecks may exist across every part of the Internet access value chain, this study focuses particularly on distribution of bandwidth, because it remains a key aspect of delivering improved Internet in Africa:

- Increased take-up and usage of Internet introduces economies of scale that dramatically reduce the unit cost of delivering service. Since Internet access services are becoming affordable in many African countries, any reduction in price – including that resulting from enhanced bandwidth markets – may attract more subscribers and create a virtuous circle of increasing usage and declining prices.

- Better bandwidth distribution, for example in IXPs or carrier neutral data centres, attracts multiple carriers who compete to supply capacity. Lower prices typically result, as local ISPs can switch between carriers quickly and easily, based on price or quality offered.

- Improved quality of service, geographical reach of service and supply and demand of local content are all drivers of increased Internet usage, and are in turn driven by improved domestic and international Internet infrastructure.

- Countries with better-functioning bandwidth markets are more likely to attract major international carriers and content delivery networks (CDNs), several of whom are currently developing plans to establish points of presence (PoPs) in Africa. Content closer to the user usually results in lower costs for the end-user and better quality of service.

- International capacity costs continue to be a substantial fraction of the cost of Internet for landlocked countries.

This study focuses on international connectivity and the national backbone; however the breakdowns shown in this section should encourage stakeholders to focus on challenges across the entire value chain if they wish to ensure their actions have the largest impact on improving Internet access and usage.

3 Comparing Internet access in African countries

This section compares a series of key indicators of development of telecoms and Internet sectors in a number of African countries to reach an understanding of the relative positioning of each of those countries. This comparison is used to identify which countries have been particularly successful in promoting Internet access, which in turn helps to identify best practices that have been adopted by policymakers in those countries.

There are various other factors that affect Internet adoption and usage, including demographics – such as income levels – and market factors – such as the level of liberalisation. This report groups benchmark indicators into three categories:

1. **Demographics.** These are indicators such as population, income and population density, that can affect the demand for, or supply of, Internet access services. As these factors are out of the control of telecommunications policy-makers, they must be taken into account when assessing the level of Internet access and when making policy recommendations. Apart from those presented here, other factors including literacy, education, consumer habits, and access to electricity are also relevant.

2. **Market environment.** These are regulatory indicators that create the environment in which Internet access services are made available, and thus are in the control of policymakers seeking to lower barriers to Internet access.

3. **Internet indicators.** These include measures relating to Internet adoption and usage, along with measures of affordability of access services, and as such are affected by the indicators in the previous two categories. This report assesses Internet indicators against the two other categories – demographics and market environment – to identify best practices in countries with successful outcomes, as well as to make policy recommendations for countries with less successful outcomes.

The degree of Internet usage among the population is one of the fundamental indicators of the impact of the Internet. Increased penetration of Internet usage tends to be the consequence of a variety of factors, including the cost of Internet access and the quality of the experience (e.g. download speeds). The price and speed of connections are themselves heavily influenced by constraints such as the cost of international and national access lines. The cost of those lines must be passed on directly through the cost of Internet access; the greater the cost, the more likely the ISP is to 'under-provision' capacity. This in turn can create congestion that degrades the user's experience of the Internet.

The 20 benchmark countries examined in this report were selected from a variety of countries across three regions of Africa: West Africa, East Africa, and Southern Africa.

West Africa	East Africa	Southern Africa
Burkina Faso (BF)	Burundi (BU)	Botswana (BW)
Cameroon (CM)	Kenya (KE)	Malawi (MW)
Gambia (GM)	Rwanda (RW)	Mozambique (MZ)
Ghana (GH)	Tanzania (TZ)	Namibia (NA)
Ivory Coast (CI)	Uganda (UG)	South Africa (ZA)
Mali (ML)		Zambia (ZM)
Nigeria (NG)		Zimbabwe (ZW)
Senegal (SN)		

Figure 3.1: Countries included in the benchmark [Source: Analysys Mason, 2013]

This report splits the countries into three regions in part because of similarities in terms of demographics and historical ties within the regions. More concretely, however, the proximity of the countries within each of these three regions means that they share landing stations and cross-border connections, and can potentially take advantage of each other's IXPs in order to create regional hubs for traffic exchange and access to content.

For instance, the comparison between East African countries is important because they belong to the same regional body, the East African Community (EAC), and because Uganda, Burundi and Rwanda depend on access through Kenya and/or Tanzania to be able to have equivalent access to the submarine cable landing stations as enjoyed in the latter countries. Nonetheless, this report also, where relevant, compares countries across the regions in terms of identifying and recommending best practices.

3.1 Demographic overview

As seen in the following tables, among the West African countries the two main outliers are Nigeria and Gambia: Nigeria's large population affords operators and content providers large national economies of scale; Gambia's small population and lower GDP per capita make it correspondingly less attractive to operators and content providers despite a highly qualified Internet technical community.

Figure 3.2: West Africa benchmark group demographic and income data for 2011 [Source: World Bank, 2012]

		GH	NG	CM	CI	SN	ML	GM	BF
GDP per capita	USD per year	1,570	1,452	1,271	1,195	1,119	669	625	600
Population	Million	25.0	162.5	20.0	20.2	12.8	15.8	1.8	17.0
Population density	Persons/ km^2	109.7	178.4	42.4	63.4	66.3	13.0	177.6	62.0
Urban share of population	%	51.9	49.6	52.1	51.3	42.6	34.9	57.2	26.5

The East African countries give a more uniform picture, with the exception of the significantly higher population density of Rwanda. A dense population typically lowers the cost of network deployment (fixed or wireless), although the fact that the urban population accounts for a relatively low proportion of the population (below 20%) will somewhat offset the benefits of high density. GDP per capita across East Africa is around half that of West African countries.

Figure 3.3: East Africa benchmark group demographic and income data [Source: World Bank, 2012]

		KE	RW	TZ	UG	BU
GDP per capita	USD per year	808	583	529	487	271
Population	Million	41.6	10.9	46.2	34.5	8.6
Population density	Persons/ km^2	73.1	443.6	52.2	172.7	333.9
Urban share of population	%	24.0	19.1	26.7	15.6	10.9

Finally, in Southern Africa there is a very broad range of GDP per capita, population size, and urbanisation; the range is starkly illustrated by the difference between Botswana (with the highest GDP per capita at USD8680, very low population density but high urbanisation), and Malawi (with lowest GDP per capita at USD370, high population density but low urbanisation). As a result, some comparisons may be better made within a subset of the countries within this group, based on GDP per capita or another indicator.

Figure 3.4: Southern Africa benchmark group demographic and income data [Source: World Bank, 2012]

		BW	ZA	NA	ZM	ZW	MZ	MW
GDP per capita	USD per year	8,680	8,070	5,293	1,425	776	535	371
Population	Million	2.0	50.6	2.3	13.5	12.8	23.9	15.4
Population density	Persons/ km^2	3.6	41.7	2.8	18.1	33.0	30.4	163.1
Urban share of population	%	61.6	62.0	38.4	39.2	38.6	31.2	15.7

In summary, these indicators provide a background against which the other results should be measured – for instance, the level of income is a significant factor in the take-up of Internet service, but out of the immediate control of any telecommunications policy-maker.

3.2 Market environment

Sector reform has been a key element in promoting telecommunications services, including fixed and mobile access as well as Internet access.[12] Such reform typically involves the formal liberalisation of the market (in other words, allowing competition), the privatisation of the

[12] See for example World Bank, 2006, *Information and Communications for Development 2006: Global Trends and Policies*, http://go.worldbank.org/PB9HXQQUR0, and infoDev and ITU, no date, *ICT Regulation Toolkit* http://www.ictregulationtoolkit.org/.

incumbent (i.e. the transition from a state-operated utility to a privately owned company), and establishing an independent regulator to oversee the sector. These reforms can create a dynamic and competitive market that encourages investment and innovation, and results in low prices and high-quality services.

The process of liberalisation is often gradual, and a key element in reducing barriers to Internet access is to liberalise relevant markets for infrastructure and service. The International Telecommunication Union (ITU) compiles data from countries on the degree of liberalisation in each of a number of services. Three such markets are directly relevant to this paper: *international gateways* (necessary to send and receive traffic across borders), *leased lines* (necessary for backhaul from the international gateways and between points of presence within a country), and *Internet services* (necessary to provide access to end users).

The table below summarises the regulatory environment in each country based on the latest ITU data.

Figure 3.5: Telecommunications sector reform key indicators. Orange indicates partial liberalisation, red indicates lack of liberalisation [Source: ITU ICT-Eye with Analysys Mason updates, 2012]

Country	Leased lines	Internet services	International gateways	Status of incumbent	Autonomous regulator
Burundi	...	C	C	State	No
Kenya(2)	C	C	C	Partial	Yes
Rwanda(2)	C	C	P	Private	Yes
Tanzania	C	C	C	Partial	Yes
Uganda(2)	C	C	C	Partial	Yes
Botswana	P	C	P	State	Yes
Malawi(2)	...	P	C	Partial	Yes
Mozambique(2)	C	C	C	State	Yes
Namibia(1)	M	C	C	State	Yes
South Africa	C	C	C	Partial	No
Zambia(1)	C	C	C	Partial	Yes
Zimbabwe	C	C	P	State	Yes
Burkina Faso(2)	P	P	P	State	Yes
Cameroon(2)	...	C	...	State	Yes
Gambia(2)	P	C	M	Partial	Yes
Ghana(1)	P	C	P	Partial	Yes
Ivory Coast	P	C	M	Partial	Yes
Mali(2)	P	C	P	Partial	Yes
Nigeria(2)	C	C	C	State	Yes
Senegal	C	C	C	Partial	Yes

C = competition, P = partial competition, M = monopoly. State = state-owned, Partial = partially private.

Data is for 2012 unless otherwise noted: (1) = 2011 data, (2) = pre-2011 data

From the table above we can make several observations:

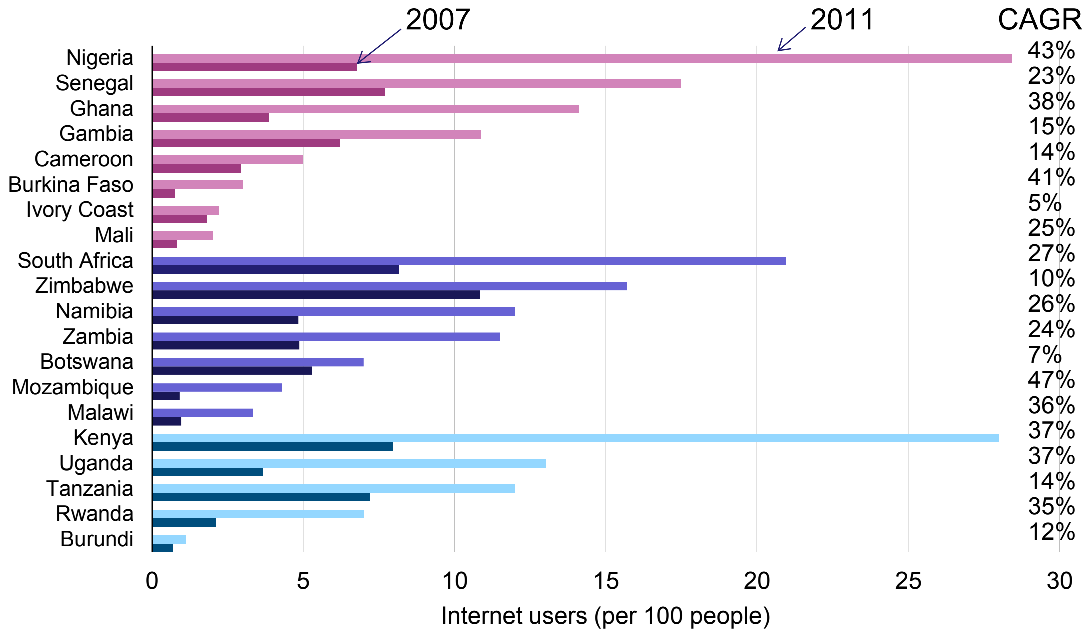
- All countries have introduced competition in offering Internet services, effectively allowing competitive ISPs to offer Internet access. In three countries there is a monopoly over leased lines or the international gateway.
- In the majority of countries the fixed incumbent has been partially privatised, with eight remaining as state-owned entities.
- All countries except South Africa and Burundi report a separate regulator able to make decisions autonomously from the government.

Sector reform is necessary, but not by itself sufficient, to remove a number of relevant obstacles to the Internet. Liberalising a market tends to foster competition, but not all liberalised markets have a significant level of competition, a situation which may be due to any combination of factors not captured here. For instance, if a licence is too expensive to acquire, or has onerous conditions, then the market is only nominally liberalised, and is unlikely to reap the benefits of full competition. In such cases a de facto monopoly – arising from historical events or difficulty of new entry – may be present despite nominal liberalisation. Where relevant, the report highlights markets where reform has been implemented in a way that there are still barriers to entry.

3.3 Internet indicators

The objective of removing barriers and promoting Internet services is to increase the level of Internet usage. The chart below shows the extent of Internet usage across the population of each country in 2011, along with 2007 data as a comparison.

