CHAPTER 1.5

Competitiveness and Information and Communication Technologies (ICTs) in Africa

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As African governments seek to liberalize their economies and integrate them more closely into the global economy, their industrial performance increasingly depends on the competitiveness of the firms serving their markets—both local and foreign-owned. Firm-level competitiveness will define the ability of African economies to grow, create new jobs, and increase exports. Competitiveness is vital across all sectors of the economy: African firms face intensifying competition both in their domestic markets and as abroad.

Competitiveness and ICTs

Becoming competitive does not mean cutting wages or environmental standards, avoiding taxation, or seeking subsidies. All these strategies have been adopted by different countries in the past, but the advantages they confer are at best transient. Rather, becoming competitive means adopting long-term strategies to raise efficiency, boost skill and technology levels, and move into higher-value products. Information and communication technologies (ICTs) are critical for Africa's growth. They enable the fast and efficient communications across different countries and different continents that are vital for success in today's global economy. Not only that, but ICT products are themselves part of the higher-value, high-tech products that are growing fastest in international trade and that can sustain faster growth of incomes. ICTs are essential for creating new skills and generating growth and technological change across the whole economy—from agriculture to finance, construction, and modern services. It is this dual role of ICTs—as enablers of competitiveness and as a key sector in their own right—that makes them vital for the overall competitiveness of nations.

This chapter of the *Africa Competitiveness Report 2007* examines the policy and regulatory landscape that is the foundation for the rapidly improving ICT infrastructure in Africa. Although African governments have already done much to liberalize telecommunications markets (as discussed in the next section), encourage investment, and promote the technological readiness vital to firms' survival, more remains to be done. Incentives are needed to build local capabilities and help make local firms become more competitive. As discussed in the following section, African firms and telecommunications operators are not waiting for government, however—they understand the importance of technology and, in many cases, they are forging ahead and introducing new communication technologies. The chapter goes on to examine the deployment of next-generation technologies in the continent, including third-generation (3G) telephony, broadband Internet, and Voice over Internet Protocol (VoIP).

Indeed, far from being isolated in the global economy, some African firms are already participating in the forefront of technological developments and investment

opportunities. One of the striking features of the recent boom in mobile communications is that it is largely African firms—such as MTN, Orascom, and Celtel—that are capitalizing on the new investment opportunities. The boom is as much homegrown as it is based on foreign investment, and is therefore likely to prove more sustainable than previous rounds of investment in the continent.

The challenge for Africa is not whether to integrate into the global economy—that is now a given—but how to become competitive within an integration process that is already taking place. Competitiveness can best be achieved through public-private partnerships between firms and government to promote the take-up of new technologies and development of new skills. This chapter provides some insights into how this could be achieved.

Intuitively everyone can appreciate the speed, capabilities, and power of computers or instant messaging (even if this power is not always realized!). Historically, however, economists have struggled to prove causation between the adoption of ICTs and improved productivity and economic growth. As Robert Solow famously remarked, "you can see computers everywhere but in the productivity statistics." Most studies originating in the United States on the relationship between ICTs and productivity have typically used static growth accounting models to analyze pre- and post-1995 productivity data relative to the number of computers or mainlines (1995 being an arbitrary cut-off point roughly corresponding to more rapid growth of the Internet in Organisation for Economic Co-operation and Development, or OECD, countries).[1] Depending on whether cross-country regressions or case studies are used, on the variables and time period studied, on the definition of the ICT sector, and on the way endogeneity is treated, results can differ widely.

There are at least two reasons why the wealth of research in this field has failed to yield a consistent answer. Regressions have mainly focused on growth in the *number* of computers or fixed telephone lines and have generally failed to take into account the network effects from connecting ICT devices together (which are likely to be sizeable). Furthermore, due to the massive growth in power and speed of ICTs over the last decade, there are likely to be not just one, but several, structural discontinuities in the time series data—that is, data for growth and productivity data for the last decade are being related to "computers" that are fundamentally different from the computers of the early or even mid 1990s. Despite these problems, Fuss and Waverman (2005) note that there is broad consensus that technical advances in the Information Computer (IC) and Telecommunications (T) sectors have led to large direct and indirect benefits to economic growth and productivity. These advances allow for spillover effects and find some support for modern, high-capacity telecommunications networks and increased deployment of computers having a positive impact on productivity.[2]

In Africa, mobile phones are the most widely used form of communications technology (see the later section of this paper on the private sector), so the debate surrounding the macroeconomic impact of computers in the United States and Europe may be less relevant. Waverman et al. (2005) examined the specific growth impact of mobile phones for both developed and developing countries and found a significant growth impact of mobiles that is twice as important for developing countries as it is for developed ones.[3] Moreover, they found an important "critical mass effect" whereby ICTs have a greater impact on productivity and growth the closer the economy is to near-universal service. Waverman et al. (2005) suggest that their amplified impact on productivity may be due to synergy and network effects. Despite some conflicting results (mainly because of the rapidity of technological change), ICTs have been found to improve productivity in several studies, and, more specifically, mobile phones have been found to have a positive growth impact in some African countries.

What role for governments?

Traditionally the role for government in ICTs in Africa has been a very direct one: owner and operator of the incumbent public telecommunications operator. This is now shifting as African governments seek, instead, to promote competitiveness by establishing a sound policy framework and stable institutions, some of the defining factors of competitiveness set out in Chapter 1.1.[4]

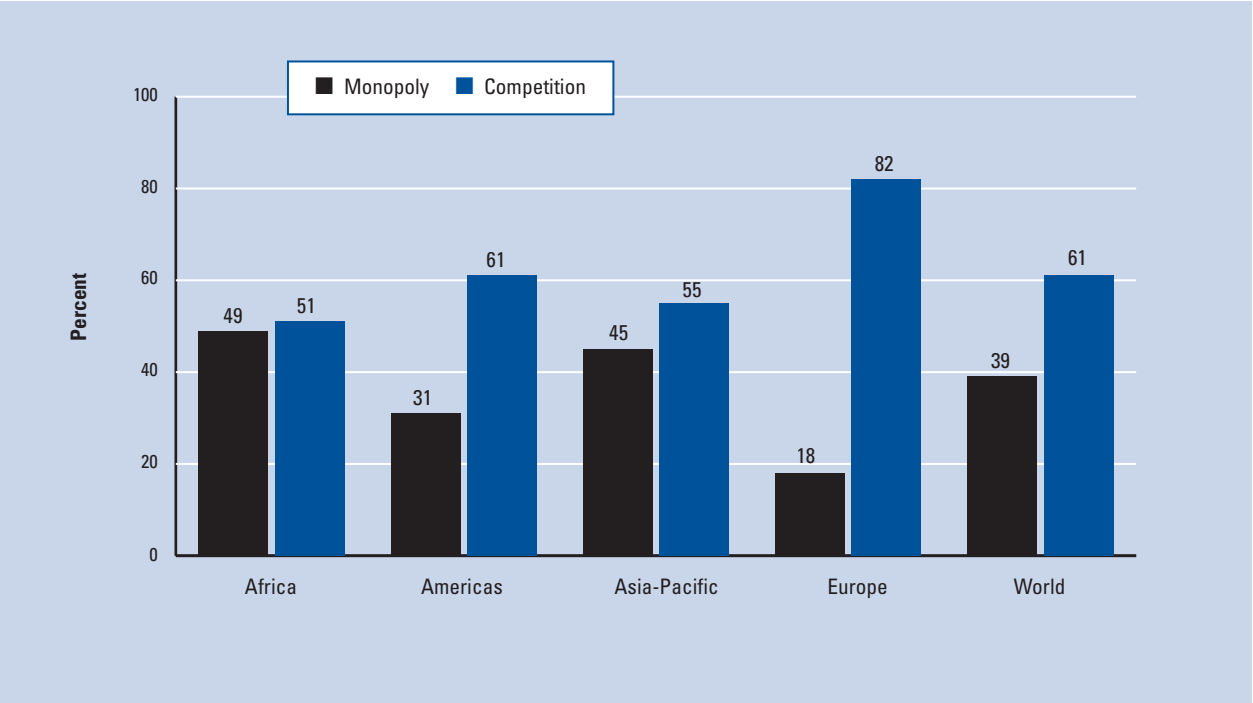
Market liberalization

In the increasingly integrated global economy, many African governments have committed to open up their domestic telecommunications market and introduce competition. Half of all Africa's fixed-line markets are now subject to competition (Figure 1a) and nearly half have private-sector participation in their ownership structure (Figure 1b). The first privatizations of African incumbents took place in 1995–97, with a second round in 2000–01. Today 25 African incumbents have been wholly or partially privatized. Nevertheless, by comparison with other regions, Africa remains the continent with the highest number of monopoly service providers and the lowest proportion of privatized incumbents worldwide.

African mobile markets are more competitive than fixed markets (Figure 2a) with four-fifths subject to competition in 2006 (Figure 2b). Over the last 10 years,

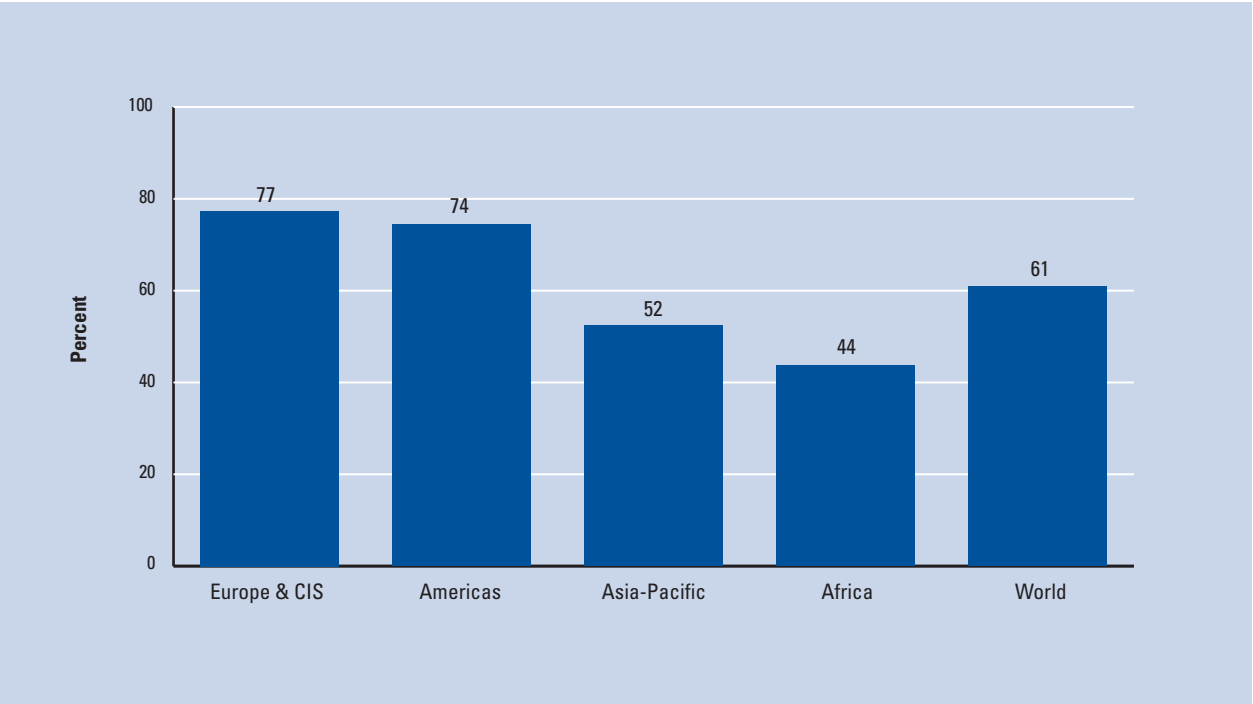
Figure 1: Slow changes in the fixed-line market: Level of competition by region (2005)

1a: Basic services (2005)



Source: ITU World Telecommunication Regulatory Database.

