International Telecommunication Union

Information Society Statistical Profiles 2009

Africa

ITU-D

In preparation for the World Telecommunication Development Conference 2010

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Africa[1]

[1] Africa in this report refers to the countries served by the ITU Regional Office in Addis Ababa (see Annex 1 for the list of countries included).

International Telecommunication Union

Acknowledgements

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Foreword

This report is the second in a series of regional statistical profiles on the information society being prepared by ITU in 2009, as input to the Regional Preparatory Meetings (RPMs) for the ITU World Telecommunication Development Conference 2010 (WTDC-10). The second RPM – for the African Region – takes place on 13-15 July 2009 and is hosted by the Government of Uganda.

The increase in the number of mobile cellular subscriptions over the last five years has defied all predictions and Africa remains the region with the highest mobile growth rate. By the end of 2008, Africa had 246 million mobile subscriptions and mobile penetration has risen from just five per cent in 2003 to well over 30 per cent today. The high ratio of mobile cellular subscriptions to fixed telephone lines and the high mobile cellular growth rate suggest that Africa has taken the lead in the shift from fixed to mobile telephony, a trend that can be observed worldwide. The number of Internet users has also grown faster than in other regions.

Despite rapid growth, Africa's ICT penetration levels in 2009 are still far behind the rest of the world and very few African countries reach ICT levels comparable to global averages. Less than five per cent of Africans use the Internet, and fixed and mobile broadband penetration levels are negligible.

African countries are facing a number of challenges in increasing ICT levels. They include the lack of full liberalization of markets and the limited availability of infrastructure, such as shortage of international Internet bandwidth. In addition, prices for ICT services remain very high compared to income levels and broadband Internet services are out of the reach of most Africans.

This report highlights the latest ICT developments in the region and includes key statistical information for every country. It features a regional analysis of the ITU ICT Development Index (IDI) and the ICT Price Basket, two ICT benchmarking tools that were launched in March 2009. The report points to key policy issues in the region and provides concrete recommendations for policy makers. I am confident that the findings of the report as well as the resulting policy conclusions will provide useful inputs to our members in preparation for the WTDC-10.

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Chapter 1.

Market Overview

What stands out most in Africa's[1] Information and Communication Technology (ICT) developments over the last decade is the strong and continued growth in the number of mobile cellular subscriptions and impressive rise in penetration rate (Chart 1.1). The number of Internet users has also grown strongly, although penetration rates remain relatively low. In 2000, the region was home to 11 million mobile cellular subscriptions and 3 million Internet users. By the end of 2008, there were 32 million Internet users, and 246 million mobile cellular subscriptions. The annual growth between 2003 and 2008 in both services in Africa has been twice that of the world. Over the same period, fixed line growth in the region has been similar to that of the world, and much lower compared to that of mobile cellular subscriptions and Internet users (Table 1.1).

Between 2003 and 2008, Africa's number of mobile cellular subscriptions grew twice as fast as that of the world

As a result of the strong ICT growth, new promising applications have emerged in the area of m-banking[2] and e-government.[3]

Although Africa has made impressive gains, it remains far behind the ICT penetration levels of the world

Notwithstanding the emergence of Africa as one of the most dynamic regions in terms of ICT growth, the region's absolute figures as well as penetration rates remain low. Two decades ago, achieving a teledensity of one per one hundred inhabitants represented a major milestone, but today's benchmarks of achievement are much higher. While the rest of the world has forged ahead with strong ICT investments and the adoption of new technologies, and although Africa has made impressive gains,