Figure 3.6: Internet usage in benchmark countries, 2007 and 2011. The labels indicate the annual growth rate of usage from 2007 to 2011. [Source: ITU, 2012]

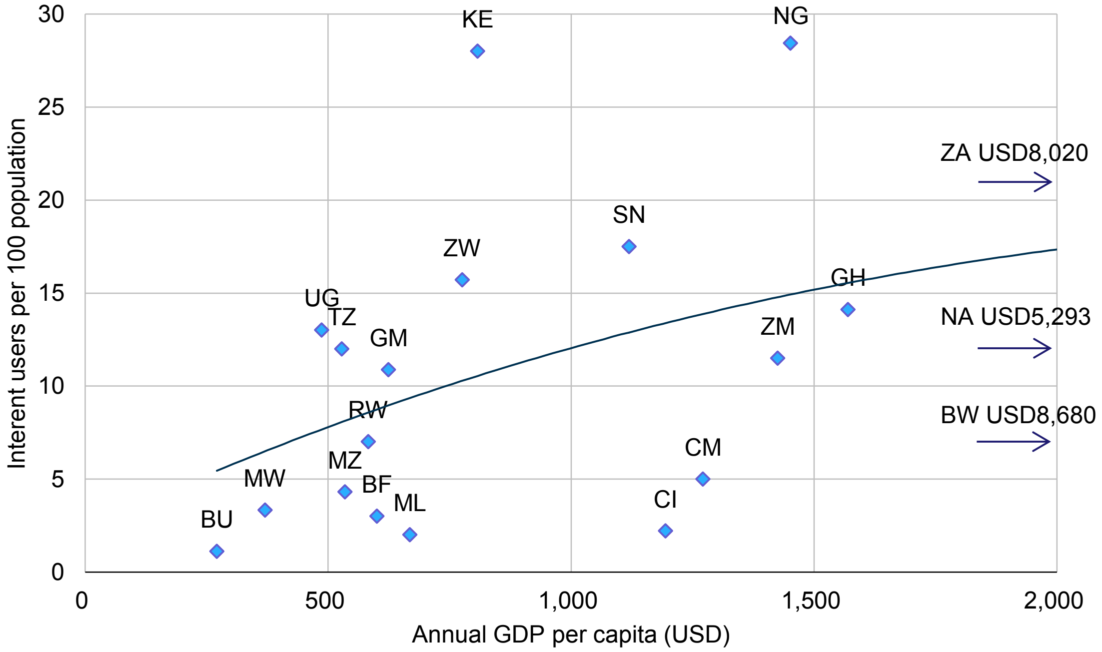


The analysis shows that the leaders in each of their respective regions are Nigeria, South Africa, and Kenya, while at the other end of the scale are Mali, Ivory Coast, Malawi, and Burundi. In terms of growth, Nigeria, Burkina Faso and Mozambique have achieved impressive annual growth of over 40% while Ivory Coast, Zimbabwe and Botswana all recorded growth of less than 10% per annum between 2007 and 2011.

The affordability of Internet access – in terms of the cost of services and the devices needed to access the Internet – is a key factor in take-up, and is dependent, above all, on income levels. Other factors, such as education and infrastructure to enable use of ICT, are also significant.

Figure 3.7 shows how Internet usage correlates with GDP per capita.

Figure 3.7: Internet take-up as a function of GDP per capita [Source: World Bank, ITU, 2012]



South Africa, Botswana and Namibia are notable for their very high GDP per capita relative to the other countries – and, yet Internet usage is not particularly high. In these cases, it appears likely that average income levels may be somewhat misleading: these countries all rank in the top four in the world in terms of income inequality[13], suggesting that a large proportion of the population may be unable to afford Internet usage. Kenya and Nigeria are both performing significantly better than one might expect on the basis of average income levels alone, as are Gambia, Senegal, Uganda, Tanzania and Zimbabwe. By contrast, Ivory Coast and Cameroon appear to be underperforming on this measure.

Broadband pricing

Once the infrastructure is in place to provide access to the Internet, a key consideration for most users tends to be the price of service. The price will be dictated by various factors. For example, lack of competition can lead to operators exerting market power over key elements of Internet infrastructure, including the international gateway and/or leased lines. This, along with other policies that limit availability, can raise the price for significant inputs used by ISPs to deliver Internet access services.

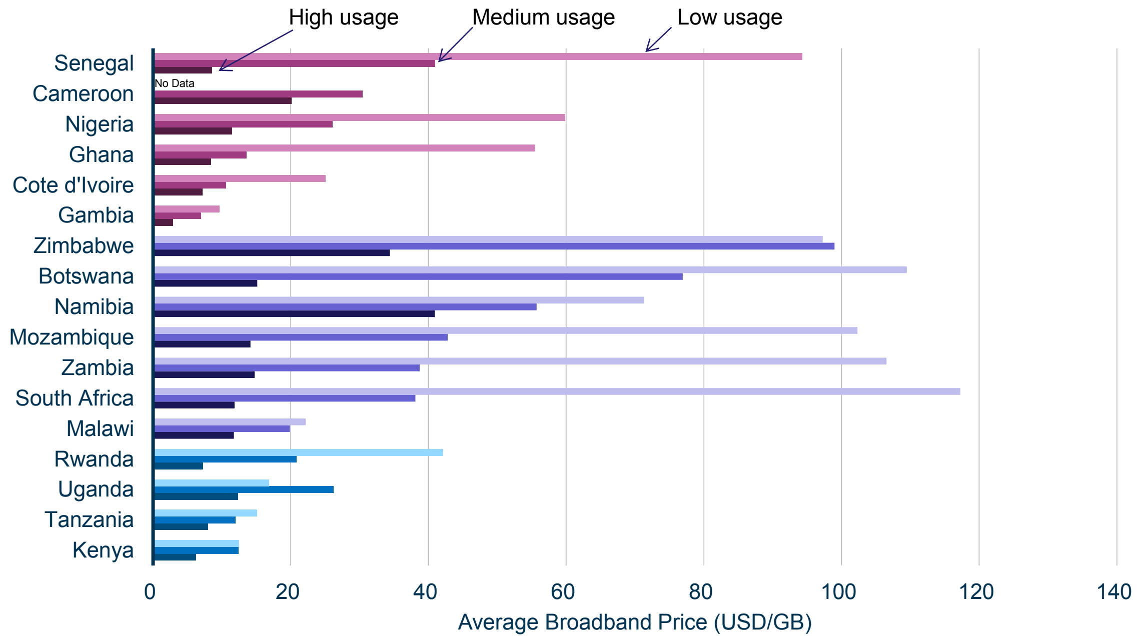
The following figure, which provides the average price of low-, medium-, and high-usage[14] Internet access bundles, demonstrates differences in prices.

---

13 Income inequality is measured by the Gini coefficient. Source: CIA, 2012, *World Factbook*

14 Low, medium and high usage are defined as: up to and including 100MB; 100MB-1GB; and 1GB and above respectively. For contract bundles, this represents bundle usage per month, otherwise the prices are for prepaid

Figure 3.8: Average price per GB of traffic for low-, medium- and high-usage Internet access bundles [Source: Analysys Mason, Google, Telegeography, 2012]



Note: Data not available for all countries

In West Africa, Gambia has uniformly low Internet access prices, which explains a positive performance in Internet usage in spite of the *de facto* monopoly in leased lines and the international gateway. In contrast, it appears that the countries with higher average income (Nigeria, Ghana, Senegal, Cameroon) have relatively high prices for low-usage bundles, potentially as a result of price elasticity. However it may be that in Gambia, pricing of low usage bundles is necessarily low; otherwise, the service would be unaffordable for most consumers due to low average income.

Turning to Southern Africa, the price levels for all three bundles tend to be uniformly high, most notably in Zimbabwe and Namibia – and low usage bundles are especially expensive. Even Malawi, with the lowest prices of the benchmark countries in Southern Africa, still has higher prices than many of the countries in the other regions. This may explain why the typically higher income levels in a number of the Southern African countries have failed to translate into the expected take-up of Internet access (and penetration remains lower than in some countries with significantly lower incomes – notably Nigeria and Kenya). The landlocked countries appear not to suffer from markedly higher prices than coastal countries with submarine cable landing stations

bundles of this size. Prices are averages of products recorded in three source databases (from Analysys Mason, the Google International Broadband Pricing Study (2012), and Telegeography). The results are not rigorous due to potential incompleteness of sources and, in some cases, low numbers of data points resulting in low significance of results. Furthermore the speed of the link provided may be a major price factor – and in some cases the only price differentiation on unlimited-traffic accounts (which are excluded from this analysis).

(South Africa, Namibia, Mozambique), despite the higher cost of delivering Internet service inland from coastal landing stations.

East Africa has the lowest costs for all three bundle levels.[15] In particular, Kenya has amongst the lowest prices of any of the countries across the regions. This goes some way to explaining its higher Internet penetration in spite of lower incomes than many of the countries in the other regions studied in this report. Furthermore the ratio of unit prices paid by low and high traffic users appears to be lower in East Africa than the other regions, which means the service is likely to be more affordable for low income users in East Africa than in those regions. This should contribute to higher penetration of Internet service.

To see how price of services affects take-up of Internet, Figure 3.9 plots Internet users in each country against the average price of a medium-usage bundle.

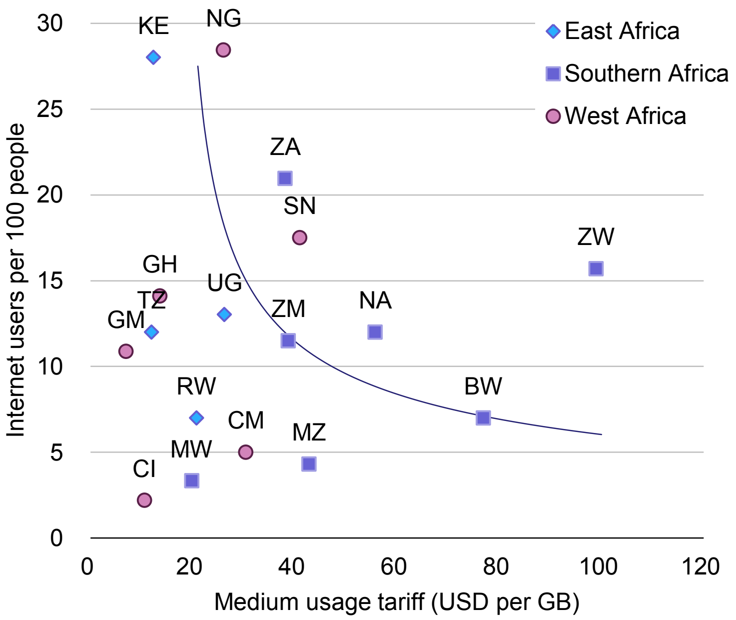


Figure 3.9: Internet users as a function of tariff in benchmark countries [Source: Analysys Mason, 2012]

The trendline is shown as a guide, and is not mathematically fitted to the data

Countries with low GDP per capita tend to be clustered below the suggested trendline while countries above it tend to be wealthier. In Cameroon and Ivory Coast in particular, usage is below what might be expected given income and pricing. Conversely, usage in Southern Africa is surprisingly high given the pricing. This is particularly the case in Zimbabwe, which might be related to the population's relatively high educational levels and a higher reliance on shared usage (at work or in Internet cafes).

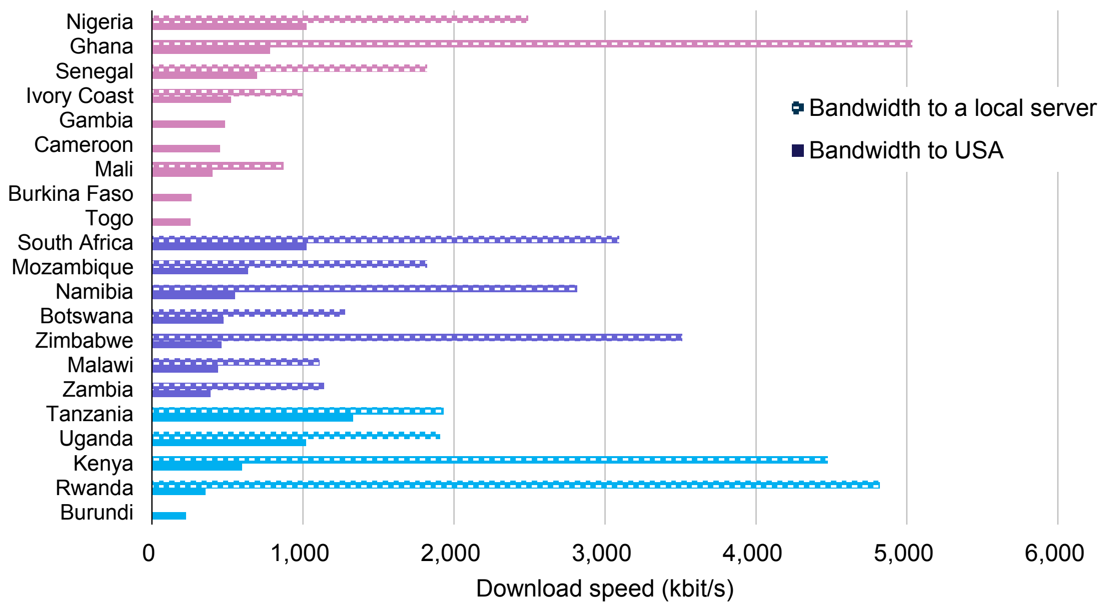
15 Pricing in Uganda is unusual in that the lowest value bundle from most operators (typically 20MB) has a lower per-GB price than all higher bundles. Pricing of higher bundles is roughly linear – there is little discounting to encourage users to buy larger bundles.

Section 4 of this report examines in more detail specific reasons why some countries have higher prices than others, with a focus on the barriers at the root of this study that may explain the higher prices.

Internet access speeds

The quality of service, and more specifically the available *speed* of Internet access, is also a significant contributor to users' decisions to subscribe to Internet access services. Quality also serves as an indicator of obstacles on domestic and international routes for Internet access – in particular, the more expensive these routes are, the less capacity is likely to be provisioned per subscriber, which lowers the average speed of access. The chart below examines the local and international download speeds of the 20 countries chosen for this report. The local connection speed is measured from the end-user to a point within the country as close as possible, and the international speed is measured from the end-user to the United States.[16]

Figure 3.10: Download speeds in benchmark countries. A local server is one estimated to be within 300 miles (480km) and this speed is therefore a measure of last mile access speed. [Source: TestMy.net, 2012, http://www.testmy.net; Net Index, 2012, http://www.netindex.com]



The results vary quite considerably between countries, but are also an accurate reflection of penetration of Internet – those countries with the highest penetration of users tend to have the highest download speeds.

16 It can be observed from the chart that local and international bandwidths do not always correlate. This may be for a variety of valid network planning reasons, including greater use of local content or caching (so fast connections to the United States may be considered less important), greater popularity of local content or better local localisation of traffic through IXPs.