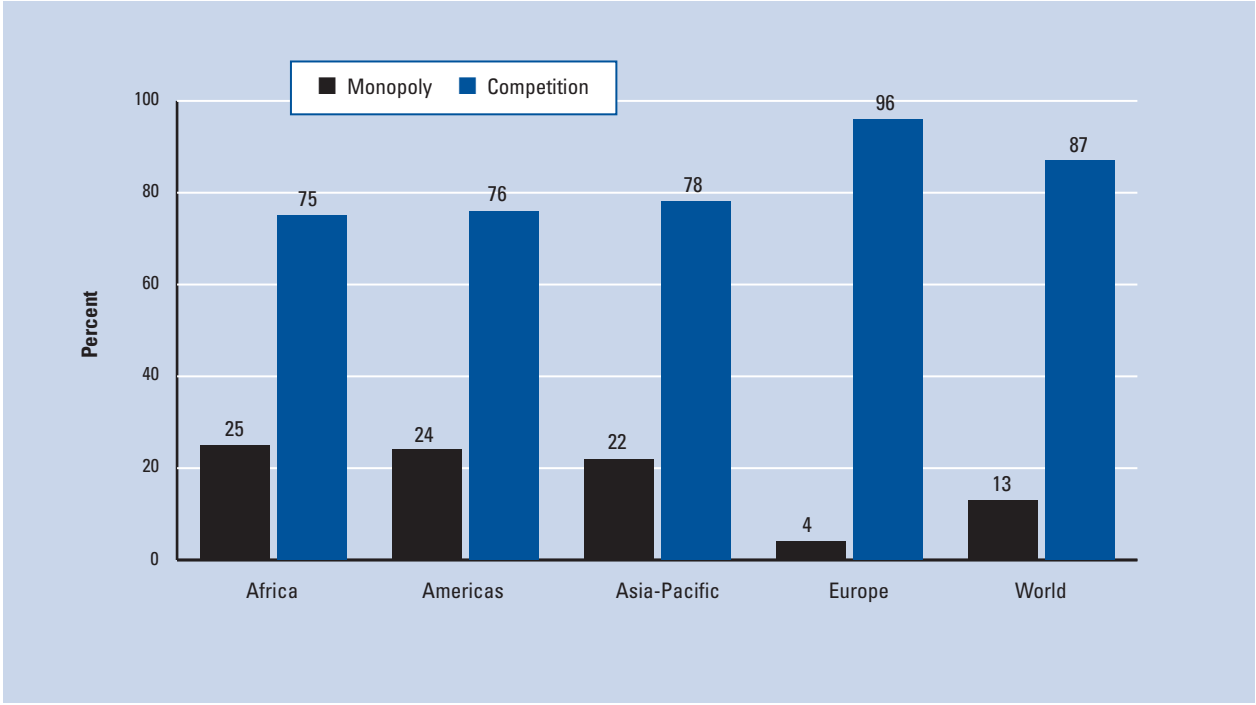
1b: Privatization of incumbent operators by region (2005)



Source: ITU World Telecommunication Regulatory Database.

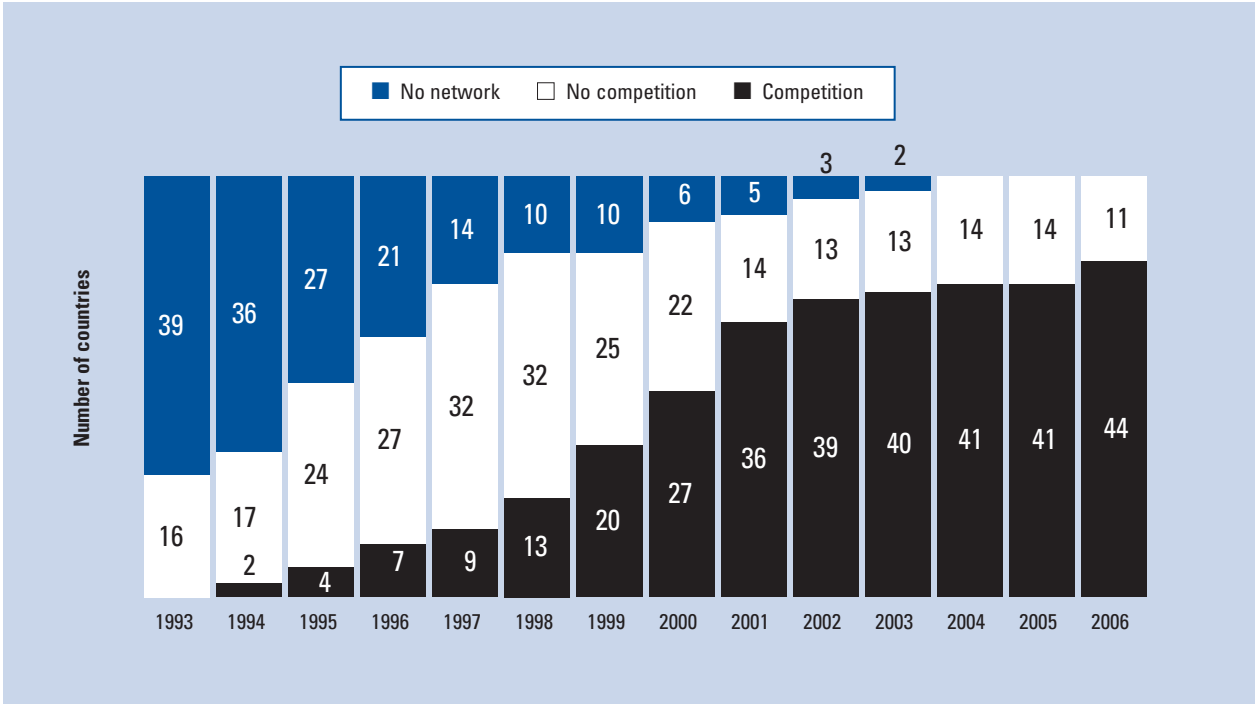
Figure 2: Transformation of mobile markets: Level of competition by region

2a: Mobile services (2005)



Source: ITU World Telecommunication Regulatory Database.

2b: Mobile market structure in Africa (1993–2006)



Source: ITU World Telecommunication Regulatory Database.

mobile operations that started out as extensions of state-owned incumbents have been transformed through:

- licensing additional operators—as happened, for instance, in Nigeria, with the licensing of three mobile operators in 2001;
- sale—for example, the disposal of Telecom Egypt's mobile subsidiary; and
- foreign acquisition—such as Vivendi's acquisition of 35 percent of Maroc Telecom in December 1999.

Recent technological advances are transforming telecommunications markets, however, and changing the nature of competition.[5] On the one hand, the migration from circuit-switched networks to Internet Protocol (IP)-based networks is opening opportunities for new entrants to offer new services and challenge established operators. Niche VoIP service providers squeezing a profit out of the margin between retail and wholesale prices have sprung up in many countries, including Algeria, Kenya, Mauritius, South Africa, Tanzania, and Uganda. VoIP traffic in the "gray market" is an alternative form of competition and is driving significant price reductions in international calls across Africa.

However, control of the international gateways is a critical factor in opening up markets. The majority of African incumbents still have only one gateway operated by the incumbent—as, for example, in the Republic of Benin—with little or no competition at this level. A few countries have led the way in establishing more gateways with licenses for mobile operators—Kenya now has over 10 international gateways in an open market, with cheaper international-call tariffs as a result. Some governments are now pioneering the structural reforms necessary for a sound and vibrant telecommunications market. Far from seeing VoIP as a threat and resisting its advance, countries such as Kenya and Nigeria have opened up their markets to multiple operators and service providers. However, other African countries have also a shown a tendency to backtrack and four of them—Benin, Central African Republic, Sierra Leone, and Zimbabwe—have taken steps to repudiate competitive international gateways in recent months.[6]

Incentives to attract investment and build local capabilities

By themselves, however, market liberalization and regulatory reform are not sufficient. They must be matched by incentives to ensure the absorption of technology and development of local capabilities at the firm level. Local capabilities are even more important in an open setting. Although some countries have succeeded in attracting investment in labor-intensive activities, this advantage is at best transient—low-skilled labor cannot easily cope with rapid technological change. As wages rise, local capabilities must be upgraded and the skills of the workforce must be developed if firms are to remain competitive. Technological readiness is one of the nine pillars of the Global Competitiveness Index (GCI), as discussed in Chapter 1.1.

Governments have adopted a range of measures to promote activities with potential for growth, employment, and technology transfer. Asian governments were among the first to pioneer the use of a wide range of fiscal and export incentives to attract investors, but tax incentives are now popular and widely used, including in Africa. Table 1 lists the tax incentives offered by various developing countries to encourage investment and technological upgrading in specific sectors or regions—often to attract investment in manufacturing, export, and high-tech activities—including ICTs.

Tax incentives are often designed to attract large investors and multinationals, for example, in the incentives offered to firms in Free Zones or Export Processing Zones (EPZs). Domestic tax incentives usually apply mainly to large, listed companies. Small firms are often more responsive to tax incentives, however, because taxes play a larger role in their cost base and they do not have access to sophisticated tax planning. This is especially important in Africa, where small and medium-sized enterprises (SMEs) account for most domestic production. Kheir-El-Din et al. (2000) note that tax exemptions in Egypt applied mostly to free zone enterprises or publicly listed companies on the stock exchange and are enjoyed mainly by large enterprises, hindering the development of capabilities by local firms that is vital for competitiveness.[7]

Many African governments have offered generous incentives targeting high-tech activities. Historically, African countries have tended to rely on tax holidays or exemptions from corporate income tax[8] in contrast to industrialized countries, which have used investment allowances more widely.[9] There is evidence that tax holidays are costly to developing economies and ineffective—Rwanda abolished its tax holiday scheme in line with best practice. Mauritius has a favorable capital allowance scheme with a 25 percent investment allowance on new premises, plant and machinery, and computer software in the first year. Nigeria has also introduced an investment allowance scheme. Egypt has established its Smart Village as a hub for ICT companies to encourage investment in ICT and high-tech sectors. Rwanda's National Information and Communication Infrastructure (NICI) Plan seeks to promote absorption of ICTs by industry (Box 1). International experience suggests that incentives are best offered on the basis of a sectoral approach.[10] Governments can promote competitiveness by designing a framework of incentives supporting higher-tech activities taking into account of the needs of local firms, as well as large investors.

Table 1: Investment tax incentives in selected developing countries

Country	Investment tax credit	Accelerated depreciation (percent per annum)	Sectoral incentives	Export incentives	Regional incentives	Loss carry forward	Tax holidays (in years)	Corporation tax rate (percent)
Botswana	None	Mining + capital allowances	Yes	Duty exemptions	No	5	None	25
Brazil	None	Yes	Yes	Yes	Yes	4	15	34
Ecuador	In tourism	5–10	Yes	Yes	Yes	n/a	20	25
Ethiopia	n/a	Yes	Yes	Yes	Yes	3–5	1–5	35
Ghana	None	5–20	Yes	Yes; less CT in NTE	Yes (–25/–50%)	5	5–10	30–32.5
Kenya	None	Yes	Limited	Yes	No	Unlimited	10	30–37.5
Korea	6–10%	Yes	Yes	Yes	No	3	5	15–25
Lesotho	None	5–25	Yes	Yes	No	n/a	None	15–35
Mauritius	10%	Yes	Yes	Extensive	No	Unlimited	0–10	15–25–35
Mexico	19–25%	Yes	Yes	Yes	Yes	4	None	34
Nepal	None	5–25	Yes	Yes	Yes	n/a	5–10	20–30
Nigeria	5–20%	No	Yes	Yes	No	4	3–5	30
Peru	None	3–20	Yes	Yes	Yes	4	None	27
Philippines	75–100%	No	Yes	Yes	No	n/a	4–5	32
Rwanda	None	5–50	Yes	Yes	Yes	5	None	30
Singapore	33.3–50%	Yes	Yes	Yes	No	Unlimited	5–10	20
Sri Lanka	None	Yes	Yes	Yes	Yes	6	5	30
Tanzania	None	25–100	Yes	Yes	Yes	5	2–5	30
Uganda	None	5–20	Yes	Yes	Yes	Unlimited	10	30

Source: Biggs 2007, adapted from El-Samalouty 2000 and UNCTAD Investment Policy Reviews.

Note: Corporation tax rates are sourced from investment promotion agency websites and from KPMG, available at www.in.kpmg.com/pdf/2003CorporateTaxSurveyFINAL.pdf. @http://www.investzanzibar.org/IPA_Information.asp?hdnGroupID=3&hdnLevelID=9&hdnlocaleid=1; Ethiopia CT rate from http://www.eatic.org/media/powerpoint/eia_presentation.ppt#297,6,Slide 6. n/a, not available.

Box 1: Rwanda: An inclusive ICT policy

Rwanda's Government has developed a National Information and Communication Infrastructure (NICI) Plan as its ICT strategy for the next 15 years until the fulfillment of Vision 2020. The Plan aims to transform Rwanda from an agricultural economy to a predominantly information-rich, knowledge-based economy.

The Plan has a dual focus:

- to build an export-oriented ICT industry; and
- to use ICTs to boost development in areas such as agriculture, government public service, the private sector, and social services such as education and health.

The Government has established a Rwanda Information Technology Authority (RITA) to oversee the implementation of the Plan. The agency aims to create pro-ICT development by pairing local ICT companies with international players and other initiatives, including:

- supporting the development of a low-cost computer for domestic use and export;
- translating software to Kinyarwanda, the local language;
- working with international IT companies, such as Cisco and Sun, to develop training facilities;
- examining the feasibility of building a national fiber optic backbone to connect public agencies and support e-government applications; and
- developing public Internet access facilities.