ICT developments in Africa, 1998-2008 penetration rate

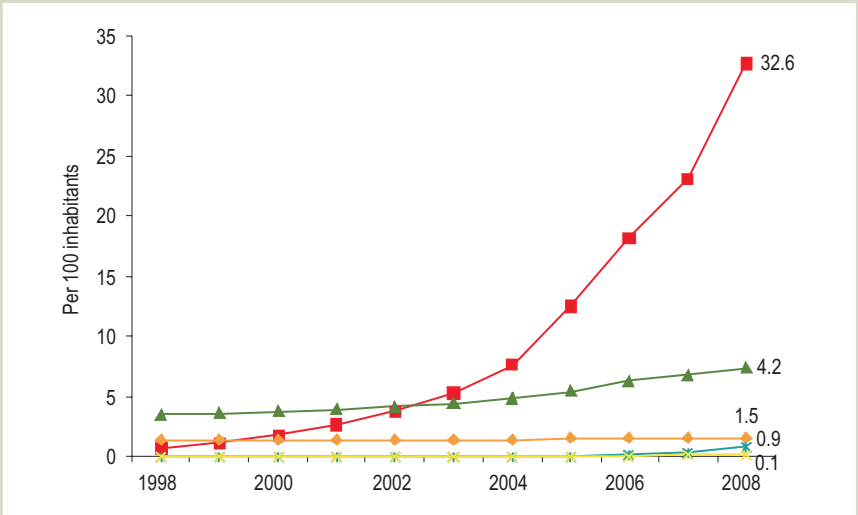


Chart 1.1

Mobile cellular subscriptions
Internet users
Fixed telephone lines
Mobile broadband subscriptions
Fixed broadband subscribers

Source: ITU World Telecommunication/ICT Indicators database.

Table 1.1

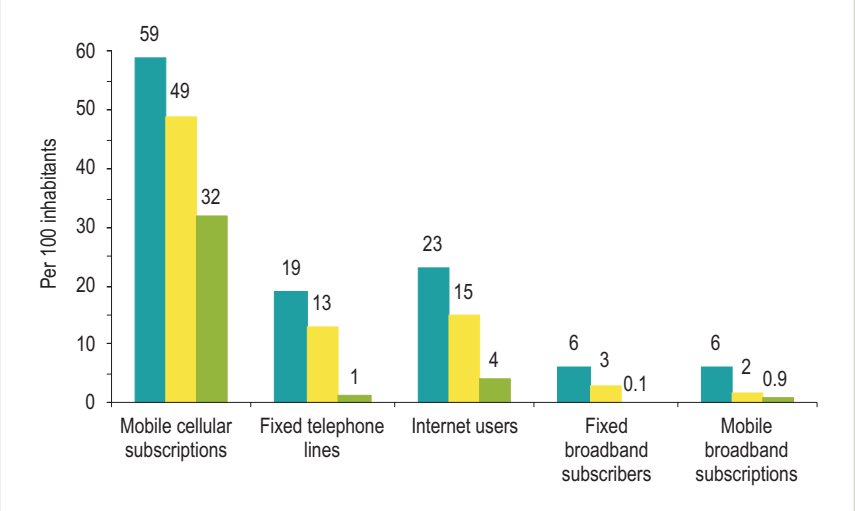
ICT growth in Africa and in the world, 2003-2008

	CAGR* (%)		
	Fixed telephone lines	Mobile cellular subscriptions	Internet users
Africa	2.4	47.0	30.6
World	2.5	23.0	17.0

Note: * CAGR refers to Compound Annual Growth Rate.
Source: ITU World Telecommunication/ICT Indicators database.

Chart 1.2

ICT uptake in Africa, developing countries and the world, 2008



Source: ITU World Telecommunication/ICT Indicators database.

it remains far behind the ICT penetration levels of the world, and even those of developing countries (Chart 1.2). The gap is more pronounced in the case of broadband Internet services, and fixed telephony, as discussed further on in this chapter.

Between 1998 and 2008, Africa added only 2.4 million fixed telephone lines, less than 1% of the telephone lines added globally in the same period