Given the interplay between all the indicators presented above, it is difficult to assign definitive causality between these measures (i.e. that high speeds create greater take-up).[17] Nonetheless, it provides further evidence that in countries such as Kenya something positive is propelling the Internet; meanwhile in countries such as Ivory Coast and Malawi, there are factors holding back Internet usage.

17 Further, there is some selection bias, as users can choose to participate or not in the TestMy.net and Net Index surveys, and the results may be impacted by the choices of users.

4 Identifying successes and failures

This section examines each part of the Internet access value chain, introduced in Section 2, to identify successful and unsuccessful policies. This section also highlights the impact of such policies, where such data is available.

4.1 International connectivity

International connectivity includes submarine cable access as well as cross-border terrestrial connections, which are used by regional IXPs for the exchange of traffic and local content, and may also be used by neighbouring countries to access submarine cable capacity. As any blockage that limits access will restrict the benefits of submarine cable access, this section highlights efforts to remove barriers to deployment and access, as well as ways to promote investment.

4.1.1 Submarine cable licensing and access

Removing barriers

The submarine cable sector is a good example of how liberalisation and increased private-sector investment can transform the market. An overview of how the situation has changed in the last ten years is given below, with examples of individual country approaches provided in the remainder of this section.

Submarine cable developments in Africa: 2002-2012

Before 2006, the operation of a submarine cable landing station in most African countries was a monopoly right granted to the incumbent operator. The sole submarine cable connecting sub-Saharan Africa to the Internet, SAT-3 on the West coast,[18] only entered service in 2002. Despite high prices and demand for more cables, policymakers resisted liberalisation of the international data market in most countries.

The SAT-3 cable is owned and operated by a consortium of international and regional operators. In traditional cable consortia such as this, membership is restricted to initial signatories, but such 'consortium cables' have lower financial risk than 'private cables' due to being owned by cable users. However if there are barriers to deployment of new cables – as there were in the African submarine cable market before 2008 – then the restricted membership can lead to market power, high prices, and low usage.

18 The SAT-3 system connected to the SAFE system in South Africa, and SAFE continued on to Mauritius, India and Malaysia.

The EASSy cable project to extend submarine access to East Africa was initiated in 2003 and originally modelled on a consortium approach similar to that used by SAT-3. By the time the construction and maintenance agreement (C&MA) was signed in 2006, however, a new model had been adopted. The new model involved wider private-sector ownership alongside a special purpose vehicle (SPV) shareholder responsible for ensuring that smaller parties had open access to the cable. By enabling increased private-sector participation through the SPV (e.g. by allowing alternative operators in each country to participate), the market power of the other consortium participants was reduced. Thus, the open-access SPV was a key innovation, allowing new entrants to gain equitable access to the cable and ensuring that there is at least one neutral provider of capacity on EASSy to any existing or future operators.

The policy environment has shifted in recent years, as many countries have liberalised markets to allow new cables, and in turn the new submarine cable operators have adopted open-access conditions that facilitate access for newly licensed entrants. Initial moves towards liberalisation were made as part of discussions around the EASSy cable (as described above), but a wave of other cable investments have followed, including consortium cables (WACS and ACE), private cables (SEACOM, Main One and Glo-1, LION, LION2), and government initiatives (TEAMS). Further cables are planned, notably SAEx and BRICS to connect to South America and Asia.

The Kenyan government has steadily increased the role of the private sector in submarine cables in the region and, as part of preparations for EASSy, initiated a reform of its own licensing regime to support new cable deployment. In 2008 a unified licensing regime was introduced in which the number of licences was not limited and any suitably qualified party could acquire a submarine cable landing licence for an up-front fee of KES15 million (USD175 000) – the only requirements being to have a Kenyan-registered entity with permanent premises, provide evidence of tax compliance, and, if foreign owned, to divest 20% ownership to Kenyans within three years of receiving the licence. Three cable landing station licences (for TEAMS, SEACOM, and EASSy) have been awarded since 2008, and as further evidence of the success of these policies it was recently announced[19] that a further submarine cable is planned to land on Kenya's shores in the near future.

Liberalisation and open access to submarine cable landing stations have also been key themes in new submarine cables reaching West Africa. The World Bank (which furnished 'soft' loans to several West African governments), the Economic Community of West African States (ECOWAS), and the ITU have supported the development of a public/private partnership (PPP)

[19] Subsea World News, 2012, "Plans for Fifth Submarine Cable in Kenya Underway", http://subseaworldnews.com/2012/11/21/plans-for-fifth-submarine-cable-in-kenya-underway

model for submarine cable investment, based on open-access regulation[20] to be applied to cable landing stations in West African countries.

A good example of the application of these innovative practices is offered in Gambia, in its efforts to attract its first submarine cable. The Gambian government in 2008/9 entered discussions to join the ACE submarine cable, an Orange Group initiative to connect Europe to the West coast of Africa. The government set up an SPV that subsequently received a World Bank loan in the amount of USD25 million to fund its investment in the ACE cable and include a Gambian landing station. The plan called for divesting part of the shareholding of the vehicle to the private sector, which was done in 2012, with a total of 51% divested to Gambian ISPs Unique Solutions and Netpage on payment terms favourable for the ISPs. The cable entered service in December 2012. Gambia has not charged a fee to the SPV for the licence to operate a submarine cable landing station and has informally indicated that it is likely to not charge for any subsequent cable landings.

Nigeria and Ghana have also both liberalised the submarine cable markets and have attracted multiple new cables since 2009: privately-owned Main One and Glo-1 cables, and consortium cables WACS and ACE.

In the south, a tenacious private sector in South Africa has ensured that the submarine cable market is open to new entrants, despite government ambivalence. A former Minister of Communications had attempted to prevent full liberalisation of the market by requiring ministerial approval for the issue of various types of infrastructure licence, including submarine cables, and insisting that any cable landing in the country be at least 51% African-owned. These conditions no longer apply and any holder of an Electronic Communications Network Service (ECNS) licence – of which there are over 300 – is now allowed to operate a landing station. New entrants are likely to be involved in landing up to three new cables in the country (ACE, SAEx, and BRICS) in the next three years.

One country in which submarine cable operators have faced challenges is Cameroon. Incumbent Camtel operated a landing station for the initial SAT-3 cable, and two cables have recently attempted to land in the country: WACS and ACE, for which the local landing parties are mobile operators MTN Cameroon and Orange Cameroon respectively. After receiving approval from the government to operate a landing station, WACS was subsequently faced with uncertainty as the government suggested that landing stations should be government, not private, business. WACS is not yet lit in Cameroon, and ACE has delayed attempts to land there.

A common challenge, and one experienced in Cameroon, is that – whether or not the market is nominally open to new entrants – landing station licensing is not transparent and in some countries requires specific ministerial approval; unclear requirements, and the involvement of politicians increases the risk and cost for potential new cables, and deters investment. This is exacerbated in

---

20 ITU, 2012, *Access to Submarine Cables in West Africa. ECOWAS Regulation*; ITU, 2012, *Access to Submarine Cables in West Africa. Assessment Report*

the case of Cameroon by the government's continued 100% ownership of Camtel which is likely to have an impact on any political decisions around competition. Indeed, one international carrier commented that Camtel keeps domestic wholesale prices high making it difficult for carriers to enter the market, while the other existing operators continue to focus on mobile, not fixed, infrastructure.

Broadly there is a clear consensus that liberalised submarine cable landing markets and open-access regulation of landing stations are required to deliver international bandwidth at a lower cost and improved quality.

Promoting investment

Several governments have committed financing to ensure the success of submarine cable projects. Countries including Benin, Gambia, Sierra Leone and Liberia signed up for World Bank funding for SPVs to own and operate submarine cable landing stations. These countries have already divested, or soon will, part of the ownership of the SPV to the private sector, thereby using the government's financial strength only to overcome identified barriers and allowing competitive forces to take over after that.

The Kenyan government has also taken a lead in submarine cable investment, in addition to liberalising licence conditions. In 2007, uncertain about whether EASSy or the privately-funded SEACOM cable would deliver the expected benefits, the government agreed to fund 85% of the TEAMS cable. United Arab Emirates operator Etisalat provided the remaining 15% for the cable to connect Kenya to the UAE. The government later sold a 65% stake to various Kenyan operators[21] and the cable was subsequently launched in June 2009 (before either SEACOM or EASSy entered service).

It is important to note that in these examples, governments have used their investment to increase, not decrease, private-sector involvement in cables and thereby establish competition on the same cable or over multiple cables. In addition governments have used their investment to ensure cost-based wholesale pricing, and to reserve capacity for new operators when they are licensed in the future.

4.1.2 Cross-border connectivity

Cross-border connectivity is important for both landlocked and coastal countries for several reasons.

1. In order to avoid using satellite connections, landlocked countries must access submarine cable landing stations via their neighbours.

---

21 Balancing Act, 2008, "Private Investors Sign Up for Stake in TEAMS cable project in Kenya", http://www.balancingact-africa.com/news/en/issue-no-398/money/private-investors-si/en

2. Even for coastal countries, geographically diverse routing is important for ensuring high availability of international capacity, and it promotes competition between submarine cables. Particularly for countries with only one submarine cable landing, having connectivity via other landings or on other cables increases options in the event of a local problem. This was vividly demonstrated in 2012 when simultaneous faults in two submarine cables in Mombasa, Kenya, led to Kenyan traffic being routed through a new link to landlocked Ethiopia, for onward connection to landing stations in Sudan and Djibouti.
3. Coastal countries can generate revenue by carrying regional or international traffic for neighbours.
4. Cross-border connectivity is critical for building strong regional hubs (e.g. regional IXPs), which in turn contributes to lowering the overall cost of Internet in the region and increasing the amount of local content.

At a policy level, cross-border interconnection is also considered important for regional economic integration. Integration – including billions of dollars of investment in transport corridors and improving cross-border logistics – is high on the agenda of policymakers throughout Africa. Cross-border Internet connectivity, costing a fraction of road infrastructure and with plenty of private-sector investment, should in principle be keenly supported by all governments.

Stakeholders have varying views of the challenges of deploying fibre networks across borders:

- Policymakers tend to report that there are few problems, and that inter-governmental meetings are sufficient to coordinate fibre border crossings. This is the case in Ghana, for example, where bilateral ministerial contact has facilitated crossings into Togo and Burkina Faso for the incumbents in those countries. Likewise the Cross Gambia Project, aiming to connect the country's northern and southern borders[22] with Senegal, had few problems with cross-border connections. The Gambian and Senegalese governments have a joint commission which facilitates inter-governmental discussions.

- In contrast, private operators have reported that permission for cross-border solutions[23] is a bureaucratically complicated procedure, with a lot of parties involved (e.g. Ministries of Defence, Communications, Immigration/Home Affairs, and Public Works). In some cases this is time-consuming but not obstructive. Operators have indicated that South African government departments are particularly slow to take decisions, potentially undermining the investment in cross-border connections that are critical for Lesotho (lying entirely within South Africa) as well as other neighbouring landlocked countries.

- In addition, once permission has been granted, there may be uncertainty about permissions to deploy infrastructure in the 'no man's land' between borders. As a result of frustrating and

22 Gambia is entirely surrounded by Senegal, apart from a short coastline.

23 The drawbacks of incumbents dominating cross-border connectivity is discussed further in M. Jensen for Internet Society, October 2011, "Transnational broadband interconnection".

time-consuming processes to cross borders, we have been told of operators in Southern and Eastern Africa who have deployed fibre 'under the radar' by using unconventional methods or hiding the location of their crossings.

- Once the cabling has successfully crossed the border, some operators report having conditions imposed on them by the local incumbent operator – frequently an operator owned by the government, or behaving in a way condoned by the government – intended to prevent a foreign operator interconnecting directly with its domestic competitors.

Private operators such as Phase 3 Telecom, Liquid Telecommunications, and Gateway are particularly interested to build regional networks, in contrast to national incumbent operators that tend to be nationally focussed (and so less interested in regional interconnection). In several countries – notably South Africa – the incumbents explicitly avoid participating in local IXPs for what they perceive to be their strategic interests, and as a result are unlikely to have the vision to support growth of regional connectivity. One of the concerns of landlocked stakeholders when setting up the EASSy cable consortium was that monopoly incumbents in coastal countries might try to charge high prices for transit to landing stations,[24] a concern only partially addressed in the final consortium arrangements.

Development of African Internet capacity therefore depends in large part on facilitating cross-border connections[25] specifically by private operators, or at least making available infrastructure to support their cross-border connections. African governments have in fact already committed to making this happen, under the CODIST-II declaration (see below) and also as part of the African Union's PIDA process, at regional level in EAC and ECOWAS and at various regional forums.

CODIST-II declaration on cross-border connectivity

The 2011 CODIST-II (Committee on Development Information Science and Technology) conference hosted by the United Nations Economic Commission for Africa (UNECA), highlighted a number of recommendations relating to cross-border interconnection and Internet Exchange Points that were adopted as one of the resolutions[26] of the CODIST-II ICT subcommittee and agreed to by Member States. Of most interest to this report is the following extract:

24 P. Hamilton and Telegeography, 2004, *Identifying key regulatory and policy issues to ensure open access to regional backbone infrastructure initiatives in Africa*.

More recently the government of landlocked Malawi has initiated a project (2011) to find ways to connect to submarine cable landing stations, since the solution of buying capacity from neighbours did not appear to be straightforward.

25 An example from outside telecommunications of the type of inter-governmental coordination that could have a large impact is the Chirundu one-stop border crossing. Trucks crossing the border used to wait five to seven days to cross; with streamlined arrangements that has been cut to half an hour, and revenues for the Zambian government have increased 30%. This is suggestive of the sort of improvements that can be made if governments can take a holistic view of the challenges facing operators.