In terms of supporting structural reforms, Rwanda privatized its incumbent telecommunications operator Rwandatel in 2005, when it sold 99 percent of shares in Rwandatel to Terracom, a private investor, the highest proportion of private ownership of any incumbent operator in Africa. Terracom boosted Rwanda's broadband subscribers from a mere 22 to some 700 in its first eight months of operations and has now embarked on a fiber expansion, laying a national backbone from the capital Kigali to the Ugandan and Burundi borders.

What role for the private sector?

The growing "information intensity" of modern manufacturing means that a range of modern technologies and skills are needed by firms.[11] The ability to use new ICTs effectively is now common to all activities. In industrialized countries it is the private sector (mainly manufacturing enterprises) that has been the main source of innovation and new technologies.[13] In Africa, the private sector is also investing to offer modern communications to African firms and consumers. However, private-sector investment does not occur in a vacuum. As we have seen, governments can establish an enabling environment for investment in infrastructure and incentives to encourage local firms to upgrade their business processes and make them more competitive. New and disruptive technologies pose significant challenges for regulation and licensing that can be resolved only by government working in partnership with the private sector.

African firms and telecommunications operators are forging ahead with new services and advanced technologies. Arguably Africa's greatest success story to date in telecommunications is the remarkable spread of mobile telephony throughout the continent. Africa's mobile market has been the fastest-growing of any region over the last five years, and has grown twice as fast as the global market (Figure 3a). Africa took over a hundred years to accumulate 28 million fixed lines: this is an average penetration rate of just 3 lines per 100 inhabitants, and is still below 1 line per 100 inhabitants in many countries. The stunning growth of mobile telephones, led mainly by private operators, means that mobile phones overtook fixed lines in 2001 and now outnumber fixed lines by nearly five to one, with 137.2 million mobile subscribers in 2005. This ratio is even higher in sub-Saharan Africa, where 9 out of every 10 subscribers with access to a telephone are using a mobile one. Mobile penetration doubled from 6.5 per 100 inhabitants in 2003 to 13.1 per 100 inhabitants in 2005. This remarkable growth has been driven by the private sector and is greatest where the mobile market is competitive. Prepaid mobile subscriptions have also been a major factor in mobile growth, with some 92 percent of African subscribers using a prepaid package in 2005.

The top 10 African markets account for over four-fifths of all mobile subscribers on the continent (Figure 3b). One quarter of all cellular mobile subscribers live in South Africa, nearly an eighth in the large Nigerian market, while the four Maghreb countries (Algeria, Egypt, Morocco, and Tunisia) account for a further third of all African mobile subscribers. It is therefore not surprising that operators from these leading countries also feature in the largest top 10 African mobile operators (Table 2). All the remaining African economies altogether account for just over a quarter of subscribers.

During the boom in mobile communications in the last decade, there has been strong competition for investment. Large markets in other developing regions—such as Brazil, India, and Thailand—have proved more attractive to multinational investors than the markets in African countries. As a consequence, African investment opportunities have often been left to African-based investors. This has resulted in the development of strong and resilient operators that are increasingly pan-regional in scope (Table 3). Large strategic investors such as Vodacom, MTN, Orascom, and Millicom have been able to transfer the skills and experience gained in their home markets to other operations across Africa. In 2005, the seven largest investors accounted for over half (53.3 percent) of all African mobile subscribers (Table 3). These operators have witnessed astounding growth in both subscribers and revenues. They remain mostly focused on Africa, but this has not stopped Orascom or MTC (Kuwait's incumbent, which owns Celtel) from expanding by organic growth and acquisition throughout the Middle East. Now, these investors are starting to look beyond their traditional markets.

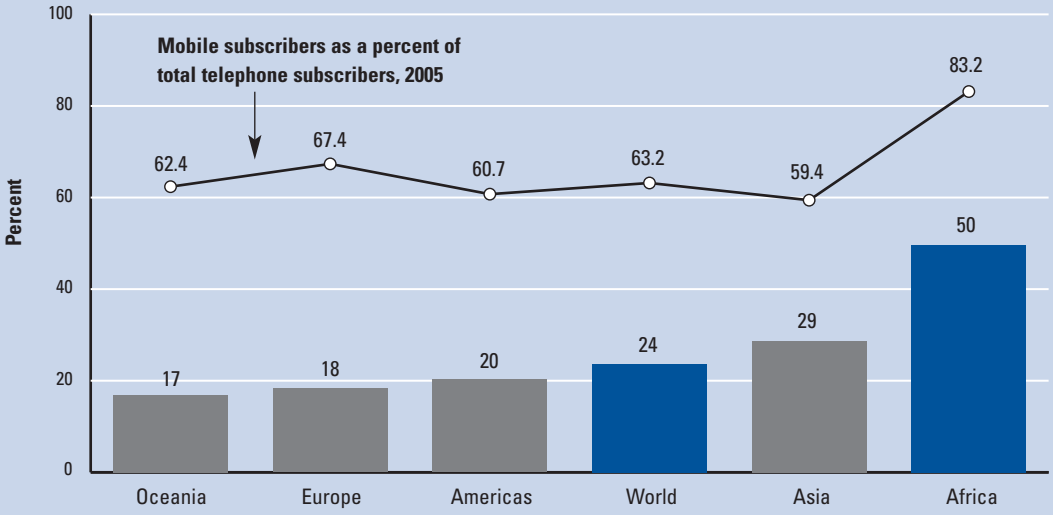
Unlike some operators, these African strategic investors are not saddled with debts from 3G license fees and are free to follow a high-volume, lower-margin strategy. They are now pioneering innovative new services (including mobile banking and instant messaging), payment methods, and pricing models. Celtel, for example, has established "One Network" and has abolished roaming charges for customers traveling between Kenya, Tanzania, and Uganda. Subscribers can buy airtime in different currencies and transfer it across borders. Celtel has, in effect, created a borderless market for mobile telephony. In 2006, MobiNil introduced an off-peak tariff, per-second billing, and online payment using credit cards.

The mobile market in Africa has been a significant contributor to expanding access opportunities to a vast majority of its population. Unlike some mature markets, the African mobile industry enjoys enviable rates of growth (as shown by Table 3). Worldwide, the total number of mobile subscribers was 2.17 billion at the end of 2005; this is projected to surpass 3 billion by late 2007 and to reach 4 billion by 2010 (Figure 4), with 80 percent of new growth expected to come from lower-income emerging markets.[13]

The future growth potential for mobile communications in Africa lies in making mobile telephony more affordable for the huge untapped market of lower-income consumers. Operators that can follow high-volume/low-cost strategies combined with innovative pricing and payment methods stand to make big gains in Africa (as the indigenous strategic investors have proven). Making mobile communications affordable includes reducing both the total cost of ownership (for example, by introducing ultra low cost handsets at around 10 dollars each) and the cash-flow ("cash-barrier") aspects of paying for mobile subscriptions. If operators can match payment to incomes through micro-financing, shared

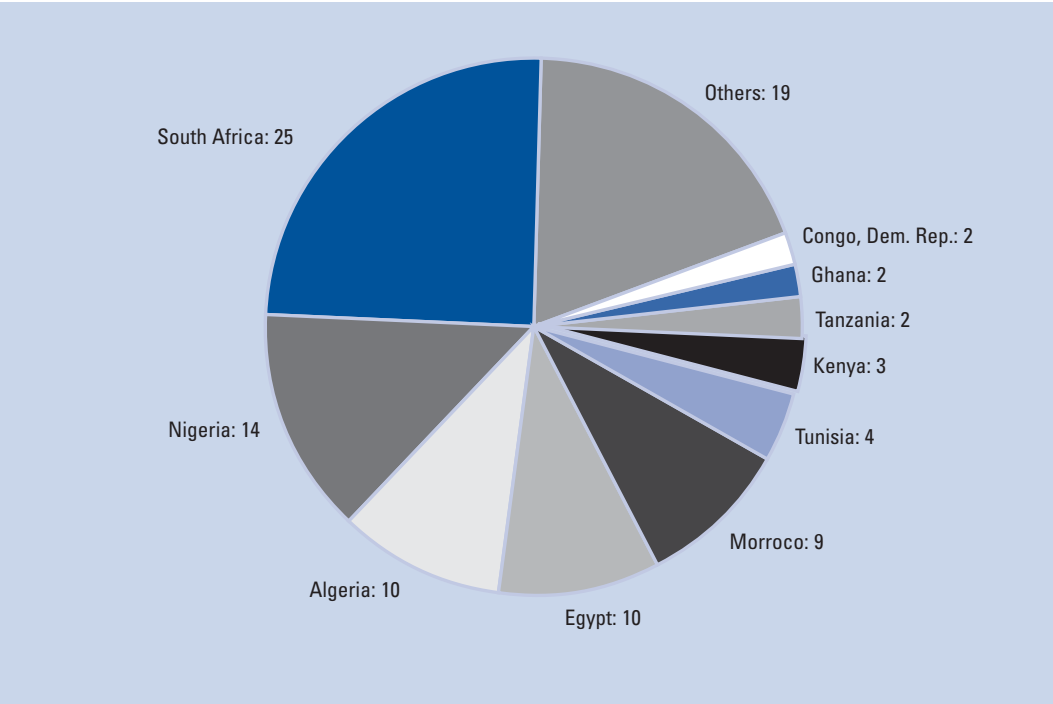
Figure 3: African mobile markets

3a: Annual average growth in mobile network subscribers: Compound Annual Growth Rate, by world regions (2000–05)



Source: ITU World Telecommunication Indicators Database.

3b: Ten largest mobile markets, percent (2005)



Source: ITU World Telecommunication Indicators Database.

Table 2: Top 10 mobile operators in Africa

	Operator	Subscribers 2006	Percent change 2005–06	Revenue (US$ millions)	Percent change 2005–06	Yearly average revenue per user (US$)*
1.	Vodacom (South Africa)	19,200	+49	$4,870	+24	$261
2.	Maroc Telecom (Morocco)	10,710	+30	$1,640	+15	$153
3.	MTN Nigeria	10,376	+24	$1,460 (2005)	+9	$76 (2005)
5.	MTN (South Africa)*	10,235	+30	$2,780 (2005)	n/a	$320
4.	MobiNil (Egypt)	9,267	+38	$920 (2005)	+18 (2004–05)	$142
6.	Vodafone Egypt	6,615	+60	$1,019	+35	$170
7.	Méditel (Morocco)	5,155	+28	$533	+7	$103
8.	Tunisie Telecom (Tunisia)	3,265	n/a	$940 (2004)	n/a	n/a
9.	Cell C (South Africa)	2,900	+34	$862	+33	$297
10.	Safaricom (Kenya)	2,512 (2005)	+64 (2004–05)	$355 (2005)	+43 (2004–05)	$141

Source: ITU, from company reports.

* Based on ITU calculations, not operators' official figures. n/a, not available.