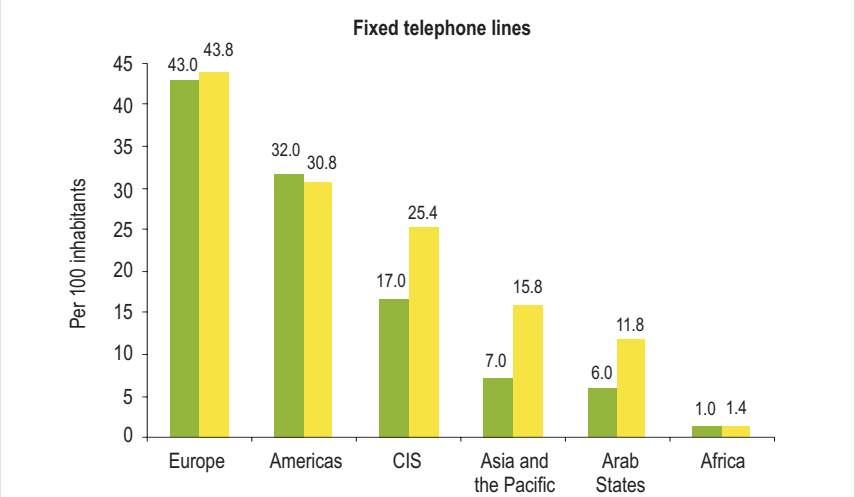
1.1 Fixed and mobile telephony

In 1998, there were some 8.2 million fixed telephone lines in Africa, which corresponded to a penetration of 1.4 per cent, the lowest of any region (Chart 1.3). Between 1998 and 2008, the region added only 2.4 million telephone lines, less than 1 per cent of the total number of telephone lines that the world added in the same period. As a result, fixed telephone line penetration increased very little in Africa, and the difference with other regions increased. At a country level, in 2008 fixed telephone line penetration was above that of the developing world average (13.6 per cent) in Mauritius and Seychelles, two countries with a small land area and population base.

In comparison to the region's limited and stagnating fixed telephone market, mobile telephony has undergone considerable growth (Chart 1.4). In 2000, the number of mobile cellular subscriptions surpassed that of fixed telephone lines in Africa (the

Fixed telephone line penetration by region, 1998 and 2008

Chart 1.3



Source: ITU World Telecommunication/ICT Indicators database.

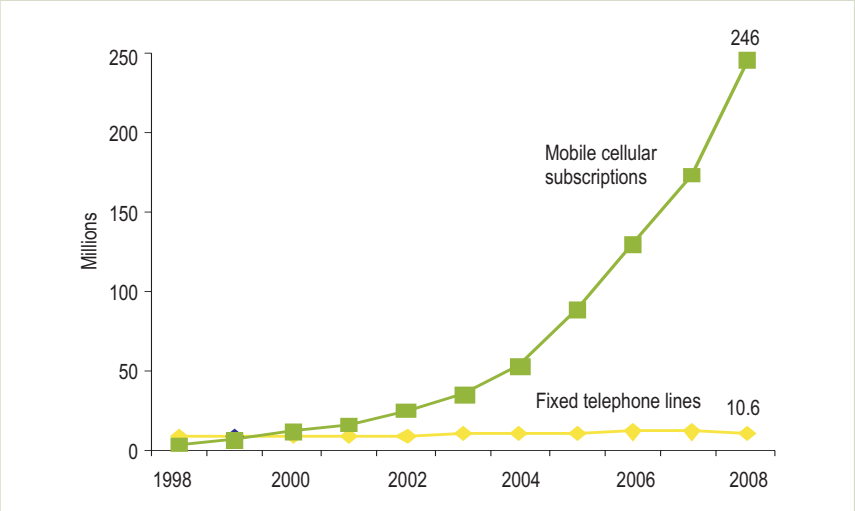
same happened globally, two years later, in 2002), and continued to grow remarkably, reaching a total of nearly 246 million subscriptions by 2008. The high ratio of mobile cellular subscriptions to fixed telephone lines (the highest of any region in the world), and the high mobile cellular growth rate suggest that Africa has taken the lead in the shift from fixed to mobile telephony, a trend that can be observed worldwide.