26 CODIST, 2011, "ICT Subcommittee Resolution: Enabling Environment - Technical and Policy Issues", in Report of the Second Meeting of the Committee on Development Information Science and Technology: Summary, resolutions and recommendation, pp. 5-9, http://repository.uneca.org/codist/sites/default/files/CODIST-II_Resolutions_En.pdf

Member States should:

- Implement policy and regulatory frameworks that support and facilitate national and cross-border Internet interconnection;
- Advance the harmonisation of cross-border interconnection and licensing regimes at the regional level, including through the regional economic communities (RECs);
- Support the development of IXPs to facilitate efficient and cost-effective Internet traffic exchange and improve the business case for the development of local content industries;
- Advance the redundancy and reliability of national information infrastructures by diversifying international Internet connections and encouraging the participation of government networks, commercial ISPs, university networks, and other data carriers in IXPs;
- Deepen the implementation of policy and regulatory approaches that encourage competition in the development of national and regional Internet infrastructure, including through public-private partnerships.

4.1.3 International gateway licensing

International gateways allow domestic operators to connect with other networks across borders, and therefore are not just important for accessing submarine cables but also for regional connectivity. While sometimes the holder of the gateway licence owns the international capacity that it is accessing (such as on a submarine cable), often newly licensed entrants must lease such capacity. For cross-border connections it is often the case that the international gateway licensee in one country does not own the capacity on the other side of the border. As such, allowing competition in the international gateway market is necessary to promote international competition, but not sufficient; issues around transparency and price are also relevant.

Between 2000 and the present, most African countries have been liberalising their international gateway[27] markets, with mixed results based on other factors:

- The South African authorities broke Telkom's monopoly on international gateway services in 2002 when state-owned broadcast operator Sentech was given a licence. Its operations were however restricted by the submarine cable monopoly held by Telkom, which reportedly forced Sentech to continue using satellite links for international capacity. The regulatory regime further envisaged that a third gateway licence would be given to the second national operator (Neotel, which launched in 2007); the three mobile operators were required at the time to buy international capacity from one of these gateway providers. Revisions to the legislation in

27 Regulators tend to distinguish between voice gateways and data gateways. For example, in Zambia data gateways have been liberalised for over six years while the voice gateway was only hesitantly liberalised (a licence fee of USD12 million was set, for which there were no takers).

2006 introduced converged[28] licensing, but the government intended to retain the power to approve or reject licence applications, rather than make this an administrative task for the regulator. Following a court case brought by value-added provider Altech in 2007/8 against the government, this right of veto was removed, and all existing value-added licences were converted to full network and services licences. As a result, since early 2009 the gateway market has been fully liberalised and competitive.

- By contrast, Gambia has up until now had only one international gateway, operated by state-owned incumbent Gamtel.[29] Alongside the liberalisation of the submarine cable market to accommodate the arrival of the ACE cable in 2012 the government is also introducing a new international gateway licence to foster competition, the text of which is yet to be finalised. Gamtel currently pays an annual gateway licence fee of USD500 000 and informal indications are that the new licence fee will be lower than this, but total licence fees collected by the Gambian government are intended to remain approximately the same.
- Both Tanzania and Kenya introduced converged licensing frameworks in 2007, under which licences are issued for network facilities, services, applications, and content. In both countries the facilities and service licences are not limited in number, and together these licences allow the operation of international gateways. Figure 4.1 shows the licence fees applied in these countries and the number of licensees.

	Initial fee (USD)	Annual fee	Number of licensees
Kenya	174 000	0.5% of turnover	13
Tanzania	300 000	0.8% of turnover	8

Figure 4.1: International gateway licence price and licensees. Note that licence durations may vary [Source: TCRA, CCK, 2012]

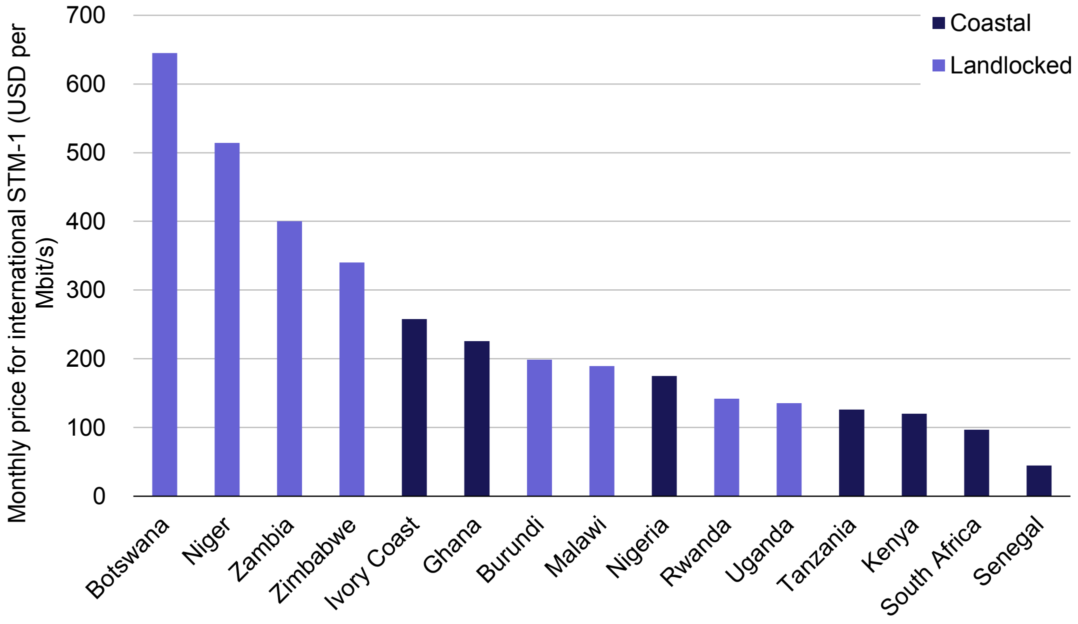
4.1.4 International pricing

An indicator of the state of the international gateway market is the resulting price for international capacity, which in turn has an impact on the price, and usage, of Internet access. Prices in various countries are shown in Figure 4.2. It is worth noting that as recently as September 2008 the price of an STM-1 on SAT-3 (West coast countries) was USD200 000 per month, or USD1290 per Mbit/s. In countries that previously relied solely on SAT-3, the introduction of competition has resulted in more than 80% decline in price in four years.

[28] Converged licensing refers to licensing based on types of services (infrastructure, service, application, content) rather than on type of infrastructure or service ("fixed" or "mobile"). The introduction of converged licensing typically involves increasing the scope of existing licences – for example mobile licensees gain authorisation to deploy fixed infrastructure.

[29] Telegeography reports that Gamsat acquired a gateway licence in Gambia in 2006 and Glo-1 in 2010, but it is not clear whether either of these were used.

Figure 4.2: Price of uncontended capacity to Europe at STM-1 level (155Mbit/s). For coastal countries this is the price from the landing station, for landlocked countries this is the price from a national hub [Source: Analysys Mason, 2012]



This chart shows that there are still significant differences in prices – including between coastal countries and land-locked countries that have extra hurdles to take advantage of the new submarine cables. East Africa as a region has the lowest prices, partly because of regional competition between terrestrial fibre network operators and partly because there are three competing submarine cables in the region. In particular, it is striking that the rates in Rwanda and Uganda are not much higher than in Kenya, suggesting that the cross-border terrestrial connections to Kenya (or Tanzania) are adding very little to the cost of the submarine capacity. This demonstrates that Rwanda and Uganda have been able to negotiate highly competitive prices for transit through their neighbours Tanzania and Kenya, due to the competition in and between those countries and lack of barriers that could create bottlenecks.

South Africa has four submarine cables, multiple international gateway operators, and a competitive terrestrial fibre market, explaining its low price in the chart above. However, landlocked countries in Southern Africa have clearly not been as successful in lowering prices as those in East Africa. This is noteworthy in Botswana, where the capacity price is significantly higher than in South Africa, as the result of a partially-liberalised licensing regime that limits infrastructure investment and raises the cost of the connectivity to access submarine capacity in South Africa (as described in Section 4.2). We have also been told of substantial bureaucratic barriers to crossing borders in Southern Africa that create entry barriers, which in turn contribute to the high prices as seen also in Zambia and Zimbabwe above.

In West Africa, Nigeria, and Ghana are served by four cables but have less competition in terrestrial fibre. Domestic terrestrial capacity bottlenecks may be constraining overall demand in these countries, resulting in higher prices than in other regions. Ivory Coast's higher price is likely due to the continued monopoly on the international gateway. This is in spite of the recent arrival of its second and third submarine cables.

It should be noted, however, that due to the very recent arrival of many of the submarine cables, and their continuing extension via regional backbones by the submarine cable shareholders, pricing is still falling rapidly wherever competitive infrastructure provision is sanctioned.

4.2 National and metro backhaul

Liberalisation as a spur for investment

Deployment of national and metro fibre networks evokes strong responses from policymakers and incumbents, who typically feel that the incumbent is the natural choice to deploy and operate backbone and backhaul networks – even more so when the state still holds a substantial stake in the incumbent. As a result, regulatory barriers to deployment of private national networks have been erected and/or maintained.

Kenya and Nigeria are distinctive for their open approach to private investment in national and metro fibre networks. As described above, Kenya has since 2007 operated a unified licensing regime that does not restrict the number of operators allowed to build and operate telecommunications infrastructure, and there are currently seventeen Tier 1 (data carrier) licensees and four Tier 2 (national cellular) licensees allowed to operate domestic fibre networks in Kenya. Nigeria offers a bewildering array of licences, but the market is liberalised: in addition to the unified licensees (mobile operators) who have the right to build fibre, there are ten national long-distance operators and eleven metropolitan cable network licensees. In both countries the initial licence fee is USD120 000–180 000, with on-going fee of 0.5–0.8% of revenue (although see the box below: "What is happening in Nigeria?").

South Africa's current liberal licensing regime had a rocky start. The new Electronic Communications Act in 2006 ushered in a converged licensing regime but with the Minister retaining the final right to refuse licences – which might have led to a small number of infrastructure operators in a partially liberalised environment, likely to protect the incumbent. However the Altech court case finally resulted in over 400 value-added services licensees having their licences upgraded to infrastructure licences in early 2009. The effect has been dramatic: neutral dark-fibre provider Dark Fibre Africa began deploying open-access metro fibre in 2009, and also furnished a link from Johannesburg to the SEACOM landing station in order to avoid very high charges proposed by Telkom. New firms Fibreco and NLD are constructing nationwide networks, and further operators are proposing to deploy fibre using sewers and into business parks. As a result, prices have fallen (in particular, Dark Fibre Africa's connection from the SEACOM landing station to metro areas helped to slash international capacity prices by over 60%) and mobile operators have enthusiastically used shared metro fibre to upgrade network quality and capacity to support ever-increasing mobile download speeds.

While the examples of Kenya, Nigeria, and South Africa can all be seen as exemplars of how to ensure the potential benefits of competition feed through to the telecoms market as a whole, they also demonstrate a potential criticism of a liberalised licensing regime: when decisions are based purely on commercial principles, deployments are focussed in profitable areas. Multiple parallel infrastructures end up being built by private operators in profitable urban areas, while rural areas and secondary towns receive no fibre investment. Nigeria[30] is a clear example, where on some routes – notably between Lagos and Abuja, and a few other large cities – there are five or more parallel fibre networks, none of which are sharing ducts or trench, but where there is insufficient fibre in more rural areas. Kenyan officials have complained of the multiple fibre networks being deployed in wealthy neighbourhoods, and it has been observed that in some business areas in Johannesburg there are at least four parallel fibre networks in each street. There is clearly a challenge for policymakers to encourage more widely beneficial investment and discourage unnecessary duplication.

Other barriers to domestic fibre networks

There remain other significant barriers to entry across countries:

- **Regulations:** Botswana's partially liberalised licensing regime allows the three public telecommunications operators (PTOs) to build fibre and offer wholesale capacity, while other private investors have struggled to obtain permission. With the mobile operators slow to deploy their own fixed infrastructure, BTC currently operates a de facto monopoly in domestic capacity despite the interest of new entrants in deploying their own networks, explaining the high price of international capacity compared to South Africa. In Lesotho the licence application process is non-transparent with the Minister retaining final right to approve or refuse a licence, and the fee for the licence is not known in advance (the regulator sets it after approval, and previous prices have varied from ZAR3 million to ZAR10 million). This uncertainty deters new entry, despite a nominally liberalised regime.

- **Market-distorting subsidies:** Barriers to entry may also be related to government subsidisation and patronage of the incumbent's network, which reduces the available market for private operators to address, distorts the incentives of the vertically-integrated incumbent that runs the network, and increases investor uncertainty. For example, governments in Botswana, Ghana, Tanzania, and Mozambique have funded construction of national fibre networks to be managed by the state-owned incumbent, and in all cases rival operators complain of poor service and unfair pricing.

- **Rights of way bureaucracy:** We have been told that payments to local authorities in Nigeria to dig trenches for fibre amount to around USD25 per metre, which adds significantly to a

30 The situation in Nigeria is complex, and involves strategic decisions not to share by some vertically-integrated operators, lack of historic infrastructure and some company-specific issues. The regulator is reluctant to interfere in potentially competitive fibre markets, and trying to promote sharing appears to be a tricky problem.

trenching, ducting and fibre cost[31] of USD20-40 per metre. One operator deploying long-distance fibre in Southern Africa indicated that regional governments had varying skill levels when it came to examining rights-of-way applications (including environmental impact reports and water use licences for river crossings), adding delay and cost to the process. The process involved consulting with around ten wayleave owners, nearly 100 municipalities, eighteen districts, five provinces – in most cases interacting with two or three departments within each level of local government – and with the national government. It took approximately two years to obtain rights to deploy 800km of fibre, including undertaking road trips with regional officials to inspect river crossings the cable would make.

- **Vandalism:** Although theft is less of a problem for fibre than for copper cable, vandalism remains a problem for fibre network operators. This directly increases costs as well as reducing quality of service and potentially causes loss of customers. Kenya has seen increased fibre cuts since the market liberalised and expanded in 2009 – for example Orange Kenya experienced 15-30 optical fibre cuts per month during 2010.[32] Sabotage by rival operators is sometimes suspected, as when a rival company's employee was found at the scene of a cable cut[33] leading to calls for new criminal punishments. Another operator has reported that positive efforts to employ locals in the construction of fibre networks may have backfired as the local staff are suspected of sabotaging fibre in order to generate on-going employment. Some countries (e.g. Ethiopia) increasingly use the electricity distribution network above the ground to carry fibre since it has proved to be less prone to vandalism, but such aerial fibre has its own maintenance challenges. In South Africa, a disturbing recent trend[34] is the use of threats and intimidation to extort money from companies deploying fibre, especially in underserved parts of the country.