Table 3: Africa's mobile strategic investors

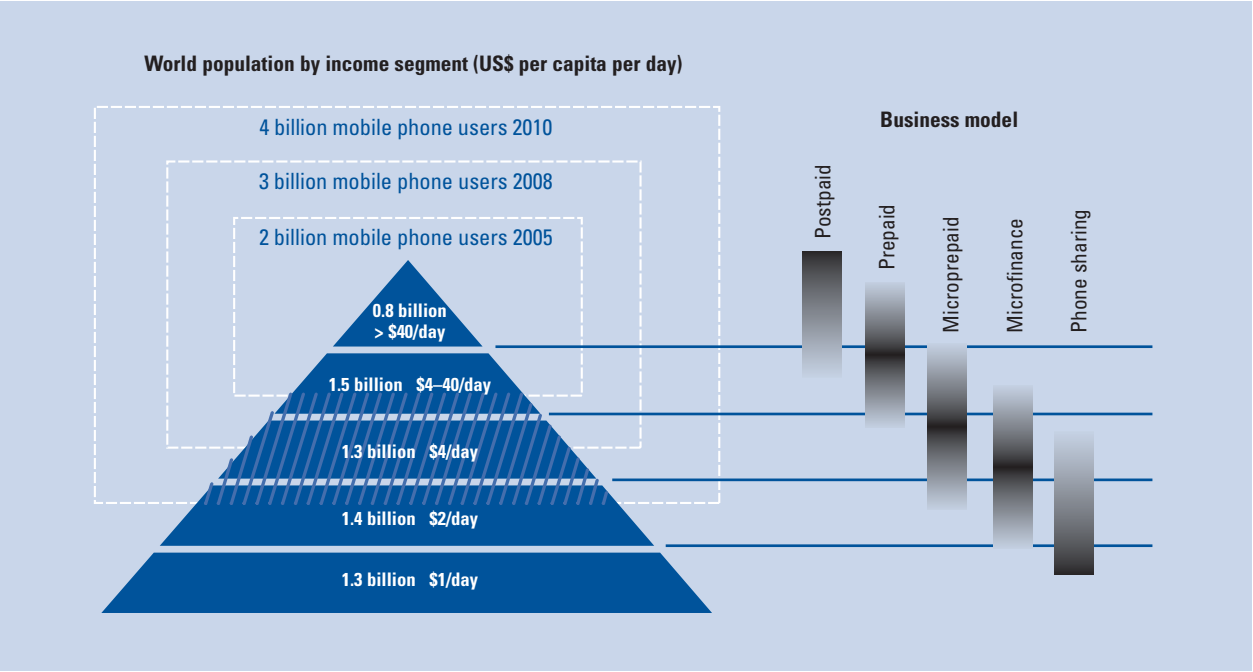
Strategic investor	Subscribers (000s) 2006	Subscribers (000s) 2005	Percent change 2005–06	Revenue (US$ millions)	Percent change	Yearly average revenue per user (US$)*	African countries where the investor has operations
MTN	24,300 (Mar 2006)	15,600 (Mar 2005)	+56	$4,545 (Mar 2005)	+21	$291	Benin, Cameroon, Côte d'Ivoire, Congo, Ghana, Guinea, Guinea-Bissau, Liberia, Nigeria, Rwanda, S. Africa, Swaziland, Sudan Uganda**
Vodacom	23,520 (Mar 2006)	15,483 (Mar 2005)	+52	$5,328 (Mar 2006)	+25	$227	Congo, Dem. Rep., Lesotho, Mozambique, Mauritius, South Africa, Tanzania
Orascom	21,128 Africa (total 46,522)	17,500 (total 30,383)	+53 (total)	$3,216	–0.3	$69	Algeria, Egypt, Tunisia, Zimbabwe***
Celtel	15,270 (Sept 2006)	5,375 (Sept 2005)	+184	$953	+60	$62	Burkina Faso, Chad, Congo, Congo, Dem. Rep., Gabon,Kenya, Niger, Nigeria, Madagascar, Malawi, Sierra Leone, Sudan, Tanzania, Uganda, Zambia
Orange	n/a	5,188 (Sept 2005)	n/a	n/a	n/a	n/a	Botswana, Cameroon, Cote d'Ivoire, Egypt, Equatorial Guinea, Madagascar, Mali, Mauritius, Reunion, Senegal
Millicom	12,800 (Sept 2006)	8,929 (Sept 2005)	+43	$1,084	+6	$85	Chad, Congo, Dem. Rep., Ghana, Mauritius, Senegal, Sierra Leone, Tanzania
Etisalat	n/a	4,534	n/a	$3,512	+23 (2004/5)	$775	Benin, Burkina Faso, Central African Rep., Cote d'Ivoire, Gabon, Niger, Sudan, Tanzania, Togo****
TOTAL	**97,018**	**72,609**	**N/A**	**$18,638**	**+18**	**$145**	

Source: ITU, abridged from company reports.

Note: n/a, not available.

* Based on ITU calculations, not operators' official figures.
**Also Syria and Yemen.
*** Also Bangladesh, Iraq, and Pakistan.
**** Also Pakistan, Qatar, Saudi Arabia and the United Arab Emirates.

Figure 4: Evolution of projected business models to reach low-income consumers (2005–10)



Source: Granath, 2007.

phones, and micro-prepaid schemes with low-denomination top-up cards and balance transfers between subscribers, then rapid growth and large profits can made in the African market. Furthermore, because of the poorly developed state of the personal finance sector in Africa and the low level of credit card ownership, there are tremendous opportunities also for mobile operators in exploring new financial services, such as m-commerce, banking, and Internet access over mobile phones.

For ICTs to have a significant impact on competitiveness, it is not sufficient to simply make information available to firms, factories, farmers, and new users—the information must be put to good use. In this respect African operators are experimenting with new information services to improve productivity and eliminate intermediaries. TradeNet, a software company in Ghana, has unveiled a simplified form of eBay over mobile phones for agricultural products across more than 10 countries in West Africa. Buyers and sellers post information about what they are after along with their contact details, which are then circulated to "matched" subscribers using Short Message Service (SMS) text-messages in several languages. Interested parties can then contact each other directly to do a deal. Similar projects are underway to provide daily price information for fruit and vegetable exports in Burkina Faso, Mali, and Senegal.[14] Such initiatives can improve the flow of business information and help reduce costs and boost profits.

Next generation mobile and Internet access

Although access to mobile communications and the Internet are vital to the competitiveness of Africa's firms, in the future the ability to upgrade to high-speed or broadband access will enable them to compete most effectively in the global market.

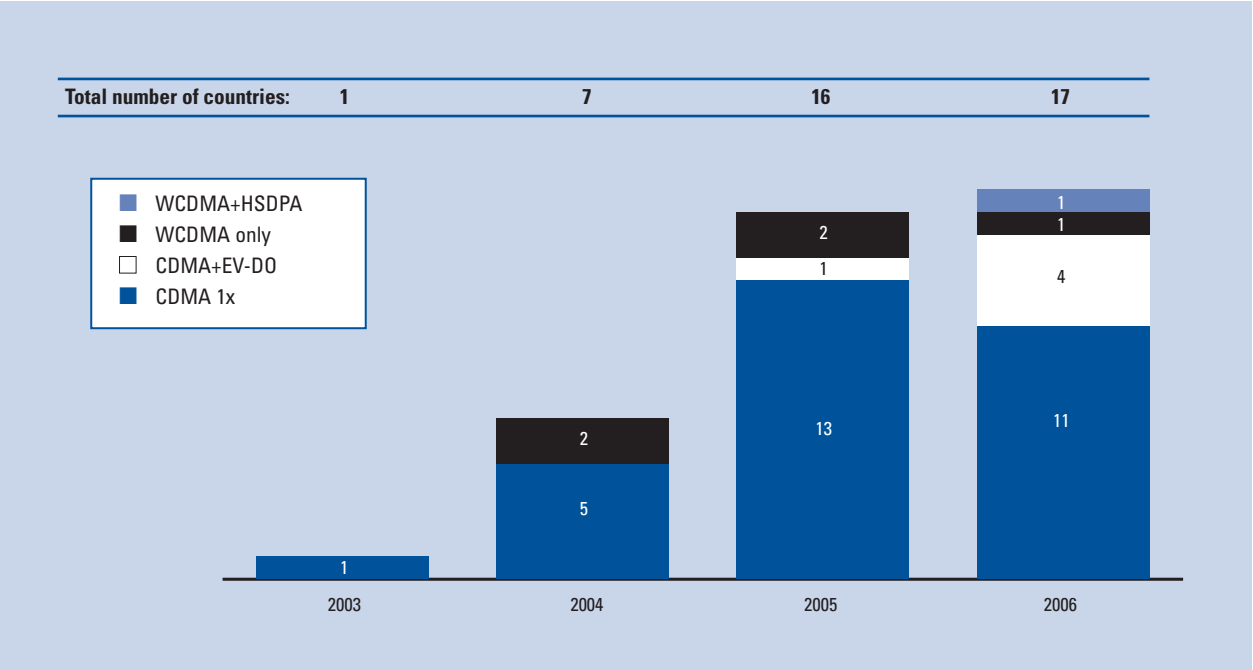
3G mobile networks

Given Africa's head start in mobile telephony, broadband Internet access is more likely to be delivered over a mobile platform than over a fixed line. Third-generation (3G) mobile services with higher transmission speeds and enhanced data services promise a range of new applications for users and new revenues for operators. ITU recognizes the following 3G services as compliant with the IMT-2000 family of standards:

- Wideband Code Division Multiple Access (W-CDMA), which can reach maximum data download speeds of 2 Mbps when fully implemented. This is sometimes known as UMTS or 3GSM in Europe.

- High Speed Downlink Packet Access (HSDPA), an upgrade to W-CDMA allowing a theoretical peak downlink rate of 14.4 Mbps, although this rate is not currently widely available on commercial handsets.

Figure 5: African countries with IMT-2000 (3G) networks (2003–06)



Source: ITU.

- CDMA 2000 1x, which delivers speeds of up to 144 kbps. This does not qualify as "broadband" as it is below the threshold speed of 256 kbps.

- CDMA EV-DO (Evolution Data Only) enhances 1x speeds up to 2.4 Mbps.

- Time Division Synchronous CDMA (TD-SCDMA), which has not yet been commercially launched, but may be the preferred choice for 3G systems in China.

3G services have been commercially available since 2001 worldwide and in Africa since 2003, when the first Wireless Local Loop (WLL) CDMA 1x networks were rolled out in Nigeria. South Africa and Mauritius launched W-CDMA networks in 2004, with South Africa already implementing an HSDPA network in 2006. A total of 17 African countries now boast IMT-2000 mobile networks (Figure 5). Eleven countries have CDMA 1x networks, while operators in Angola, Côte d'Ivoire, Nigeria, and Rwanda have launched EV-DO networks (Box 2 and Table 4). Further 3G launches are expected in 2007, including Etisalat and Vodafone in Egypt (in Q1 and Q3 respectively)[14] and Vodacom in Tanzania.[16]

Fixed broadband Internet access

Although the major adoption of broadband has been in residential markets, broadband also has a big impact in

Table 4: African countries with 3G (IMT-2000) networks

Economy	Technology	Operator	Launch date
Algeria	CDMA 1x	Lacom	February 22, 2006
		Algerie Telecom	July 15, 2004
Angola	CDMA 1x	Movicel	January 21, 2004
	EV-DO	Movicel	July 31, 2005
Cameroon	CDMA 1x	Camtel	September 15, 2005
Côte d'Ivoire	EV-DO	Arobase	March 15, 2006
	CDMA 1x	Arobase	October 27, 2005
Egypt	CDMA 1x	Telecom Egypt	January 15, 2005
Ethiopia	CDMA 1x	ETZ	December 2, 2004
Ghana	CDMA 1x	Kasapa	September 19, 2005
Kenya	CDMA 1x	Papote Wireless	March 29, 2006
	CDMA 1x	Telkom Kenya	December 15, 2004
Madagascar	CDMA 1x	Telecom Malagasy	August 15, 2005
Mali	CDMA 1x	Sotelma	October 1, 2005
Mauritius	W-CDMA	Emtel	November 15, 2004
Mozambique	CDMA 1x	TDM	July 15, 2005
Nigeria	EV-DO	Starcomms	February 27, 2006
	CDMA 1x	Nitel	July 15, 2005
	CDMA 1x	Bourdex	August 14, 2005
	CDMA 1x	ITN	August 14, 2004
	CDMA 1x	MTS First Wireless	August 15, 2004
	CDMA 1x	Rainbownet	March 1, 2004
	CDMA 1x	Intercellular	February 15, 2004
	CDMA 1x	Starcomms	November 1, 2003
	CDMA 1x	Reltel Nigeria	October 15, 2003
	CDMA 1x	Cellcom Nigeria	September 15, 2003
Rwanda	EV-DO	Terracom	January 23, 2006
	CDMA 1x	Terracom	December 15, 2005
South Africa	HSDPA	MTN	March 29, 2006
	W-CDMA	MTN	June 15, 2005
	W-CDMA	Vodacom	December 19, 2004
Uganda	CDMA 1x	MTN Uganda	November 24, 2004
	CDMA 1x	Uganda Telecom	May 15, 2004
Zambia	CDMA 1x	Zamtel	September 15, 2006

Source: ITU, adapted from 3GToday and GSM Association, start 2007.

Box 2: Nigeria: Licensing to create a dynamic market

At the turn of the century Nigeria had one of the most backward telecommunications networks in Africa. It had just half a million fixed lines and had still not surpassed the symbolic milestone of one fixed line per 100 inhabitants; waiting times stretched to years and connections were unreliable. The analogue mobile system was very limited and not available outside the main urban areas. In response to the growing need for telecommunications and a modern infrastructure, Nigeria launched the National Telecommunications Policy (NTP) in September 2000.

The government issued a round of new licensing, including:

- three mobile cellular licenses in 2001, to MTN, Econet, and the incumbent NITEL;
- a second national operator (SNO) license to Globacom in 2002 for all telecommunications services; and
- more than a dozen local network operator licenses since 2000.

The results have been dramatic. Teledensity has soared—by June 2006 there were almost 26 million fixed and mobile subscribers with a teledensity of over 22 subscribers per 100 inhabitants. Population coverage of mobile networks has increased from a mere 5 percent in 2000 to over 75 percent in June 2006. Nigeria now has some of the most competitive fixed and mobile markets in Africa, with over 20 private operators accounting for nearly three-quarters of the 1.5 million fixed lines in operation at June 2006. Ten operators have launched IMT-2000 compliant CDMA 1x networks (some using Wireless Local Loop, WLL), while the mobile operator Starcomms launched the second CDMA EV-DO network in Africa in February 2006.

This startling growth has not been without problems. Mobile interconnection disputes have arisen and the privatization of the incumbent NITEL has been subject to repeated setbacks. ISPs have complained about access to backbone infrastructure and the high prices charged by NITEL. However, the Nigerian Communications Commission (NCC) has been proactive in dealing with these issues—it established rates to be followed by the mobile industry. In February 2006, Nigeria also became one of the first countries in Africa to adopt a unified licensing approach. In the future the NCC will issue unified licenses, allowing operators to provide multiple services under the terms of a single license. These will streamline and accelerate licensing procedures and enable operators to deploy new infrastructure and services more rapidly.