Africa has taken the lead in the shift from fixed to mobile telephony, a trend that can be observed worldwide

Strong growth in mobile cellular subscriptions has dramatically increased the scale of access to a telephone. Between 2000 and 2008, mobile cellular penetration has risen from less than two in 100 inhabitants to 33 out of 100 (Chart 1.5). Although this is

Mobile cellular subscriptions and fixed telephone lines in Africa, 1998-2008

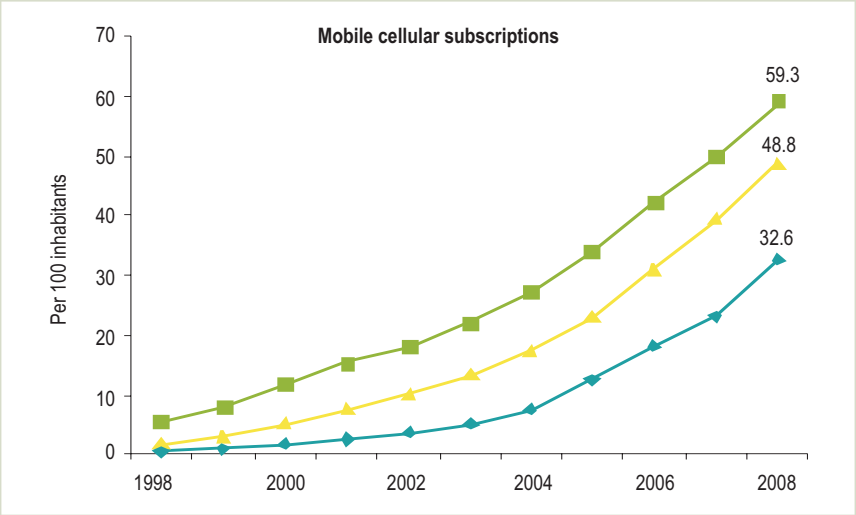
Chart 1.4



Source: ITU World Telecommunication/ICT Indicators database.

Chart 1.5

Mobile cellular penetration, 1998-2008



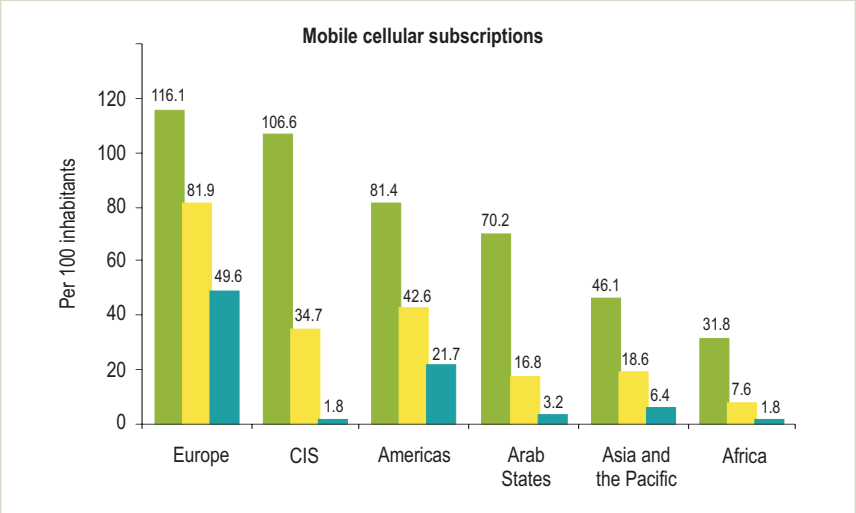
Source: ITU World Telecommunication/ICT Indicators database.

significant in terms of growth rates, penetration rates are still considerably lower in Africa than in other regions (Chart 1.6).

Over time, mobile cellular subscriptions have become more evenly distributed across the region. This is illustrated by the situation in South Africa which, in 2000, accounted for 74 per cent of Africa's mobile cellular subscriptions. Yet by 2008, only 19 per cent of Africa's mobile subscriptions were located there. The growth in Nigeria is most notable, but other countries including Kenya, Ghana, Tanzania and Côte d'Ivoire have also greatly contributed to the change in the distribution of mobile cellular subscriptions in the region (Chart 1.7).

Chart 1.6

Mobile cellular penetration rates by region



Source: ITU World Telecommunication/ICT Indicators database.