- **Poor service:** Operators wishing to purchase capacity from incumbent operators are typically unlikely to get any service level agreement (SLA). This is the case for offerings from Telkom in South Africa and BTC in Botswana. When operators purchasing capacity on such networks are required by their own customers to provide SLAs, they are exposed to a substantial risk that may require them to pay penalties for faults caused by their supplier. Furthermore the time from order to activation of capacity services can be 3-6 months in some countries, seriously affecting the ability of ISPs to serve customers and innovate quickly.

31 Deployment costs can be much lower (USD5-10 per metre) if microtrenching is used, although this is less scalable and of lower quality than ducted fibre.

32 Orange Kenya, 2010, *Anti-vandalism campaign*, http://www.telkom.co.ke/index.php?option=com_content&view=article&id=133

33 Kinyanjui, K, 2009, "Telkom charges at rivals over cable vandalism", *Business Daily*, http://www.businessdailyafrica.com/Corporate-News/-/539550/668600/-/15r1yjl/-/index.html

34 TechCentral, 2013, "Crime tears at telecoms sector". http://www.techcentral.co.za/crime-tears-at-telecoms-sector/39659/

Wholesale pricing barriers

Wholesale access to existing backbone networks can be very efficient at promoting a diverse ICT ecosystem and increasing competition in the industry. However, in some countries there are pricing barriers for operators wishing to purchase wholesale capacity, particularly (although not exclusively) in countries where the incumbent fixed operator still holds some market power in the domestic capacity market. Typical prices for STM-1 capacity between cities in the same country are shown in Figure 4.3, showing a huge variation. In particular, the cost in Nigeria is massively higher than in the other countries.

	Monthly price (USD per Mbit/s)
Nigeria	3,226
Mozambique	742
Zambia	226
Senegal	176
Botswana	91
South Africa	65
Tanzania	65
Ghana	63
Kenya	40-60

Figure 4.3: Price for a domestic STM-1 between cities within various countries [Source: Analysys Mason, 2012]

By way of comparison, intra-continental capacity prices[35] at STM-1 level in Europe and the United States are around USD3-5 per Mbit/s, largely because of high demand, use of DWDM and, in Europe, relatively small geographies. International terrestrial routes – crossing borders, not just domestic – in Central and South America are often USD40-50 per Mbit/s.

As discussed above, these wholesale prices for domestic capacity are important because not all market players wish to acquire licences and build infrastructure. This is particularly the case for multinational operators that seek to expand into a new territory: they may have need for (and be used to) buying large amounts of capacity in several countries in order to establish new points of presence to serve local customers, rather than facing the arduous task of deploying infrastructure everywhere they go.

A noticeable feature of some operators' wholesale pricing strategy is that the implied payback period for a fibre network can be as little as two years – compared with an asset lifetime of 20 years or more. Some stakeholders have suggested that this could be due to regulatory and policy uncertainty, which increases investment risk; in other situations it may be due to unwillingness of managers, particularly of government-funded networks, to show an accounting loss in early years. In any case, in such countries such as Nigeria, this significantly (and artificially) increases the wholesale cost of capacity.

35 Telegeography, 2013, *Global Bandwidth Report 2013*.

What's happening in Nigeria?

From Section 3 it is apparent that Nigeria is performing well in terms of key Internet outputs (usage, speed and pricing). However the monthly price of domestic capacity is extraordinarily high. How are these two factors related?

The dynamics of the Nigerian market are complex and there are many factors involved. MTN Nigeria's high market share (over 40%) is part of the equation: with that volume of subscribers it can afford to build its own fibre network and it has done so. However the high cost of rights of way in Nigeria is an entry barrier that offers some market power to fibre network owners, which in turn allows them to charge wholesale high prices. The actual cost of providing capacity for MTN's subscribers may well be lower than is reported in Figure 4.3.

Counter-intuitively, the high level of fibre network duplication in Nigeria is partly a response to the high prices caused by barriers to entry. Smaller network builders have built their own infrastructure to avoid – or take advantage of – the high prices, while some have deployed fibre via lower-cost rights of way (e.g. strung on electricity pylons). However these operators have less traffic than MTN and thus their prices are also high. It is likely that over time the market will mature and potentially consolidate, leading to a reduction in domestic capacity prices.

In the short term, however, it is clear that this excessive duplication is wasteful and increases the industry's cost base. It also has wider detrimental impacts, for example the high domestic capacity costs undermine use of the local IXP,[36] which slows local content development and again increases the industry's costs by causing tromboning.

However, the challenge is not always simply the level of pricing as in the case of Nigeria, but also the pricing structure. In many markets, incumbents are accustomed to providing low-capacity circuits (delivered in multiples of E1 or 2Mbit/s, which are commonly used by GSM operators for mobile voice backhaul). Offering STM-1 (155Mbit/s) capacity may be unfamiliar and lead to a pricing approach that is uncommon internationally. The most common complaint is that operators offer linear pricing (e.g. one STM-1, which equals roughly 78 E1s, would be priced roughly 78 times the price of an E1). This pricing discourages take-up of higher bandwidth; in mature markets there are typically steep unit price declines for higher capacity.

For example, the access charge for Metro Ethernet services offered by BTC in Botswana is shown in Figure 4.4 and indicates that an increase in bandwidth by a factor 10 equates to an increase in cost by a factor of about nine; this is in contrast to pricing in competitive markets, where for a similar increase in capacity the cost increase is typically a factor of three. In the example of

36 Analysys Mason, 2012, *Assessment of the impact of Internet Exchange Points – empirical study of Kenya and Nigeria*, 2012, http://www.internetsociety.org/assessment-impact-internet-exchange-points-empirical-study-kenya-and-nigeria

Botswana, therefore, we would typically expect a price for 1Gbit/s that is 27 times higher than the price of 1Mbit/s, rather than 800 times higher.

	Monthly access charge	Ratio with 1Mbit/s price
1Mbit/s	BWP3120 (USD350)	1
10Mbit/s	BWP29 640 (USD3300)	9.5
1000Mbit/s	BWP2 496 000 (USD278 000)	800

The port charge is an additional BWP2500 per month

Figure 4.4: Price of "Platinum" Metro Ethernet in Botswana [Source: Botswana operator, 2012]

High prices for high bandwidth do not reflect underlying costs and clearly discourage increased usage. In turn, this risks creating a vicious circle in which the low take-up of high-capacity services keeps unit prices high, depressing further demand. By contrast, Tanzania's National ICT Backbone (NICTBB) uses a pricing model that follows best practice in competitive markets – although we have no data from which to judge the effect of this on usage.

Promoting investment

Governments can encourage investment in a variety of ways including acting as an 'anchor tenant' by procuring long-term capacity for their own aggregated demand, using state assets and right-of-ways to cut the cost of deploying new networks, and supplying funding to overcome clearly-identified barriers. It has been calculated that accumulated universal service funds (USF), collected from levies on operators since liberalisation in most African countries and intended to promote access to telecommunications, may run into billions of dollars. While this suggests that public money should be available for supporting Internet access, government fiscal pressures may in fact have depleted many of these funds, and in many cases universal service agencies have a poor track record as custodians of these funds. Public investment has usually taken the form of direct budget allocation from central or regional government.

We provide some examples of government intervention here, showing a variety of outcomes in such investments.

- After acquiring a NFP Tier 2 licence in 2009, Kenyan state-owned electricity firm KPLC in 2010 sold fibres deployed on its national transmission network to Jamii, Safaricom, Wananchi and Kenya Data Networks. KPLC also allows operators to deploy their own fibre on its transmission infrastructure. This allows operators to avoid duplication and save on infrastructure deployment costs.

- The Kenyan government has also invested KES5 billion (USD58 million) in the first phase of the National Optical Fibre Backbone Infrastructure (NOFBI) to reach 31 county headquarters with more than 4500km of fibre, addressing those areas not covered by the concentration of fibre deployment in urban areas. Supported by a loan from the Chinese government, the government is currently extending that network to reach more distant counties. However it awarded to incumbent Orange Kenya, still 49% owned by the government, the management contract for NOFBI without a competitive tender. To date the network is reported to have no customers apart from Orange Kenya itself and Safaricom, which has been "testing the network" for around two years. Competing operators have complained that prices are high; the Ministry and Orange have reportedly been unable to agree prices (exacerbated by unexpectedly high maintenance costs due to vandalism), and the Ministry has in turn complained that Orange "has not been aggressive in selling capacity to its rivals".[37]

- The South African government pooled the fibre networks deployed by the state rail company and the state electricity company to create a new state-owned company called Broadband Infraco. This company is intended to "improve market efficiency in the long distance connectivity segment by increasing available long distance network infrastructure" and in particular was intended to be the vehicle for providing services to national, provincial and municipal government. Infraco's launch in 2006 did not however prevent two private-sector firms, Fibreco and NLD, from deploying parallel national networks. Broadband Infraco has itself experienced strategic and operational problems, including significant irregular and wasteful expenditure and financial losses.[38]
- The Ugandan government invested USD62 million in a 2100km national fibre network, the management of which it intended to subcontract to a private sector company. Built by Huawei and funded by a loan from the Chinese government, the network has been plagued by problems including alleged inflation of costs, inadequate burial of fibre and use of the wrong type of fibre. The Ugandan president in October 2012 ordered an investigation into the project.[39]

While it is positive that governments are sharing infrastructure and investing their own funds to ensure that fibre networks are deployed nationwide, the results are mixed. One analysis[40] has highlighted the potential risks in government investment, namely the potential to bias government policy decisions, the compromised management of the backbone through a state-owned operator, and the public monopoly that limits incentives for efficiency. Indeed, in many cases privately-funded networks have out-competed state-funded networks on quality and price – examples are Liquid Telecommunications in Zimbabwe and DFA in South Africa. It appears that best practice principles need to be developed and closer due diligence applied to the exact mechanism for procuring and managing the networks.

37 Balancing Act, "State seeks fresh fibre optic link deal with Telkom Kenya", July 2011

38 Engineering News, "Broadband Infraco showing signs of a turnaround", 3 August 2012

39 IT News Africa, "Uganda Orders Investigation Of Huawei's Fibre Optic Grid", 2 October 2012

40 Stefanotti, "Domestic Broadband Infrastructure Policy: Laying the Foundation for the Future of ICT in Tanzania", March 2010. http://www.ictworks.org/news/2011/05/13/tanzania-domestic-broadband-Internet-infrastructure-policy-analysis

4.3 ISP market

Numerous studies[41] have been performed on the effect of taxation, levies and duties on the price – and therefore on the usage – of mobile services. Up until now the focus has generally been on mobile telephony rather than Internet services, and some results of a recent study are shown in Figure 4.5.

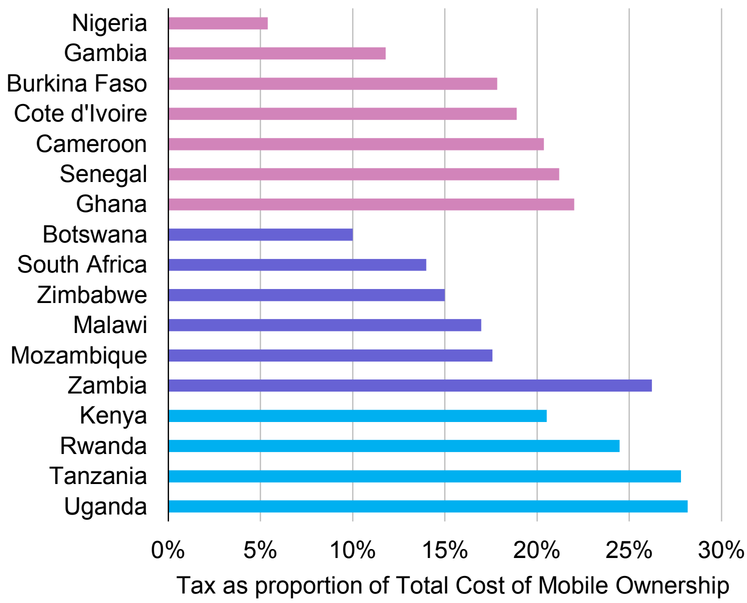


Figure 4.5: Tax as a proportion of total cost of mobile ownership (TCMO) including device purchase and on-going service costs [Source: GSMA/ Deloitte, 2011]

The situation is likely to be similar when considering the tax burden on Internet access services. Key differences are that in many jurisdictions laptops and smartphones may incur even higher import duties than feature-phones[42] (as high as 45% in DRC), and that since Internet is typically provided by more and smaller companies than mobile telephony, the burden of collection and the impact on sector competitiveness are likely to be higher.

The taxes are not just on consumer devices, but also on network equipment and revenues. For example we have been told by a Zambian ISP that it is typical for 40% of the consumer expenditure on Internet service to be paid to the government, comprising:

- VAT at 16%
- Import duty on all transmission and back office equipment, between 15 and 25%
- Corporation tax on operators and ISPs which is higher than any other in the country at 40%
- The communications authority levy of 3% of all recurrent revenue.

A multinational operator in Africa has told us that the overall tax burden is sometimes a result of uncoordinated decisions by the Ministry of Finance, the Ministry of Communications or regulator,

41 See e.g. Deloitte for GSMA, "Global Mobile Tax Review 2011", and Martin Cave and Windfred Mfuh, "Taxing telecommunications/ICT services: an overview (draft)", 2011.

42 The 2009 removal of VAT from mobile handsets sold in Kenya resulted in a 200% reported increase in handset sales (Source: GSMA/Deloitte, "Mobile telephony and taxation in Kenya", 2011.

and other government bodies. This emphasises the need for a cross-disciplinary and cross-governmental approach to achieve the full benefits of Internet adoption in Africa.