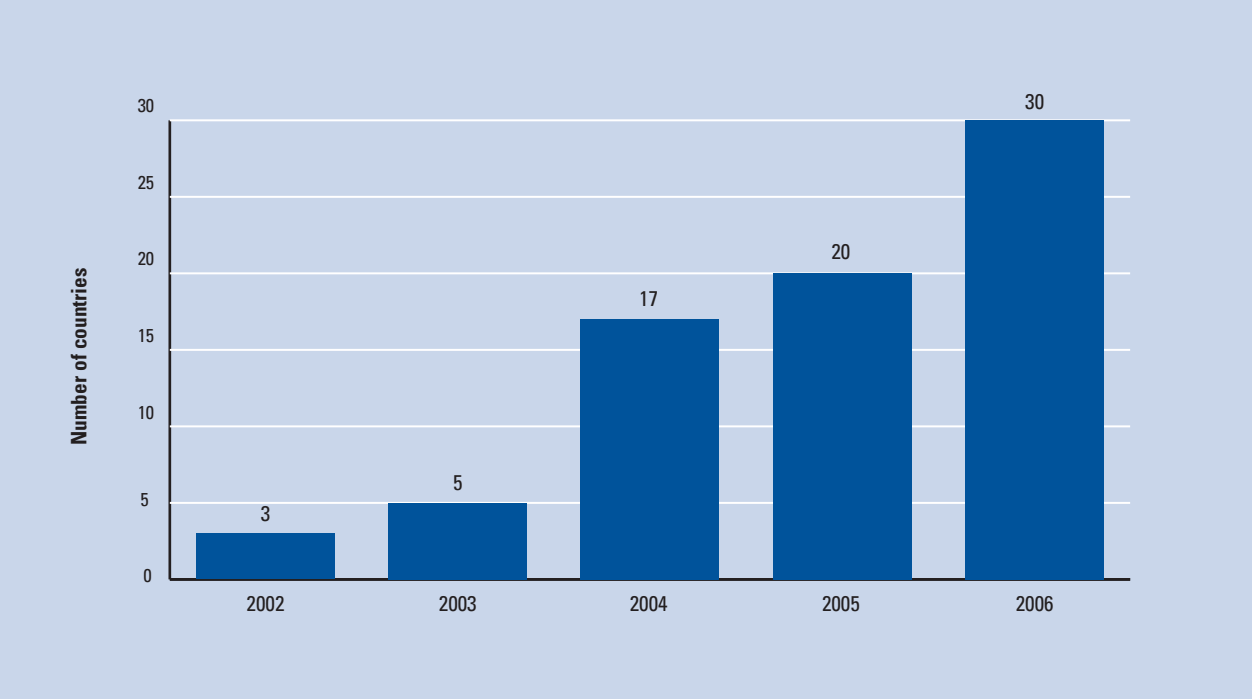
the business sector, where it competes favorably on price with leased-line solutions. Broadband Internet access [17] can give firms access to new markets, improved business information, and e-commerce. In 2002 broadband Internet access was commercially available in three African nations. Today ADSL is on offer in over 30 economies (Figure 6a). ADSL was rolled out in Botswana in mid 2006,[18] in Ghana in March 2006,[19] and is currently being introduced over Libya Telecom and Technology's ATM network.[20] Existing operators are investing in extending coverage outside main urban areas to other provinces. In Rwanda, 700 subscribers now enjoy broadband ADSL service in Kiyovu and Terracom is laying fiber in other main towns throughout the country, with ADSL services rolled out in Kigali, Gitarama, and Butare in 2006.[21] Efforts are underway to extend broadband outside main urban areas in Uganda.[22]

Broadband speeds and quality are also increasing in Africa. Advertized maximum speeds are rarely achieved because of a number of factors[23] but average speeds are increasing nevertheless (Figure 6b). In 2003, the maximum speed commercially available was 512 kbps. By 2006, Internet service providers (ISPs) in 18 African countries had launched commercial offers at 1 and 2 Mbps, while the ISP Menara in Morocco offered a 4 Mbps service (Box 3).

Although the high-speed broadband access, vital to modern businesses, is now available in many capital cities and major towns, it comes at a high price. The cost of broadband must be evaluated relative to speed, as higher-speed Internet access costs more. Broadband packages for sub-Saharan Africa show that high-speed Internet access is available in 22 African economies, but only at very high prices. On average, broadband prices in Africa are three times higher than they are in Asia (see Figure 8b). However, at least 10 African countries now offer broadband at below US$15 per 100 kbps per month (Table 5). Broadband is available at semi-reasonable prices in most North African countries (Morocco, Egypt, and Tunisia), as well as in Mauritius and South Africa. In Senegal the low price of broadband has encouraged Internet subscribers to migrate to Digital Subscriber Lines (DSL), with 40 percent of all Internet subscribers accessing the Internet over DSL in 2004.[24] In Morocco, the launch of comparatively high speed offers has encouraged broadband subscribers to upgrade to higher speeds (Box 3). However, even these prices far exceed typical European and Asian prices and, in the rest of Africa, broadband access (frequently leased-lines in disguise) can cost hundreds of dollars per month, beyond the reach of most small firms and individuals. The effect in terms of skills and training cannot be understated—teenagers in Europe spend many hours online exploring the virtual world and developing IT know-how. Most African teenagers cannot afford the

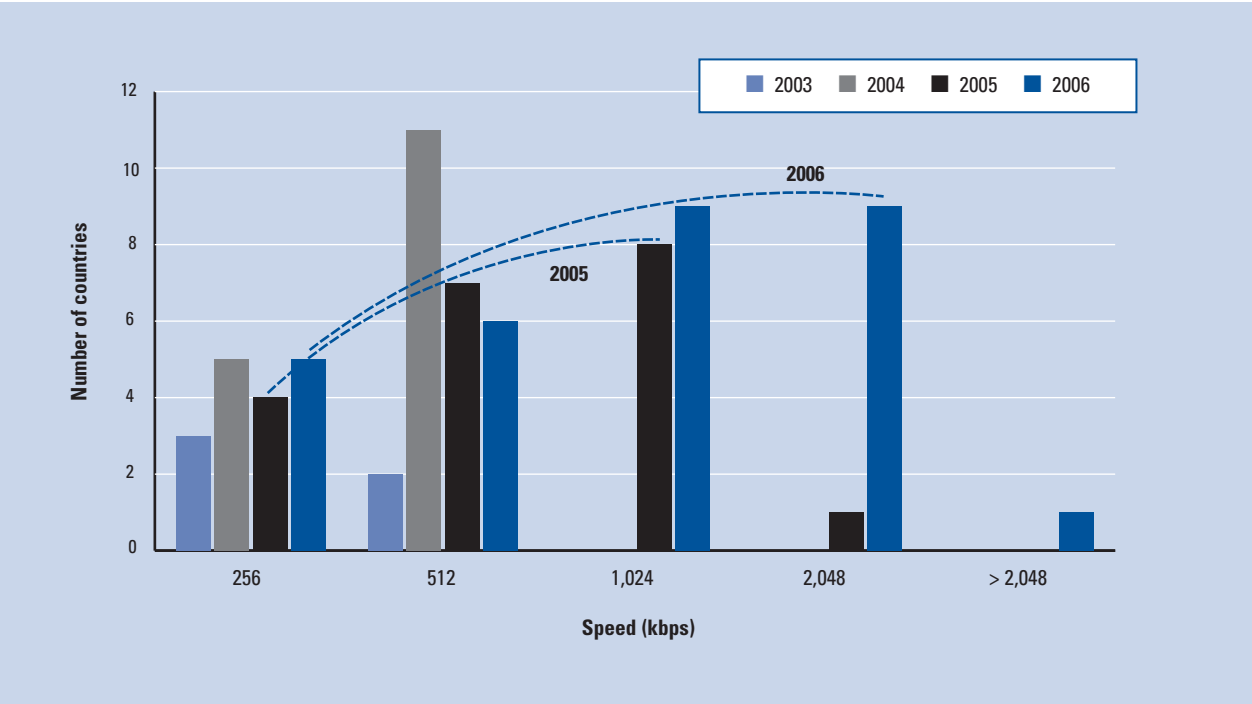
Figure 6: Growth in availability of broadband and broadband speeds in Africa

6a: African countries with broadband (2002–06)



Source: ITU.

6b: Growth in maximum speeds for fixed broadband available in Africa (2003–06)



Source: ITU.

Table 5: Ten African countries with lowest broadband prices

In order of cheapest broadband Internet access (US$ per 100 kbps per month)	Economy	Internet service provider	Speed in kbit/s (high – low)	Subscription price per month (US$)	Price (US$) per 100 kbps per month
1	Morocco	Menara	256 – 4,096	89.21	2.18
2	Egypt	Soficom	1,024 2,048	124.36	6.07
3	Madagascar	Wanadoo	256	21.40	8.36
4	Senegal	Sentoo	512 – 1,024	43.59	8.51
5	Botswana	BTC	256 – 768	75.22	9.80
5	Mauritius	Telecom Plus	512 – 1,024	51.96	10.15
7	South Africa	Telkom	384 – 1,024	125.24	12.24
8	Sierra Leone	Limeline	1,024 – 2,048	295	14.40
9	Tunisia	Hexabyte	256 – 512	37.52	14.66
10	Côte d'Ivoire	Aviso	256 – 2048	301.85	14.74
	Africa average	**various**	**806**	**n/a**	**205.63**
	World average	**various**	**1,958**	**n/a**	**76.57**

Source: ITU.

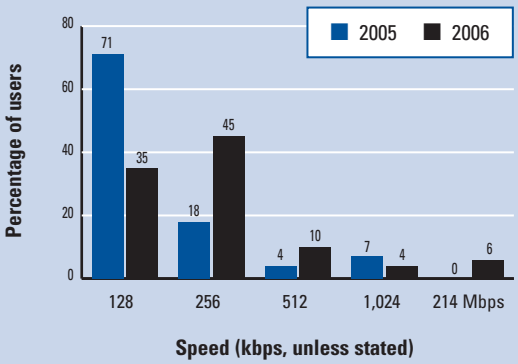
Note: Prices sampled in July–August 2006. There was an offer in Réunion with a price of US$3.94 per 100 kbps in 2006, but is not included here as it is not a sovereign state in its own right. n/a, not available.

Box 3: Morocco: An African success story

Morocco initiated market liberalization relatively early. In mobile communications, it licensed a second mobile operator, Médi Telecom, as early as July 1999. In December 1999, it sold 35 percent of its incumbent, Maroc Telecom, to Vivendi of France. Intense competition between the two operators led to mobile phones overtaking fixed lines in August 2000, just six months after the second operator had launched its network. By June 2001, Médi had 755,000 customers and a population coverage of 70 percent. Not to be surpassed, Maroc Telecom responded by investing US$275 million in its network and innovating in its price strategy. It achieved a client base of 1 million customers in June 2000, 2 million in November 2000, and 3 million by May 2001. The growth in Morocco has significantly surpassed that of all its North African neighbors.