4.4 Policy environment

The previous sections have examined parts of the Internet access value chain and how policy and investment have affected those parts individually. A final critical aspect of supporting growth of the Internet is for policymakers to take an integrated view of the value chain, and to take strong leadership in implementing policy. Two contrasting examples, from Kenya and South Africa, illustrate this.

Kenya's government has been setting the pace in terms of promoting ICT and Internet development in Africa, with resulting high Internet usage compared to peer countries. This has largely been done without highly-publicised formal strategies and public pronouncements, but rather through support for worthwhile initiatives and principled decision-making by well-informed policymakers, along with multi-stakeholder participation in the policymaking process.[43] Government actions have addressed various parts of the value chain including investment in submarine cables and terrestrial fibre, liberalisation of the licensing regime, removal of VAT from mobile handsets, participation in the Nairobi IXP, and sharing of electricity company infrastructure. A bill shortly to be signed into law recognises telecommunications as a basic utility, requiring ducting to be incorporated into new housing and roads. There has also been consistent visible government leadership, in particular from individuals in the Ministry of Information and Communications and from the parliamentary Departmental Committee on Energy, Communications and Information, which has been receptive to industry feedback.

By contrast, South Africa has suffered a failure in public leadership on telecommunications and Internet issues. There have been five ministers of communications in the last five years, with none offering sustained leadership. On the key issue of the assignment of so-called 'digital-dividend' spectrum, the government and regulator were forced to make an embarrassing U-turn in early 2012. The authorities have been unable to fulfil a 2006 promise to deliver local loop unbundling by 2012, and indeed the future of fixed incumbent Telkom remains unclear. Moves towards liberalisation have generally only happened due to action by the private sector, such as the lawsuit that led to full liberalisation of licensing. On the investment front, the Presidential Infrastructure Plan does include "Expanding access to communication technology" as one of its Strategic Integrated Projects (SIPs), with the following goal:

[43] For an example of positive performance in one ICT arena, see D. Souter and M. Kerretts-Makau, September 2012, "Internet Governance in Kenya - An Assessment for the Internet Society", http://www.internetsociety.org/internet-governance-kenya-assessment-internet-society

> Provide for 100% broadband coverage to all households by 2020 by establishing core Points of Presence (POP's) in district municipalities, extend new Infraco fibre networks across provinces linking districts, establish POP's and fibre connectivity at local level, and further penetrate the network into deep rural areas.[44]

However this is one of as many as 17 infrastructure projects, and to date it is difficult to discern any steps that would serve to deliver this goal and signal that the government considers this a key driver of socio-economic progress.

Other countries that stakeholders have noted for strong political leadership are Ghana and Rwanda – the latter particularly notable for President Paul Kagame's championing of ICT and the involvement of individuals from his office in the regular 5-year ICT plans that have been developed since 2000. Given the diverse Internet outcomes of Kenya and South Africa, the value of such leadership cannot be overstated. As discussed below, such a high-level approach can be crucial to coordinate a range of policies necessary to remove critical roadblocks and promote investment in needed infrastructure.

44 Presidential Infrastructure Coordinating Commission, "Provincial and Local Government Conference A summary of the Infrastructure Plan", 13 April 2012

5 Policy lessons and impact of best practice

This section extracts the policy lessons from the previous section, in three categories: removing roadblocks; promoting investment; driven by high-level political leadership. Together, these policies will encourage private-sector investment and leave the public sector to focus on infrastructure investments that would otherwise not be made, while ensuring that these investments are made in as efficient a manner as possible.

5.1 Removing roadblocks

Where the private sector is willing to invest, all roadblocks should be assessed and minimised or removed, in order to promote maximum investment in infrastructure and service provision while protecting the public interest where needed. We focus on three potential roadblocks here:

- regulatory regime including restrictions on submarine cables and international gateway
- bureaucracy and cost of rights of way, including cross-border
- sector-specific tax burden.

5.1.1 Liberalising the regulatory regime including submarine cables and international gateway

Today the benefits of sector liberalisation are widely understood and accepted. For instance:

> Liberalization and competition – and the resulting increase in private investment – have driven the development of telecommunications infrastructure and ICT in general…. By opening their communications markets through well-designed reforms, governments can create competitive markets that grow faster, lower costs, facilitate innovation and respond better to user needs.[45]

In the context of this paper, liberalisation increases the number of operators able to access new international capacity and the number of ISPs that can sell the resulting services. However, liberalisation is not a single instant of change that is completed as soon as entry and competition is allowed; rather it is a continuum, and the longer-term outcome of the process can be strongly affected by sound policy. In particular, once a market has been nominally liberalised, attention turns to the conditions under which a licence to operate in that market is available, as these conditions can implicitly or explicitly create a bottleneck that limits or prevents competition. We provide several guidelines below.

1. It is evident that limits on the number and nature of licences can constrain the resulting competition. While limits are required with respect to spectrum assignments or other scarce

[45] World Bank, 2006, *Information and Communications for Development 2006: Global Trends and Policies*

resources, such restrictions should be targeted in order to promote competition wherever feasible. Improved spectrum management, through greater investment in systems and resources by the spectrum authority, may in any case increase the amount of spectrum available for broadband services and reduce the scarcity.

2. In order to mitigate any reasonable limits on entry, it is common to separate licences for infrastructure from licences to provide service, and to not limit the latter. In other words, even with a limited number of submarine cable landing licences, competition can be increased by allowing any licensed operator to access and utilise capacity at the landing station.

3. The conditions attached to the licences themselves should not be onerous. For instance, licensing procedures should be transparent and non-discriminatory in order to provide regulatory certainty that will attract investment. The licences themselves should be as broad as possible, to allow the operator to offer a variety of services, with limited obligations that would unnecessarily prevent uptake.

4. Where possible licence exemptions may be appropriate. For instance, other than Kenya, it is not common to require IXPs to have licences.[46] In the United States, no ISP licence is required, while in Europe only a general authorisation is required. Even where an ISP licence is required, it should be imposed reasonably. For instance, a country wishing to promote its IXP as a regional hub should refrain from requiring foreign ISPs to acquire licences if they simply exchange traffic at the IXP, as opposed to selling retail services in the country.

5. The cost of the licence can be a significant issue. For instance, the voice gateway licence in Zambia cost USD12 million until several years ago, which clearly raised a barrier to entry, and so favoured the status quo. The fee for an operating licence[47] should not be treated as a means to slow entry, or raise money, but rather to cover reasonable costs.

Undue conditions imposed on potential entrants can represent a significant barrier to the Internet access market at every stage of the value chain. At one end of the spectrum, they can prevent large international operators from using their submarine cable investments as a means to enter a national market and serve their enterprise customers, while at the other end of the spectrum, smaller ISPs may not have the finances or knowledge to navigate any difficulties in acquiring a licence. In both cases, competition and innovation suffer accordingly.

46 While the license obligation in Kenya slowed the introduction of KIXP, there has been little or no impact since then. Nonetheless, it is not common to license an IXP that provides connectivity in a data center but does not offer services outside the data center, and there is a risk that such a license could be used to protect similar services provided by an incumbent. We also note that in 2011 the East Africa Communications Organization (including regulators from Kenya, Uganda, Tanzania, Rwanda and Burundi) agreed to allow operators to connect to existing IXPs in the region without the need to obtain a license.

47 Fees for scarce resources such as spectrum (or indeed, for example, for mining licences) should aim to recover some of the supernormal profit that results from scarcity. Conversely, governments should be aware that scarcity itself causes higher prices; limiting the number of operating licences increases service prices, regardless of whether the licences are charged for or not.

5.1.2 Reducing bureaucracy and cost of rights of way, including cross-border

Deploying infrastructure typically requires two types of permission:

- The landowner or agency responsible for land use must agree to allow their land to be used. This may be a private landowner, or a government department such as the roads authority, or a municipal council. It is common for this permission (referred to as a wayleave) to be granted on commercial terms, involving payment to the responsible agency.
- Planning permissions, including environmental and social, and coordination with other utilities. The parties responsible for administering these permissions usually are not permitted to charge commercial terms and are limited in their power to refuse permission.

Both of these can present barriers to deployment of Internet infrastructure, particularly multiplied across a host of local authorities whose permission is required for cross-country terrestrial fibre. For example wayleaves in Nigeria can be prohibitively expensive, and obtaining planning permission in South Africa can be cumbersome and slow.

Wayleaves

A completely open and low-cost approach to granting wayleaves is not optimal because it can result in, for example, inefficient, repeated digging up of roads. Wayleaves are commonly granted by municipalities and may be a useful source of municipal income, so waiving fees could harm local finances. A policy on wayleaves that is harmonised amongst different types of users – for example, a code of practice for all municipalities, and all state-owned enterprises – is likely to be the best approach, stipulating amongst other items whether sharing of trenches, ducts or fibre is mandatory, standards for reinstatement of pavement, and broad commercial terms. While leaving some room for commercial negotiation, the cost of wayleaves should be as harmonised as possible.

There are moves to harmonise wayleaves in Kenya and South Africa. In Kenya legislation is proposed that would give telecommunications infrastructure utility status, like that water and electricity, to ensure that it is taken into account in civic planning. In South Africa the regulator is working on a rapid fibre deployment guide, in collaboration with industry.

Governments can also support new investment in infrastructure by making available existing passive infrastructure and rights of way, for example roads, railways, electricity and gas networks, and water and sewerage infrastructure, as described further below. There are already numerous examples across Africa of electricity transmission networks being used to carry optical fibre. ECOWAS states all new power infrastructure is required to have fibre planned in, while PIDA recommends extension of this principle to all new transport infrastructure in Africa. These efforts can be enhanced by the use of an “atlas”:

Definition: A centralised *atlas of passive infrastructure* is a database to which telecoms operators and other utilities send relevant information on their passive infrastructure, including ducts (e.g. actual availability, conditions for access), to the NRAs (or other responsible bodies). Those bodies would manage such information in a database and provide it only upon request to interested parties (thereby responding to security concerns). [48]

Analysys Mason has recently conducted an impact assessment[48] of such an atlas in the context of plans to roll out superfast broadband in Europe. The summary result is shown below, alongside evaluations of four other potential measures to reduce the cost of roll-out.[49]

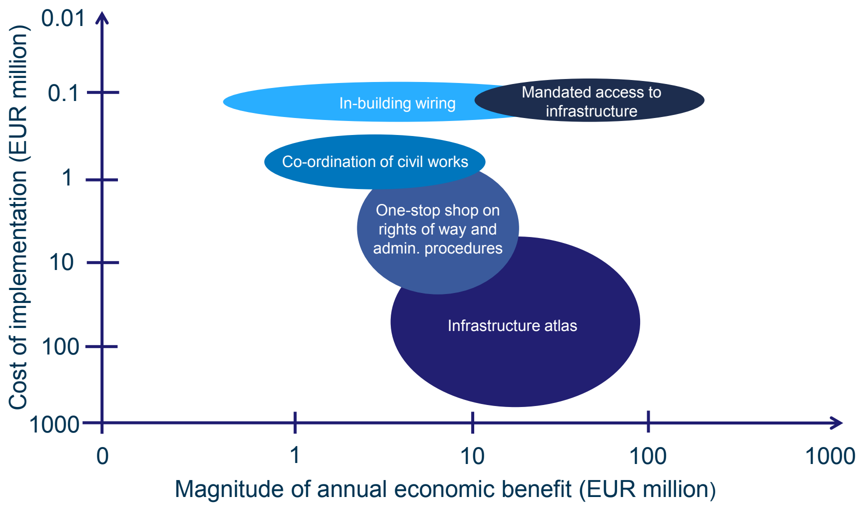


Figure 5.1: Estimate of the cost and benefit of implementing various regulatory measures for speeding up last-mile broadband access in Europe [Source: Analysys Mason, 2012]

Although the cost of an atlas in the European case (relating to last-mile broadband access) is expected to be relatively high, a more limited atlas focusing on public utility rights of way in specific areas (e.g. underserved areas) may be an option that minimises costs, but provides significant value.

Finally, it is important to carefully consider how the rights of way that are controlled by public authorities are commercialised. Options include the utility itself owning and operating an open-access network, or making dark fibre available to private operators who create their own networks. Options that create bottlenecks and reduce competition should be avoided.

48 Analysys Mason for the European Commission, 2012, "Support for the preparation of an impact assessment to accompany an EU initiative on reducing the costs of high-speed broadband infrastructure deployment. Final report", https://ec.europa.eu/digital-agenda/en/news/support-preparation-impact-assessment-accompany-eu-initiative-reducing-costs-high-speed

49 Note however that this study was primarily aimed at rolling out last-mile, not backbone, infrastructure. Nevertheless, the potential remedies remain relevant in the context of this report.

Planning permission

Currently, planning permissions suffer when myriad agencies administer them. A ‘one-stop shop’ approach (also shown in Figure 5.1) may be useful in addressing both the permissions and wayleaves issues:

Definition: A *one-stop shop* on rights of way and administrative procedures would be an organisation that managed information and permits on rights of way. Relevant authorities, including local authorities, would provide information on necessary permits, applicable rules and conditions, and so on to this central organisation (possibly the NRA). That organisation would not only provide information to interested parties, but could also act as an intermediary by receiving and forwarding permit requests to the relevant authorities, and monitor that existing deadlines are adhered to. [48]

It is worth noting that arduous planning permissions may be tolerated by operators deploying fibre on profitable routes, but are likely to be a strong disincentive to deploying fibre to rural or remote areas – particularly since such areas are likely to have even more complex environmental demands. A one-stop-shop is therefore even more important in promoting universal access.

An important part of creating such a one-stop-shop and an atlas of infrastructure is to maintain accurate and up-to-date records of existing underground and aerial infrastructure. Failure to do so can and has resulted in catastrophic loss of service when new civil works sever existing ducts and pipes.

Cross-border connections

Cross-border fibre connection is typically easy to arrange for government departments and state-owned incumbents. Private operators, on the other hand, are often frustrated by bureaucracy. Cross-border bureaucracy may include confusion about who grants permission to the ‘no man’s land’ between countries and uncertainty about waterway impact assessment, since many borders are demarcated by rivers and water use may be a sensitive international issue. Private operators would benefit most from being able to deliver regional connectivity (and bring most benefit to users), as they are less likely than state-owned operators to be confined by national market interests.

Some parties have suggested that the ITU or regional bodies such as CRASA, WATRA, the AU, or NEPAD should be involved in resolving this issue. While it may indeed be useful to develop best practice on optical fibre border crossings at a regional level, due to the specific licensing, environmental and planning issues arising at each border, effective solutions will ultimately rely on bilateral arrangements. Acknowledging the vital importance of cross-border connectivity, it may end up being more practical for governments to invest in their own neutral “meet me” facilities at the border (hopefully overcoming permitting and planning obstacles by internalising them), incorporating ducting and fibre to connect to each country, and sell access at this location at a nominal fee.

5.1.3 Reducing sector-specific tax burden

A number of stakeholders contacted for this study commented on tax issues. In particular, stakeholders mentioned: taxes affecting the cost of equipment needed to provide service, such as routers; taxes on end-user devices such as smartphones; and taxes on Internet access services themselves. In addition, a number of recent reports have addressed this issue.[50] Without reproducing those arguments, we make two broad points here.

1. We recommend that, rather than look at each element of the value chain individually, governments should take a broader perspective on the value chain as a whole in order to understand the entire tax burden. This is particularly true where multiple ministries or agencies may impose taxes on various pieces of equipment and services. Taking a holistic view of the value chain would provide governments with two complementary perspectives: first, the supply-side cost of entering the market and offering facilities-based services; and second, on the demand-side cost of subscribing to and using a service.

2. Governments should recognise the trade-off between the opportunity to raise taxes from Internet access services (and underlying telecommunications services) on the one hand and, on the other hand, the impact on the broader economy (and the tax revenue therefrom) resulting from lower usage of Internet access services. The use of the Internet has a broad set of benefits, including growing businesses, delivering customer services, and enhancing social inclusion. Focusing on the business and employment benefits alone, it may be better to tilt towards promoting Internet usage through lower taxes on that sector, with a view to recouping revenue from the resulting economic activity across all sectors. There is a growing body of evidence that high connectivity prices can render local businesses – particularly knowledge-based business – less competitive, while regions with good, low-cost connectivity have been shown to attract businesses.

As discussed below, a supportive policy environment at the highest level of government is required to undertake such a broad review of taxation – including such issues as the tax collection burden and efficiency – as well as implementing any needed reforms.

5.2 Promoting investment and services

In addition to removing roadblocks, governments and regulators should consider actions to actively promote investment, and where such actions may not be sufficient, to step in to invest in a way that promotes access and competition.

50 See "Taxing telecommunications services; an overview" by Professor Martin Cave and Dr. Windfred Mfuh, prepared for the ITU Global symposium for Regulators 2011, and the GSMA report "Global Mobile Tax Review 2011" by Deloitte.

5.2.1 Offer investors greater regulatory and policy certainty

Some operators have suggested that lack of regulatory certainty means that they are pricing capacity to third parties on the basis of a very short payback period (sometimes two years), even though the asset itself can have a lifetime of decades. While such anxiety on the part of operators may be unwarranted, it must still be taken into account, and there are actions that governments can take to address these anxieties:

- Regulators should make clear that remedies (ranging from mandated access to price controls) may need to be applied if operators are found to have market power – even if they are private operators. They should also make clear that it is possible to avoid investigations into market power by sharing duct and fibre during the construction of a network. If operators do not share, they should be made aware that they can mitigate future regulatory action by ensuring that the fibre network is owned and operated at arms' length, preferably in a separate subsidiary (i.e. avoiding vertical integration with retail operations). By being clear on the rules – and effective and consistent in implementing them – regulators can avoid having to change rules later to force infrastructure sharing or open access. This predictability is key both for those that choose to invest and firms that would like to avoid building and purchase wholesale capacity instead.

- Although it may be tempting to levy taxes on optical fibre infrastructure, governments should be aware that historically, when fibre networks have been sold, it is the metro fibre assets (not long-distance) that fetch high prices. Relatively little economic value resides in national transmission networks, so additional taxes can undermine deployment. Fibre network operators should have clarity about what their costs will be in future; however it is not necessary to guarantee that all future fibre deployments will face the same levies because the resulting entry barriers[51] may allow the operator to charge higher prices.

- Further, governments can offer greater certainty that fibre infrastructure will be supported. This includes protection from vandals and from damage due to poorly-planned civil works. For example, Kenya's government is planning to make vandalism of fibre an economic crime, indicating the high value it places on ICT infrastructure. Likewise greater confidence in the national grid electricity system would allow operators to reduce reliance on diesel – with its volatile price – to power network nodes. While reducing actual costs, these infrastructure support measures also reduce investment uncertainty, thereby reducing risk and allowing operators to set prices lower.

[51] An example of such an entry barrier is given by the award of 3G spectrum in Kenya. Safaricom received 3G spectrum in 2007 for a fee of USD25 million, which other operators declined to pay. When the regulator reduced the fee to USD10 million in 2010, other operators did purchase licences. Safaricom felt aggrieved that it had had to pay more than others for its 3G spectrum and threatened to sue the regulator, suggesting that it had hoped the entry barrier would be maintained to allow it to continue to offer data service at a higher price.

- Finally, any government investment in fibre should not create unfair competition (see section 5.2.3), since both the threat and the delivery of unfairly subsidised services will increase investment risk and therefore the cost of services.

5.2.2 Infrastructure sharing should be incentivised

Governments should make it a priority to maximise private investment, both to increase competition in targeted areas and to extend infrastructure to un- or under-served areas. One way to do this is to facilitate the sharing of infrastructure, such that it is deployed once but used by many companies. There are a number of ways to do this.

- First, as discussed above, governments themselves control significant rights of way across a number of network industries, including roads, railways, electricity, and sewage. Allowing the agencies controlling those rights of way to build their own network, or requiring them to grant access for third-party networks will increase the reach of networks at a lower cost using the existing rights. Further, as these rights of way are controlled by government bodies, any infrastructure deployed should be made available under open access[52] or with requirement for shared construction by all interested operators.

- Second, where there is existing infrastructure and it can be shown that the owner has market power, conditions can be put in place to require the owner to share the infrastructure with others at cost-based prices. Such wholesale access can quickly increase the competitive intensity without additional costs to deploy infrastructure.

- The same is true for any infrastructure built using universal service funding, which should be made available to others under open-access conditions, in order to get the largest return on these investments and ensure that all citizens benefit from competition, rather than entrenching a new monopoly supported by universal service funding.

While sharing should be encouraged, private operators should only be required to share their infrastructure if they have market power or the infrastructure was supported by government, whether in cash or in kind. Once private-sector investment is maximised, the government should consider deploying its own infrastructure if needed, as described next.

5.2.3 Government should invest, but carefully

As has been illustrated in Section 4, government intervention is often thought to be necessary to fill gaps left by private-sector investment. Such intervention has not always led to the best outcome, however, as it potentially confers market power on one player – typically the incumbent – and creates uncertainty among private investors. This uncertainty arises from questions about

52 We note that various African governments have committed, under the Kigali Protocol, to make infrastructure and licences available to a regional open access carrier called Umojanet. The Protocol defines a variety of principles governing open access.

whether retail and/or wholesale services will end up being available, and at reasonable prices. More fundamentally, however, uncertainty arises because the incentives of project sponsors and subsidy recipients can be hard to predict.

There are a variety of tools and guidelines that have been developed to guard against market distortions, including:

- Analysys Mason's "*Developing successful Public–Private Partnerships to foster investment in universal broadband networks*" report, prepared for the ITU in 2012 and based on observations of 13 projects from around the world, describes seven best practices in PPP projects specifically aimed at promoting broadband roll-out, namely to:
  - conduct a public consultation
  - consider multiple investment models and funding
  - be technology-neutral
  - conduct pilot projects
  - provide funding in line with milestones and targets
  - mandate open access and monitor compliance
  - consider setting up parallel initiatives to stimulate demand.
- South African National Treasury "*PPP Manual. Module 4: Feasibility study*". This outlines detailed best practice in evaluating PPP, including evaluating capacity to manage the project and alignment with strategic objectives. A key (and often overlooked) stage of PPP described in that document is to define the outputs and the scope of the project at the outset and then to compile a long-list of potential solutions that can be qualitatively assessed. Assessment of potential solutions should ideally incorporate public consultation, to avoid selecting the first idea or the idea for which one or more operators lobby the hardest.
- European State Aid rules (see box below).

European state aid rules

In the European Union (EU), state aid is defined as "an advantage in any form whatsoever conferred on a selective basis to undertakings by national public authorities".[53] The treaties underlying the EU aim to avoid government distortion of free markets and therefore have strict rules around how and when state aid may be granted.

State aid can correct market failures, ensure equitable outcomes and promote wider, faster ICT roll-out; however it can also confer economic advantage on one player and distort market competition – potentially undermining private investors' incentives. As a result, the European Commission asks following questions about any proposed government investment:

[53] European Commission, http://ec.europa.eu/competition/state_aid/overview/index_en.html.

- *Is the aid measure aimed at a well-defined objective of common interest (i.e. does the proposed aid address a market failure or other objective)?*
- *Is the aid well designed to deliver the objective of common interest? In particular:*
  - *is state aid an appropriate policy instrument, i.e. are there other, better-placed instruments?*
  - *is there an incentive effect, i.e. does the aid change the behaviour of firms?*
  - *is the aid measure proportional, i.e. could the same change in behaviour be obtained with less aid?*
- *Are the distortions of competition and the effect on trade limited, so that the overall balance is positive?*

To answer these questions, there is usually a detailed geographical and market analysis to determine where private funds are unlikely to be invested. Furthermore implementation of the state aid should use an open tender, with bids judged on "best economic offer", preferably using existing infrastructure. There should also be a claw-back mechanism if the return on investment is higher than expected.

In addition, government investment in related infrastructure – notably power generation and distribution – can have a large impact on ICT infrastructure without introducing any concerns around market distortion.

5.3 High-level political leadership

Governments can signal the importance of promoting Internet access through high-level leadership. This may be necessary in order to undertake the actions listed in relation to removing roadblocks and promoting investment.

5.3.1 Good political leadership and a clear ICT strategy are key

Consistent leadership at the highest levels of government, accompanied by successful implementation, is vital to supporting growth of Internet usage. This involves development of relationships with industry stakeholders, consistent and visible political leadership, investment in human capacity to plan and monitor projects, and having the confidence to financially support projects where needed.

Industry has a part to play too, in demonstrating the practical benefits of broadband, particularly in improving service delivery and reducing inequality. Demonstrating impact on GDP is only part of the story. Until Ministers are persuaded that the Internet can improve individual citizens' lives they are likely to remain ambivalent about investment in ICT infrastructure when compared with other pressing social needs.

5.3.2 Holistic view of the Internet access value chain to address obstacles

Governments should take a holistic view of promoting the Internet and removing obstacles. Issues should be addressed across the value chain and across geographies – on a figurative 'single piece of paper' to ensure that top officials can easily comprehend the overall impact of the broad range of government policies on deployment and offering of services.

One example of what can happen when this holistic view is not taken is the fragmentation of taxes and levies, as discussed above. In some countries the payments due from ISPs are decided by three or more ministries: Finance Ministries may determine taxes on end-user devices, Communications Ministries may decide industry-specific levies, and Public Works Ministries may impose levies on new infrastructure build. Local governments may also introduce additional taxes. The cumulative effect may be unintentional distortion of the market.

Wayleaves and permissions are another factor that requires a coherent view, preferably from a single custodian that advises on best practice and ensures that it is implemented (as per the 'one-stop-shop' approach advocated in Section 5.1.2). This includes not only facilitating various permissions – such as river crossings and environmental impact assessment – but also ensuring that rights-of-way owners such as municipalities promote sharing of trenches while also receiving much-needed revenue.

A single agency with a remit to examine the entire Internet access value chain and work to harmonise policy, simplify permitting and reduce detrimental taxation would be a strong indication of government leadership in the promotion of the Internet.

5.3.3 Policies should not have the effect of distorting the market or re-creating bottlenecks

In numerous countries around Africa, the management of the national backbone network has been awarded to the incumbent – an operator in which the government typically still holds a sizeable stake. Although there are some that show signs of qualified success, for example in Tanzania and Ghana, there have been a larger number of unambiguously poor outcomes.

Problems may arise in such arrangements not necessarily through malicious blocking of access but simply through the inefficiency and lack of innovation repeatedly observed in management of bottleneck infrastructure. Open-access conditions clearly have their place, as embodied for example in the ECOWAS open-access regulations[54] for submarine cables. However even insistence on open access may not always deliver optimal outcomes because it limits the ability to innovate and create diverse products, pricing structures, geographical coverage or quality of service. If possible, the bottleneck should be limited to assets that do not require innovation in their management, such as passive infrastructure.

---

[54] ITU, "Access to Submarine Cables in West Africa. ECOWAS Regulation", 2012

It should be noted that the principle of not re-creating bottlenecks applies not only to fibre infrastructure; several governments including those in South Africa and Kenya have suggested creating a single wholesale LTE network for the use of all operators. If not done carefully, these plans may also result in new bottlenecks.[55]

55 Analysys Mason, 2013, "Wholesale mobile broadband: what could go wrong, and how it could be fixed", http://www.analysysmason.com/About-Us/News/Insight/Wholesale-mobile-broadband-Mar2013/

6 Conclusion

In many countries in Africa a number of key inputs to Internet access services still present a challenge, notably the terrestrial connectivity between the submarine cables, the IXPs, and the ISPs that deliver access to end-users.