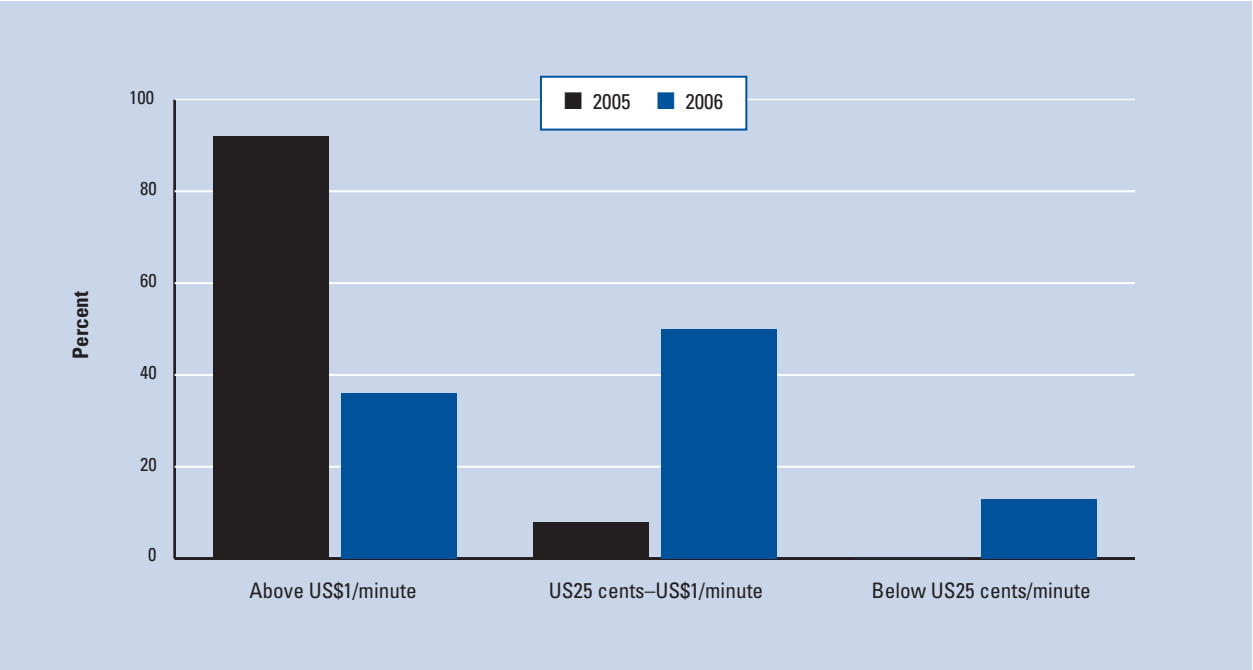
Some of the same dynamism is now reaching the Moroccan Internet market. Helped by Morocco's proximity to fiber networks in the Mediterranean, Maroc Telecom and the ISP Menara have launched a range of high-speed packages at comparatively low prices, including the highest speed broadband package in Africa at 4 Mbps. Surveys of the residential market carried out by the regulator, the National Agency of Telecommunication Regulation (Agence Nationale de Régulation des Télécommunications or ANRT), show that broadband connections are moving to progressively higher speeds. With nearly 400,000 ADSL connections at the end of 2006, Morocco is the top country in Africa in terms of the total number of broadband subscribers, well ahead of South Africa (although Mauritius had the highest broadband penetration). Broadband now accounts for 98 percent of all Moroccan Internet connections (including dial-up and leased lines). Broadband connections increased by 58 percent between 2005 and 2006, while dial-up connections actually lost ground, with a 40 percent drop. The future of the Internet in Morocco seems to be assured.

Figure 1: Evolution in the speed of Internet access in Morocco: Proportion of broadband connections by speed (2005 and 2006)



Source: Agence Nationale de Régulation des Télécommunications (ANRT).

Figure 7: African international retail telephone rates (2005 and 2006)



Source: Southwood, 2007.

luxury of experimentation time online, however, and cannot develop these skills.

The limited fixed-line network is proving a barrier to more extensive broadband access in some countries, especially in areas outside the major cities. To overcome the lack of underlying infrastructure (including copper telephone lines and coaxial television cable), wireless technologies hold real promise for spreading broadband access. Broadband Internet access is most likely to be achieved through 3G, as mentioned previously. Wi-Fi (or, more correctly, Wireless Local Area Networks based on the IEEE 802.11 series) is proving popular for connecting computers to the Internet, but it has only limited range—typically less than 100 meters. A related technology, WiMAX, is being promoted as a solution for high-speed Internet access because it can cover large distances (theoretically, at speeds of up to 70 Mbps over 50 kilometers). If WiMAX proves to be a commercial success it could provide broadband solutions for many developing countries in and beyond Africa, resulting in competition among DSL and cable providers to provide more affordable prices. However, both the technical standards and the likely spectrum allocations for WiMAX remain uncertain for the moment, although there are a growing number of pilot projects.

Voice over Internet Protocol (VoIP)

Until recently, the carriage of voice services over Internet Protocol–based networks or VoIP (and associated technologies, such as Voice over Broadband) were banned in many African countries, although VoIP technology has been in use in Africa for international calls since at least 1996. Initially incumbents invested in IP-based networks as a way of reducing their costs while maintaining prices. Incumbents sought to exploit profit margins between the falling cost of international minutes at wholesale prices while continuing to sell services at higher Public Switched Telephone Network (PSTN) prices. Today over a quarter of African incumbent operators have international VoIP gateways,[25] but the savings they realize on the cost of calls have not necessarily been passed on in full to customers.

Today retail and wholesale prices have increasingly diverged because of the introduction of competition that has helped push prices down, the use of IP-based networks that has further reduced rates, and the growing demand for international calls—mainly from multinational corporations and overseas workers (see Figure 7). The international calling market has been transformed from a low-volume, high-margin market to a higher-volume, lower-margin market.

New entrants are now undercutting incumbents, offering VoIP services over incumbents' networks or bypassing incumbents' networks altogether through alternative infrastructure. This has led to a large "gray market" in VoIP-based calling, with VoIP service providers exploiting "arbitrage" opportunities and squeezing a profit out of the margin between retail and wholesale prices. Bypass traffic in the gray market is estimated at between one-fifth to one-third of overall

international call revenue in some African markets.[26] African incumbents have even witnessed declines in their annual international traffic volumes and revenues as traffic goes over to the gray market. They are faced with the challenge of watching their traffic disappear into the gray market or adopting fresh strategies to attract traffic back to their networks.

Mauritius was one of the first countries to adopt a licensing regime for VoIP services. Today 36 African governments prohibit VoIP adoption except by monopoly incumbents. Seven African countries have now legalized VoIP services (Algeria, Kenya, Mauritius, Somalia, South Africa, Tanzania, and Uganda), with VoIP in the process of being legalized in a few other countries, such as Ghana and Nigeria. Despite this, Africa and the Arab states are still the regions most resistant to the introduction of IP telephony. VoIP is often legal only for operators holding an international gateway license, and while there are moves to extend these to mobile operators, in many countries currently only incumbents hold international gateway licenses. New second national operators (SNOs), such as Arobase in Côte d'Ivoire, KDN in Kenya, and MTN in Uganda, have established IP-based fiber rings in anticipation of wider VoIP liberalization, but these plans have yet to become fully realized.

International IP infrastructure

It has been argued that IP connectivity will prove as important in the 21st century as roads were in the 20th century or railways in the 19th century.[27] The network of high-speed links for Internet traffic is a critical infrastructure for development and wealth creation. IP networks can carry vast volumes of information in real time and can substitute demand for other types of transport in teleconferencing or long-distance inspection. IP networks will form the basis not only of Internet access and browsing, but also of voice communications (including long-distance mobile voice traffic) and future video communications and entertainment.

For Africa, a continent that missed out on some of the earlier rounds of infrastructure investment, it is crucial not to miss out on the next round. In particular, Africa's future prosperity will depend critically on its integration with the global economy, and this in turn depends partly on its connectivity. At the regional level too, as the post-war experience of Western Europe has shown, greater regional integration, promoted through trade, communication, and migration, can encourage economic and social development.

How well connected is Africa? The data for 2005 show that Africa's 900 million inhabitants (nearly 14 percent of the world's population) had access to 19,512 international circuits (that is, 64 kbps circuit equivalents) at the end of 2005[28]—just 0.16 percent of the global total of 12.2 million international circuits.[29] Indeed, Africa has fewer international circuits than Ireland despite the fact that Africa has more than 200 times as many inhabitants. Furthermore, Africa's lack of connectivity is even more evident when compared with the rapid progress it has made in other ICTs: for instance, in expanding its Internet user base, where Africa accounts for 3.4 percent of the global total, or mobile phone ownership, where Africa is home to 6.2 percent (see Figure 8a).

Such lack of connectivity means that Africa's users are starved of bandwidth. This relative scarcity feeds through into higher prices and slower speeds of connection than in other parts of the world, even among other developing regions. As shown in Figure 8b, Africa's average monthly price for broadband service (US$762 per month) is more than three times higher than the average for Asia and almost six times higher if expressed as a percentage of percentage of GNI per capita.

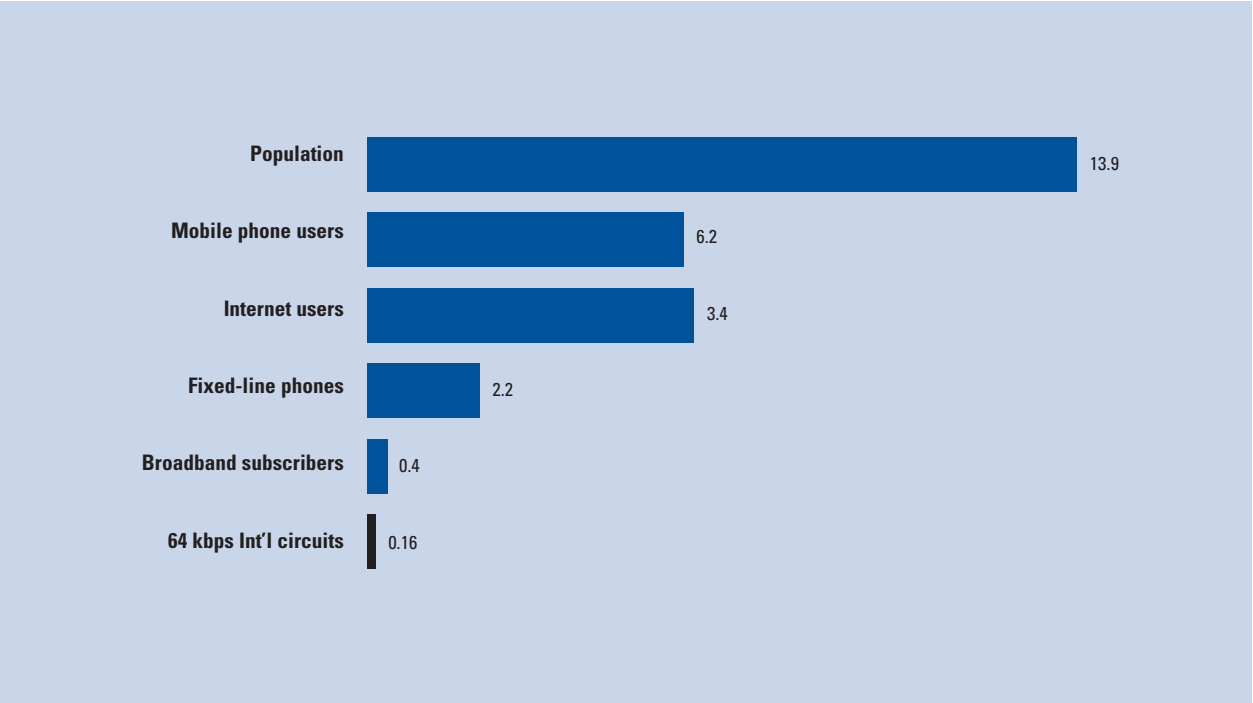
Analysis of Africa's international bandwidth shows that the situation is even worse than it appears. Over a third of Africa's circuits are dedicated to voice telephone traffic, compared with less than 5 percent for Western Europe. This means that a far smaller share of active circuits is available for IP traffic in Africa. Furthermore, whereas in Europe more than 45 percent of the available circuits were "idle" in 2005 (usually reducing prices as a result of overcapacity), in Africa less than 2 percent were idle, meaning that African carriers are poorly prepared to respond to sudden surges in demand. As recently as 2002 around 9 percent of Africa's international circuits were idle at any one time, but the lack of capacity is now becoming critical.

In summary, Africa's communications infrastructure is grossly under-resourced and underinvested by international standards. A recent study by the UK Department for International Development (DFID), for example, identifies 28 countries that are unconnected to an international fiber connection, with a severe negative impact on the competitiveness of African firms and economies.[30] Conversely, this lack of connectivity could represent an exciting investment opportunity that is potentially very profitable. A summary of the major fiber projects that are currently planned is provided in Table 6. Some of these are in the planning stages while others are seeking funding.

If all the projects shown in Table 6 are developed and put into operation, Africa will most likely have the necessary infrastructure to absorb future bandwidth demand. Nevertheless, this is not sufficient to ensure that Africa's carriers and the users of their services will get cheaper prices. Action is needed to stimulate competition and introduce the affordable and high-quality services that are often lacking in markets where transmission capacity is abundant, but this capacity is controlled by monopoly state-owned telecommunications providers.

Figure 8: Bandwidth scarcity and its consequences in Africa

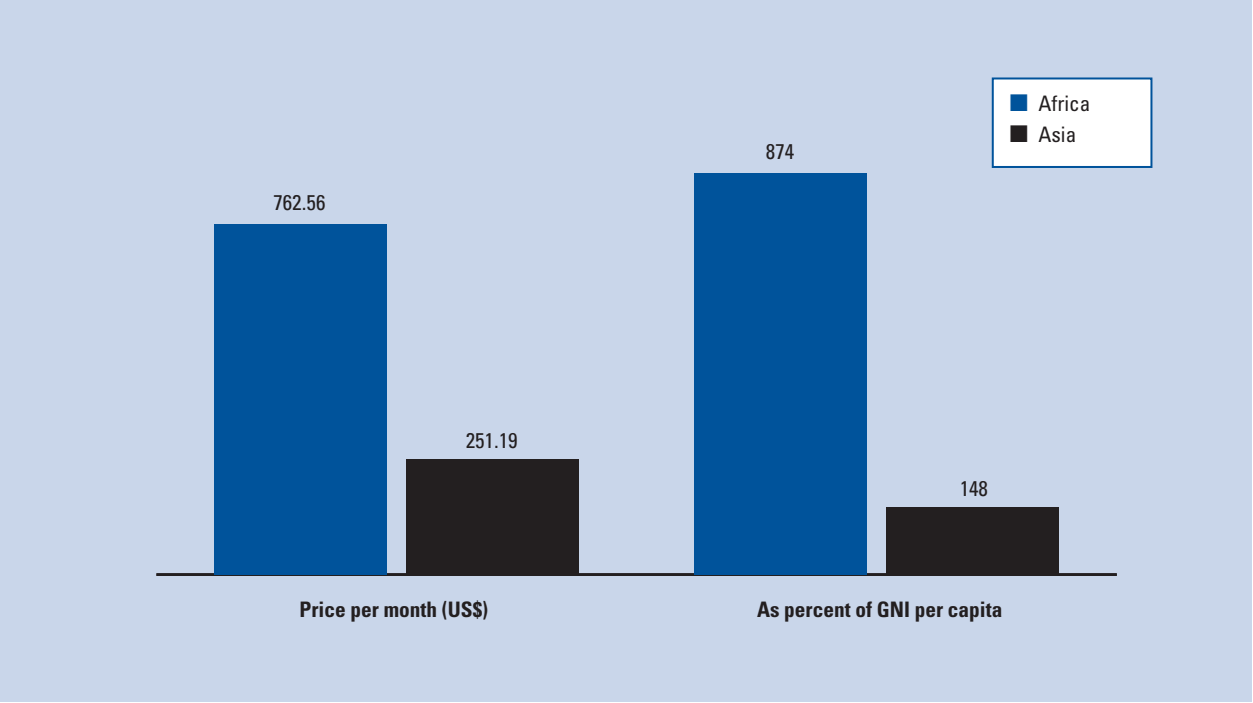
8a: Africa's share of global total as percent (2005)



Source: ITU Internet Report, 2006; Digital Life; and the ITU World Telecommunication Indicators Database.

Note: The price sample is based on the 22 African economies that had fixed-line broadband service at the end of 2005. The average value is inflated by the fact that a high proportion of the economies in this sample offer broadband through leased lines and/or price broadband as a service for businesses, rather than residential users.

8b: Average monthly fixed broadband prices (August 2006)



Source: ITU Internet Report, 2006; Digital Life; and the ITU World Telecommunication Indicators Database.

Table 6: Planned network initiatives in Africa

Planned initiative	Comments	Projected costs
Afritel subregional projects (4)	SRII will link the unconnected countries in the southern and central African region to a network that will allow them to connect to either or both SAT3 and EASSy. It is divided in three stages: 1. All transmission links be digitalized (US$60.6 million) 2. Digital capacity expansion (US$77.1 million) 3. All fiber technology (US$34.9 million)	US$172.60 million
	Intelcom I was established to create links between all the capitals of the ECOWAS region member states. On the other hand, Intelcom II is a plan to expand and upgrade the analogue routes of the existing network. It was initiated in 1997, aiming to establish 32 inter-country links in the ECOWAS region. It will connect 10 out of 13 countries that are currently unconnected to the SAT3 cable.	n/a
	COMTEL aims to connect all of the unconnected countries in East Africa with the exceptions of Somalia, Mauritius, and the Seychelles. It will provide a fiber link to Lubumbashi in the Democratic Republic of Congo (DRC). It will function as a regional network delivering traffic into SAT3 in South Africa.	US$250–270 million
	The Central African Ring is a piece of network infrastructure proposed by Celtel. It would be able to link a range of countries including Kenya, Malawi, Uganda, Tanzania, and Bukoba in eastern Congo.	n/a
EASSy	This system is intended to establish a fiber optic undersea cable system to connect eastern African countries with the rest of the world. The cable system will connect Mtunzini, located just north of Durban in South Africa, to Port Sudan, in Sudan, a distance of about 9,900 kilometers.	US$150–200 million
East African Digital Transmission Project (EADTP)	The EADTP system was conceived in 1997. It aimed to see the deployment of fiber optic cable and microwave radio to interconnect the three countries of the East African Community (EAC): Kenya, Tanzania, and Uganda.	n/a
COM-7	COM-7 is intended to connect nine countries: Angola, Botswana, DRC, Malawi, Namibia, South Africa, Tanzania, Zambia, and Zimbabwe via power/railway lines.	n/a
Boucle de Nord	This system is intended to traverse the North African coast from Cairo to Dakar and then cut inland through Mali and Burkina Faso to Kano in Nigeria. From there it would go via N'Djamena and Khartoum to Cairo.	US$300 million
Boucle de Sud	This system is intended to go south from N'Djamena to Cameroon, Congo-Brazzaville, and Equatorial Guinea. It would then take an inland route around the continent and back up to Khartoum via Addis Ababa.	
NIGAL	The NIGAL pipeline project planned by the national oil companies to link Nigeria to Algeria via Niger will also establish fiber links among the three countries using 24 fiber pairs along the 4,200 kilometers.	US$78 million
Infinity West African cable	This cable is intended to link the remaining West African countries to Europe via marine fiber that would also provide competing infrastructure to SAT-3. The seven initial cities being focused on are four in Nigeria (Lagos, Abuja, Wari, Port Harcourt) plus Dakar, Accra, and Douala.	US$750 million
GLO-1	Owned by GLOBACOM (Nigeria) and being developed by Alcatel, this is planned to connect Lagos with the United Kingdom via an 8,600-kilometer submarine cable.	US$170 million
West African Festoon System	This system is intended to link countries currently unserved by SAT-3—Congo Brazzaville, Equatorial Guinea, Chad, and Sao Tome and Principe—and to provide diversity to SAT-3/WASC/SAFE for countries with landings—that is, Luanda (Angola), Libreville (Gabon), Douala (Cameroon), and Lagos (Nigeria).	US$90 million
East African Backhaul System (EABS)	East African Backhaul System is a joint venture project among operators from Tanzania, Burundi, Rwanda, Uganda, and Kenya to link the five countries to cables to be laid along the Eastern African seaboard. MTN and 30 other operators in Eastern and Southern Africa are involved with this project.	n/a

(cont'd.)

Table 6: Planned network initiatives in Africa *(cont'd.)*

Planned initiative	Comments	Projected costs
TEAMS	The Telkom Kenya and Etisalat initiative is to lay undersea fiber from Mombasa to Fujairah, United Arab Emirates.	KSh5.7 billion
FLAG	Reliance is investing US$1.5 billion to upgrade its global network Flag Telecom. This will include an East African backbone to link South Africa and Kenya, and will also serve Tanzania, Mauritius, Mozambique, and Madagascar as well as some landlocked countries.	n/a
Infraco	A joint initiative of the South African government and the strategic investor in its Second Network Operator, VSNL, the project will operate an alternative national backbone in South Africa and a competitor to SAT-3, fiber cable running from Cape Town to London.	2.3 billion South African rands
NEPAD SPV	Twelve governments in eastern and southern Africa have signed an accord to establish an SPV that will own and manage new regional fiber optic backbones financed by their governments and other investors.	n/a

Source: Winrock/Pyramid Research (forthcoming, 2007).

Note: n/a, not available.

Toward a measure of digital opportunity

As demonstrated in this chapter, measuring competitiveness at the regional and international level is a multidimensional problem that must take account not only of infrastructure availability, but also of the pricing of services, extent of geographical coverage (especially outside the large urban areas), the availability of the newer higher-speed services mentioned, and the level of utilization of ICT services.[31]

In response to a call from the World Summit on the Information Society (WSIS),[32] ITU has worked with its partners (including UNCTAD, MIC Korea, KADO, LIRNEAsia, the London Business School, and others) through a multi-stakeholder partnership (the Digital Opportunity Platform) to develop a composite index to measure each country's progress in bridging the digital divide. The Digital Opportunity Index, or DOI, uses 11 separate indicators of ICT performance to monitor three clusters of opportunity, infrastructure, and utilization. The index was endorsed by the World Summit on the Information Society at the Tunis Phase.[33]

The DOI can be used in conjunction with other measures of competitiveness, such as the Global Competitiveness Index (GCI) in this *Report*; it complements the GCI by allowing analysis to zoom in on the ICT sector. The GCI uses four ICT indicators to measure technological readiness: telephone lines, mobile phones (which, as we have seen, are especially relevant for Africa), Internet users, and personal computers (all of which feature in the DOI). The DOI extends this analysis by including measures of geographical coverage of mobile service, tariffs, and the availability of high-speed Internet access (both fixed and mobile) that are critical to ICT competitiveness.

The results for Africa are shown in Figure 9 and Table 7. The highest-performing African economies in terms of digital opportunity are Mauritius and Seychelles, ranked 58th and 62nd respectively in the world (out of a total of 181 economies). The cluster of North African economies comes next, led by Morocco ranked at 68th, followed by Algeria and Tunisia. South Africa is ranked 5th in Africa and 86th in the world, while Nigeria is ranked 29th in Africa and 155th in the world.

In addition to providing a snapshot of relative rankings for any given year, the DOI can also track progress over time. Among the African economies, Morocco shows the most dramatic improvement. It has increased its DOI score from 0.33 in 2004 to 0.47 in 2006, a strong improvement of 14 percentage points. Indeed, between 2005 and 2006, Morocco's global ranking improved from 78th to 68th in the world (see Box 3 for reasons why). Other high risers in the African region include Kenya (Kenya's ranking improved by 11 places between 2005 and 2006), Rwanda (+10 places) and Mauritania (+6 places), while the Central African Republic (–5 places) and Zimbabwe (–5 places) are among the economies experiencing declines in their overall ranking.

The Digital Opportunity Index suggests that the digital divide is evolving in new and complex ways: rather than being defined in terms of narrow connectivity or subscriber numbers, the digital divide is taking on new dimensions in speed, mobility, and capacity of access, with countries catching up or falling behind according to their achievements in these areas. There are grounds for optimism, including the commitments made by governments at the WSIS in Geneva in 2003 and Tunis in 2005, as well as examples of excellence by

Table 7: Digital Opportunity Index scores for Africa (2006)

Rank in Africa 2005/2006	Country	Opportunity 2005/2006	Infrastructure 2005/2006	Utilization 2005/2006	Digital Opportunity 2005/2006	World Rank 2005/2006	Change in ranks 2005/2006
1	Mauritius	0.98	0.43	0.09	0.50	58	—
2	Seychelles	0.96	0.35	0.14	0.48	62	—
3	Morocco	0.89	0.16	0.37	0.47	68	—
4	Algeria	0.93	0.19	0.15	0.42	83	—
5	South Africa	0.94	0.24	0.08	0.42	86	2
6	Tunisia	0.97	0.20	0.07	0.41	87	–1
7	Egypt	0.96	0.22	0.04	0.41	91	–1
8	Botswana	0.93	0.15	0.08	0.38	100	1
9	Gabon	0.92	0.13	0.07	0.37	103	2
10	Senegal	0.73	0.07	0.31	0.37	106	3
11	Libya	0.93	0.13	0.02	0.36	109	–3
12	Namibia	0.88	0.14	0.02	0.35	113	—
13	Cape Verde	0.79	0.16	0.07	0.34	115	–3
14	Swaziland	0.85	0.10	0.02	0.32	120	—
15	Equatorial Guinea	0.73	0.07	0.01	0.27	131	—
16	Djibouti	0.74	0.05	0.01	0.26	132	—
17	Lesotho	0.71	0.05	0.01	0.26	133	—
18	Sudan	0.66	0.04	0.02	0.24	136	3
19	Cameroon	0.66	0.04	0.01	0.24	137	—
20	Angola	0.64	0.03	0.01	0.23	138	–2
21	Ghana	0.56	0.04	0.03	0.21	142	4
22	Gambia	0.53	0.08	0.01	0.21	144	–2
23	Côte d'Ivoire	0.43	0.06	0.09	0.20	145	–1
24	Benin	0.52	0.03	0.03	0.19	146	—
25	Togo	0.46	0.03	0.03	0.17	151	–2
26	Congo	0.48	0.04	0.00	0.17	152	4
27	Kenya	0.46	0.05	0.01	0.17	153	11
28	Mauritania	0.46	0.06	0.00	0.17	154	6
29	Nigeria	0.45	0.05	0.01	0.17	155	2
30	Comoros	0.47	0.03	0.00	0.17	156	2
31	Zimbabwe	0.37	0.06	0.06	0.16	157	–5
32	Uganda	0.46	0.02	0.01	0.16	158	–3
33	S. Tomé & Principe	0.38	0.06	0.03	0.15	159	—
34	Guinea	0.43	0.01	0.00	0.15	161	–6
35	Tanzania	0.41	0.03	0.00	0.15	162	4
36	Zambia	0.40	0.03	0.00	0.14	163	–1
37	Rwanda	0.40	0.01	0.01	0.14	164	10
38	Burkina Faso	0.38	0.03	0.01	0.14	165	–1
39	Madagascar	0.35	0.02	0.00	0.12	167	–3
40	Mozambique	0.33	0.02	0.01	0.12	168	2
41	Mali	0.33	0.02	0.00	0.12	169	—
42	Sierra Leone	0.32	0.02	0.00	0.11	171	2
43	Ethiopia	0.30	0.01	0.00	0.10	172	2
44	Burundi	0.27	0.01	0.00	0.09	173	–1
45	Central African Rep.	0.25	0.01	0.00	0.09	174	–5
46	Malawi	0.23	0.01	0.01	0.09	175	—
47	Congo, Dem. Rep.	0.22	0.02	0.00	0.08	176	–20
48	Eritrea	0.19	0.01	0.00	0.07	177	1
49	Guinea—Bissau	0.10	0.03	0.01	0.04	178	–1
50	Chad	0.11	0.01	0.00	0.04	180	1
51	Niger	0.06	0.01	0.02	0.03	181	–1
	Africa	**0.55**	**0.08**	**0.04**	**0.22**	**140**	