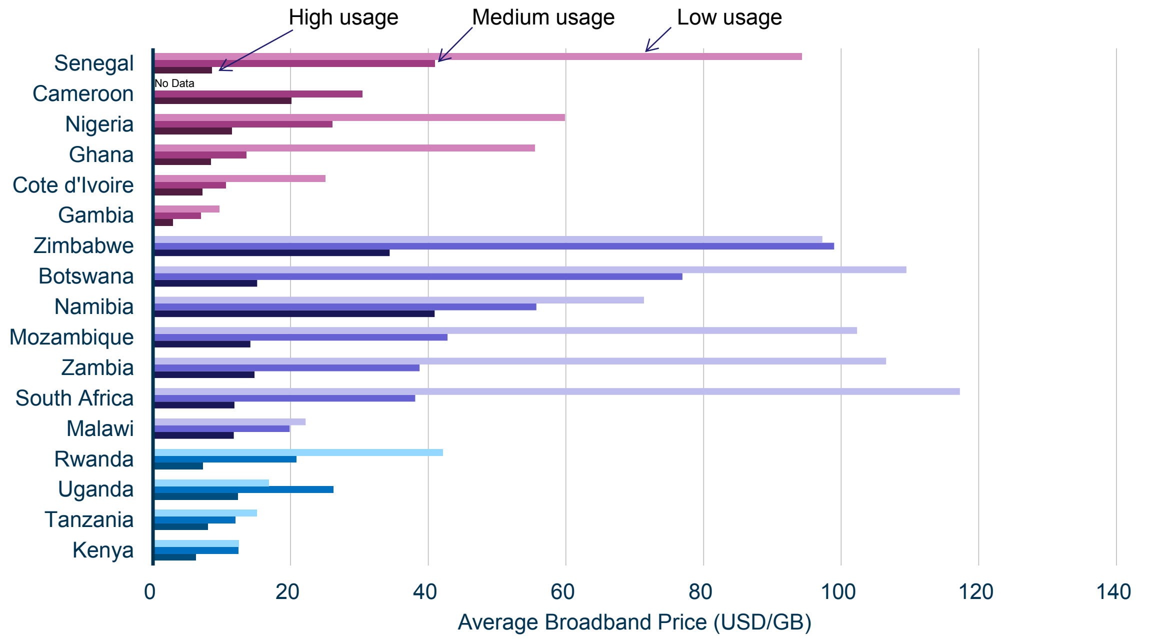
A previous study conducted by Analysys Mason found that the IXP in Kenya, which had a significant impact in lowering costs and improving quality of Internet service, represented a best practice for regional IXPs. In this study, we have found that Kenya excels on all benchmarks: it has the lowest Internet prices, the highest Internet usage and high quality of service, despite having a low to middle GDP per capita. It is therefore useful to examine the Kenyan environment to determine what can be replicated to improve Internet in other African countries.

Two key factors have been highlighted in this report have contributed to Kenya's success. The first is a highly liberalised licensing regime that has facilitated private investment and led to substantial infrastructure competition, in both submarine and terrestrial fibre networks. The second is political leadership that has, for the most part, not seen the government interfering in potentially competitive telecommunications markets even if at times it has been tempted to do so. The consequences of these two factors, in terms of impact on usage, speed and pricing, are described in Section 3; the impact on pricing is reproduced in Figure 6.1 below.

End-user pricing is, we believe, one of the strongest measures of a successful policy environment for two reasons:

1. Low prices themselves demonstrate a competitive market with few bottlenecks that raise the cost of providing services
2. Low prices generate a virtuous circle by attracting more users, which reduces unit costs and increases the utility of the Internet to citizens and businesses, which in turn further lowers end-user prices.

Figure 6.1: Average price per GB of traffic for low-, medium- and high-usage Internet access bundles [Source: Analysys Mason, Google, Telegeography, 2012]



This study has observed that markets with higher prices and lower Internet use tend to be characterised by barriers and obstructive government involvement in the sector. Ivory Coast operates a monopoly on the international gateway; incumbent operators in Cameroon and Botswana remain state-owned; and crossing borders in Southern Africa has been described as bureaucratically challenging. As a result, this study suggests the following policy lessons:

Category	Specific lessons
Remove roadblocks	• Liberalise the regulatory regime by allowing competition and lowering barriers to entry, particularly in the markets related to submarine cables and international gateways • Reduce bureaucracy and costs of Right of Way, including cross border • Reduce the sector-specific tax burden
Promote investment and services	• Offer investors greater policy and regulatory certainty • Infrastructure sharing should be incentivised, or obliged where appropriate and proportionate • Government should invest judiciously, ideally in open access PPPs, and not in infrastructure that competes with the private sector
Offer high level political vision and leadership	• Good political leadership and a clear ICT strategy are key • Holistic view of the Internet access value chain, involving a wide range of stakeholders, to identify obstacles and remove conflicting policies around tax, investment and promotion of ICT • Policies should not have the effect of distorting the market by favouring individual operators or restoring *de facto* monopolies

Figure 6.2: Policy lessons drawn from this study [Source: Analysys Mason, 2012]

There are also countries where barriers exist but Internet usage or pricing may be better than expected – examples are Senegal (which has the fourth highest Internet usage of the 20 countries surveyed despite a virtual monopoly on Internet access services), and Zimbabwe (where Internet usage is higher than might be expected based on GDP per capita, policy and broadband pricing). It is likely, however, that these countries could do better and in particular that they could achieve more widespread benefits from the Internet if they removed roadblocks, promoted investment and services, and drove changes with high-level political leadership.

Annex A Contributors to this study

The following people generously cooperated by contributing their time and insight in the preparation of this report. The views expressed in this report should not, however, be regarded as having been expressed by any of the individuals named.

- Nii Quaynor (Ghana)
- Issah Yahaya, Ministry of Communications (Ghana)
- Nic Rudnick, Liquid Telecommunications (United Kingdom/Zimbabwe)
- Michuki Mwangi, ISOC (Kenya)
- Kazeem Oladepo, Main One Cable (Nigeria)
- Aidan Baigrie, SEACOM (South Africa)
- Lamin Camara, Ministry of Information and Communication Infrastructure (Gambia)
- Mohammed Bouhelal, Etisalat Nigeria (Nigeria)
- Neo Nwako, Abaricom (Botswana)
- Shady Masarweh, BICS (Belgium)
- Angus Hay, Neotel (South Africa)
- Ory Okolloh, Google (South Africa)
- Simon Harvey, Fibreco (South Africa)
- Fiona Asonga, Kenya Internet Exchange Point (Kenya)
- Winston Ritson, Africonnect (Zambia)
- Philippe Vogeleer, Vodafone Group (United Kingdom)
- Semere Tekie, Microteck (Botswana)
- Mark Bennett, iSchool (Zambia)
- Zaipuna Yonah, Ministry of Communications, Science and Technology (Tanzania)
- Benny Otim, Abaricom (Switzerland/Botswana)
- Bijal Sanghani, Euro-IX (United Kingdom/Netherlands)
- Kai Wulff, Google (Kenya)

Annex B Glossary

ACE: Africa coast to Europe (submarine cable)
AU: African Union
CDN: Content Delivery Network
CRASA: Communications Regulators Association of Southern Africa
DWDM: Dense wave division multiplexing (high capacity optical fibre technology)
EAC: East Africa Community
ECNS: Electronic Communications Network Service (licence)
ECOWAS: Economic Community of West African States
GDP: Gross Domestic Product
ISOC: Internet Society
ISP: Internet service provider
ITU: International Telecommunication Union
IXP : Internet exchange point
MEO: Medium Earth Orbit
NCBC: National Communications Backbone Company (Ghana)
NEPAD: New Partnership for African Development
NICTBB: National Information Communications Technology Backbone (Tanzania)
NOFBI: National Optical Fibre Backbone Infrastructure (Kenya)
PIDA: Programme for Infrastructure Development in Africa
POP: Point of Presence
PPP: Public-private partnership
PTO: Public telecommunications operator (licence)
SADC: Southern African Development Community
SDH: Synchronous digital hierarchy (a transmission technology)
SLA: Service level agreement
SPV: Special purpose vehicle
TCMO: Total cost of mobile ownership
USF: Universal service fund
WACS: West African Cable System (submarine cable)
WATRA: West African Telecommunications Regulators' Association

Annex C About us

C.1 About the Internet Society

The Internet Society is a leading advocate for a free and open Internet, promoting the open development, evolution and use of the Internet for the benefit of all people throughout the world. We are the trusted independent source for Internet information and thought leadership from around the world. The Internet Society has worked for more than 20 years to ensure the Internet continues to grow and evolve as a platform for innovation, economic development, and social progress.

The Internet Society educates, informs, and communicates with technology, business and government stakeholders, as well as the general public, to promote an open Internet for everyone. We advocate for the ongoing development of the Internet as an open platform that empowers people to share ideas and connect in new and innovative ways, and which serves the economic, social, and educational needs of individuals throughout the world. To achieve this mission, the Internet Society:

- facilitates open development of standards, protocols, administration, and the technical infrastructure of the Internet
- supports education in developing countries specifically, and wherever the need exists
- promotes professional development and builds community to foster participation and leadership in areas important to the evolution of the Internet
- provides reliable information about the Internet
- provides forums for discussion of issues that affect Internet evolution, development and use in technical, commercial, societal, and other contexts
- fosters an environment for international cooperation, community, and a culture that enables self-governance to work
- serves as a focal point for cooperative efforts to promote the Internet as a positive tool to benefit all people throughout the world
- provides management and coordination for on-strategy initiatives and outreach efforts in humanitarian, educational, societal, and other contexts.

The Internet Society is at the centre of the largest global network of people and organisations focused on ensuring the Internet continues to evolve as a platform for innovation, collaboration and economic development. By tackling issues at the intersection of technology, policy and education, we work collaboratively to preserve and protect the multi-stakeholder model of development and management that has been key to the Internet's success. With more than 130 organisational members and over 55 000 individual members in over 90 Chapters, the Internet Society represents a worldwide network of corporations, non-profit organisations, entrepreneurs, and individuals who are interested in working to identify and address the challenges and opportunities that exist online.

Among its many initiatives, the Internet Society has embarked on a multi-year programme to assist emerging economies in developing robust, cost-effective, and efficient Internet interconnection and traffic exchange environments. Our work includes a range of activities, such as:

- Assisting universities, government network operators, and ISPs to gain the world-class knowledge and skills needed to build reliable, cost-effective, and interconnected networks,
- Facilitating the development of new IXPs, and helping stakeholders to maximise the use of IXPs already in place,
- Assisting policy-makers and regulators in developing approaches to expanding the Internet achieving a beneficial interconnection and traffic exchange landscape, and
- Facilitating multi-stakeholder collaborations on these issues, including the African Peering and Interconnection Forum (AfPIF), and supporting the Latin American and Caribbean IXP association (Lac-IX).

For more information about the Internet Society, including our work to improve the Internet interconnection and traffic exchange environment in emerging economies, please visit our website at http://www.internetsociety.org

C.2 About Analysys Mason

Analysys Mason is a trusted adviser on telecoms, technology and media. We work with our clients, including operators, regulators and end users, to:

- design winning strategies that deliver measurable results
- make informed decisions based on market intelligence and analytical rigour
- develop innovative propositions to gain competitive advantage
- implement operational solutions to improve business efficiency.

With around 250 staff in 13 offices, we are respected worldwide for our exceptional quality of work, independence and flexibility in responding to client needs. For 25 years we have been helping clients in more than 100 countries to maximise their opportunities.

C.2.1 Consulting and research in the Technology, Media and Telecommunications industries

At the core of our offer are two key services, shown below: consultancy and research.

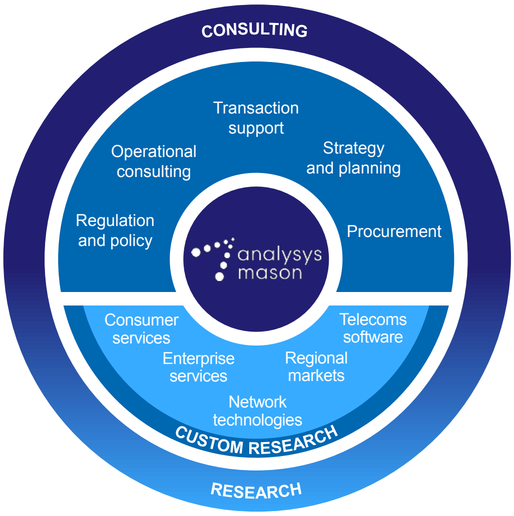


Figure C.1: Analysys Mason's consulting and research propositions [Source: Analysys Mason, 2013]

Consultancy

Analysys Mason's focus is exclusively on telecoms, media and technology (TMT). We support multi-billion dollar investments, advise clients on regulatory matters, provide spectrum valuation and auction support, and advise on operational performance, business planning and strategy. We have developed rigorous methodologies that deliver tangible results for clients around the world.

For more information, including case studies and topical articles on work we have done in these areas, visit http://www.analysysmason.com/Consulting/.

Research

Analysys Mason analyses, tracks and forecasts the different services accessed by consumers and enterprises, as well as the software, infrastructure and technology delivering those services. Beyond our published subscription research (shown in the table below), our custom research team offers specialised, bespoke research projects that address specific client needs in opening up new markets and exploiting emerging opportunities.

Practices	Programmes					
Consumer Services	Fixed Broadband and Media	Mobile Broadband and Devices	Mobile Content and Applications	Voice and Messaging		
Enterprise Services	Enterprise	SME Strategies				
Regional Markets	Global Telecoms Forecasts	*Europe* European Country Reports	European Core Forecasts	Telecoms Market Matrix	*MEA* The Middle East and Africa	*APAC* Asia–Pacific
Network Technologies	Fixed Networks	Wireless Networks	Spectrum			
Telecoms Software Strategies	Analytics Software Strategies	Customer Experience Management Software Strategies	Operational Transformation Software Strategies	Digital Economy Software Strategies		
Telecoms Software Markets	*Application programmes* Revenue Management	Service Assurance	Customer Care	*Data programmes* Telecoms Software Market Shares		
	Infrastructure Solutions	Service Delivery Platforms	Service Fulfilment	Telecoms Software Forecasts		

For more information including more detail on the programmes and a catalogue of recent publications, visit http://www.analysysmason.com/Research/.