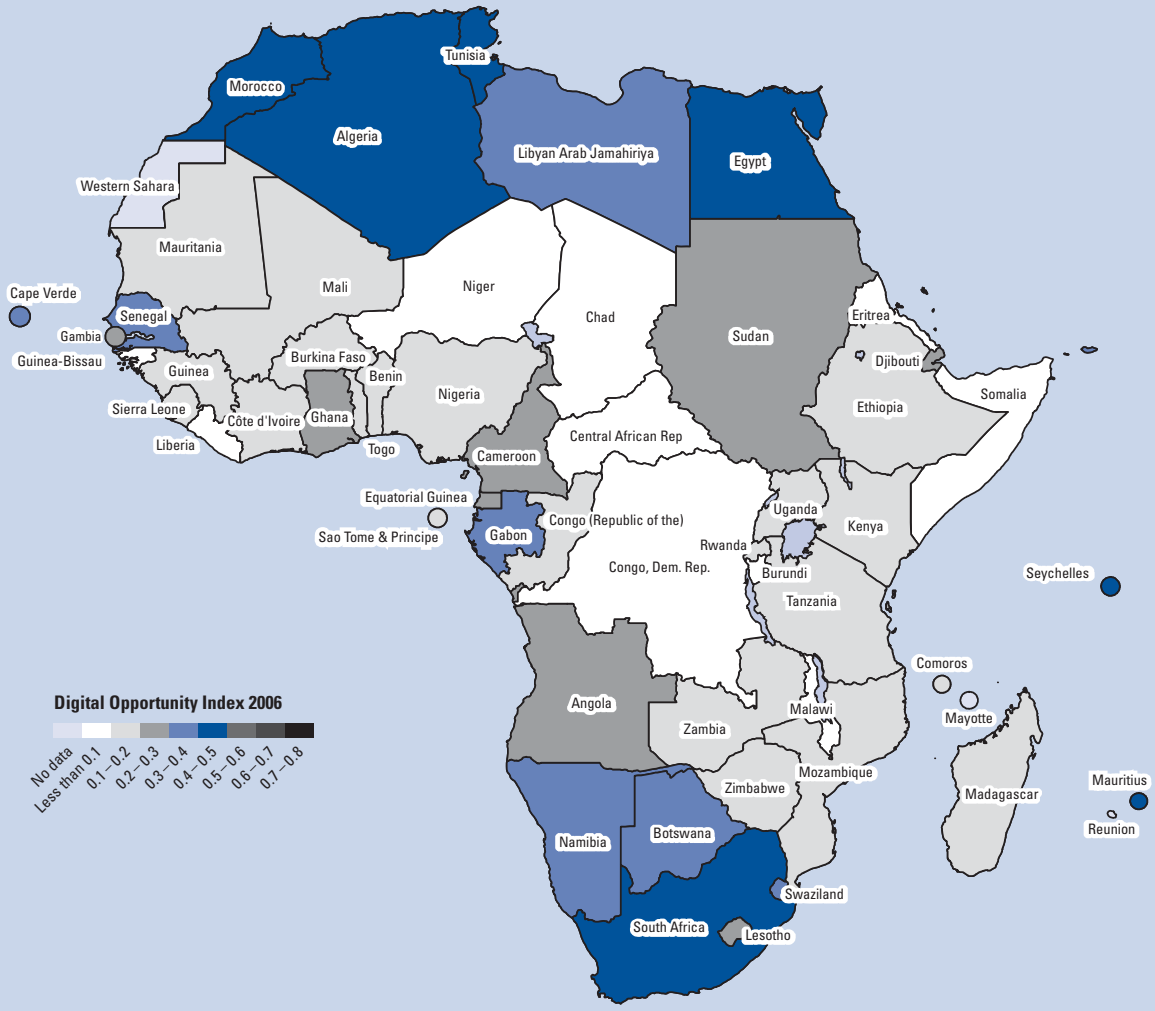
Source: ITU/UNCTAD/KADO Digital Opportunity Platform.

African companies leading the way in all these aspects, but much more remains to be done.

Conclusions: Toward a more competitive Africa

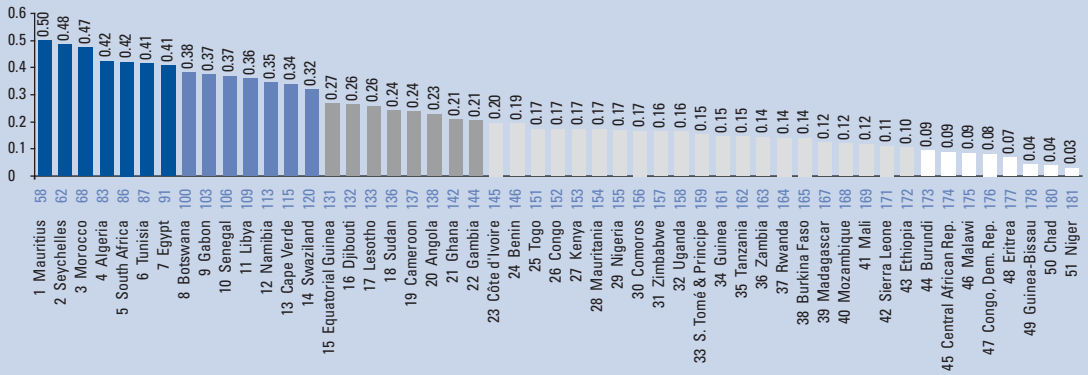
As we have seen, Africa's future growth and success depends on the competitiveness of its firms. Becoming competitive needs a long-term strategy to raise efficiency, boost skill and technology levels, and move into higher-value products and processes. ICTs are a vital part of this strategy. ICTs enable rapid communications and can create the new skills essential in modern business. They can generate new growth and technological change across the whole economy—from agriculture to finance, construction, and modern services.

Figure 9: Digital opportunity in Africa (2006)



The designations employed and the presentation of material in this map do not imply any opinion whatsoever on the part of the ITU concerning the legal or other status of any country, territory or area or any endorsement or acceptance of any boundary.

Overall Digital Opportunity Index scores, 2006



Source: ITU/UNCTAD, 2007.

This chapter has reviewed the changing policy and regulatory landscape in African telecommunications. African governments have made considerable headway in opening up the telecommunications markets to greater competition and introducing measures to encourage investment and to build local capabilities. The results are promising. African markets have witnessed strong growth, especially in mobile markets and the rise of resource-rich strategic investors. Telecom operators are innovating with a range of different strategies and pricing models to suit consumers. African firms and telecom operators understand the importance of technology and, in many cases, they are forging ahead and introducing new communications technologies. Far from being isolated in the global economy, some African countries are participating in the forefront of technological developments.

African governments and telecom operators no longer face the strategic choice of whether or not to resist new technologies—they must instead decide how best to adapt to them. The challenge for Africa is not whether to integrate into the global economy, but how to become competitive within an integration process that is already taking place. The next 10 years will show whether Africa has succeeded in this challenge.

Notes

1 See, for example, the series of research studies by Robert McGuckin and Kevin Stiroh, which started with Robert H. McGuckin and Kevin J. Stiroh, "Computers, Productivity and Growth," Economic Research Report, 1213-98-RR, The Conference Board 1998.

2 Fuss and Waverman 2005.

3 Waverman et al. 2005.

4 In Chapter 1.1 the World Economic Forum defines *competitiveness* as the set of institutions, policies, and factors that drives productivity and sets the sustainable current and medium-term levels of economic prosperity.

5 See, for example, the discussions at the ITU Workshops, "What Rules for Next Generation IP-Enabled Networks?" March 23–24, 2006, Geneva, Switzerland, and "The Future of Voice," January 15–16, 2007, Geneva, Switzerland. Available at www.itu.int/osg/spu/ngn/ and www.itu.int/osg/spu/voice/.

6 See "Balancing Act: Africa," Issue 340, January 29, 2007, available at: http://www.balancingact-africa.com/.

7 Kheir-El-Din et al., Economic Research Forum Working Paper 200035.

8 For example, economists and researchers in Egypt are widely agreed that Egypt has tended to (over-)rely on tax holidays as its main tax incentive (Kheir-El-Din, Fawzy, and Refaat 2000 and El Samalouty 2000). The authors conclude that tax incentives have been costly and not very effective in achieving Egypt's investment goals.

9 Morrisset and Pirnia 2000.

10 All successful industrializing countries have supported promising new activities by domestic and foreign firms. What distinguishes the strategies of the most successful countries is that their promotion did not mean protection of sectors from international markets: targeted sectors were encouraged to compete internationally to become efficient and develop capabilities. Promotion was flexible, broad and conditional on export performance.

11 ILO World Employment Report 2001: Life at Work in the Information Economy.

12 In advanced OECD countries, the private sector funds between a half to two-thirds of total research and development (R&D) spending in new technology.

13 Global Insights, as quoted by Rauno Granath, Director, New Growth Markets, Nokia, in his presentation, "Voice Services in New Growth Markets" to the ITU Workshop on the Future of Voice (http://www.itu.int/osg/spu/ni/voice/meeting.phtml). Available at http://www.itu.int/osg/spu/ni/voice/presentations/S4-5-Nokia-Granath.ppt.

14 As reported by *The Economist*, "Buy, cell and hold," January 25, 2007.

15 See http://www.balancingact-africa.com/news/back/balancing-act_340.html.

16 See http://www.vodacom.co.za/mccrdetail.do?id=1016&action=detail.

17 Defined as speed of 256 kbps or more in the upstream and downstream direction.

18 www.btc.bw/adsl/index.htm, accessed in April 2006.

19 www.ghanatelecom.com.gh/gt_aboutus/newsdetails.asp?pnum=3&id=228&catid=0.

20 www.lttnet.com/english/coming.php and www.lttnet.com/english/sr_libyadsl.php.

21 As reported by Balancing Act Africa, Issue No. 296, 2006, available from www.balancingact-africa.com/news/back/balancing-act_294.htm.

22 Map of broadband coverage available from Uganda Telecom Ltd at http://www.utl.co.ug/utl.php?i=9.

23 Maximum download speeds are often not available in practice, due to network conditions and congestion.

24 Agence de Régulation de Télécommunications (ART, Sénégal), "Le marche de l'Internet" Web page. Available at http://www.artp-senegal.org/telecharger/Fiche_Internet_2005.pdf.

25 Southwood 2007.

26 Gray market revenues as a proportion of overall international call revenues are estimated at 17 percent in Lesotho, 20 percent in Equatorial Guinea, 30 percent in Cameroon, and 47 percent in Sierra Leone. See Southwood 2007.

27 Parts of this section draw upon work carried out by ITU, Winrock, Pyramid Research and Mike Jensen for a World Bank–funded project on Africa's future infrastructure requirements. See Winrock/Pyramid Research Forthcoming (2007).

28 The 2005 International Circuits Report was issued by the FCC in January 2007. It is available from http://hraunfoss.fcc.gov/edocs_public/attachmatch/DOC-269605A2.pdf. For more information see the FCC International Bureau website at http://www.fcc.gov/ib. Although the report covers only U.S. facilities–based international carriers, in practice, because of reporting requirements, this covers most of the world's carriers.

29 The International Circuits Reports issued annually by the U.S. regulator, the Federal Communications Commission (FCC), available from www.fcc.gov.

30 DFID/ Balancing Act 2004.

31 The World Economic Forum publishes, in conjunction with INSEAD, an annual "Networked Readiness Index" (NRI) in the *Global Information Technology Report*. This *Report* examines the networked readiness of 122 countries around the world in terms of their environment, readiness, and usage, taking into account government, businesses, and users.

32 For information on the World Summit on the Information Society (WSIS), see www.itu.int/wsis. The reference to the composite index comes from the Geneva Declaration of Principles, para 28, and the Tunis Agenda for the Information Society, para 115.

33 For more information on the Digital Opportunity Index (DOI) and its methodology, see www.itu.int/doi.

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