Distribution of mobile cellular subscriptions in Africa, 2008

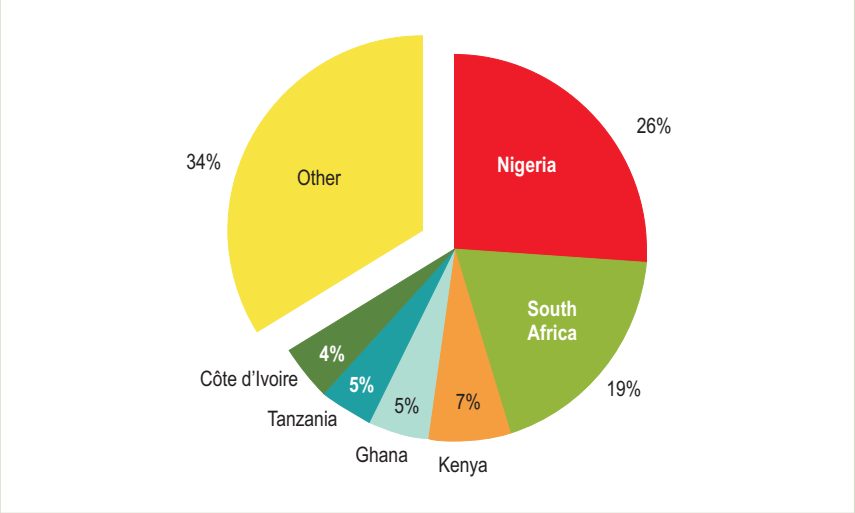


Chart 1.7

Source: ITU World Telecommunication/ICT Indicators database.

Chapter 2 sets out the achievements and challenges of mobile cellular growth in Africa by looking into the current situation, by considering the most successful mobile applications in the region, and by highlighting pressing regulatory challenges that remain ahead.

1.2 Internet and broadband

By 2008, Africa had nearly eight times as many Internet users as in 2000

Over the last decade, Internet usage has greatly increased in Africa, and together with the mobile cellular market, the Internet market represents an important area of ICT growth and development. The Internet is now recognized not only as a source of information, but also as having the potential of a significant development enabler, with its many applications, and making it particularly important for Africa. Africa is home to 29 Least Developed Countries (LDCs) (out of a total of 43 countries) and often highlighted as the region that is at risk of not achieving the Millennium Development Goals (MDGs) by 2015.[4]

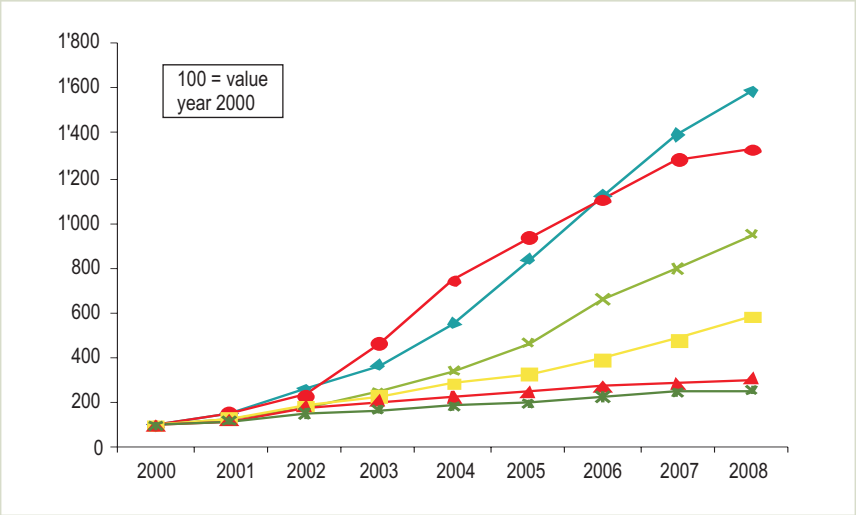
By 2008, Africa had nearly eight times as many Internet users as it did in 2000. Compared to other regions, growth in Africa was the third-highest, after the CIS and the Arab States (Chart 1.8). The increase was led by Nigeria, which alone added 10.9 million new Internet users (Chart 1.9) between 2000 and 2008, 38 per cent of the total additions in Africa in that period. Kenya also contributed remarkably, with 3.3 million new Internet users.[5]

In the majority of African countries, less than 5% of the population use the Internet

Notwithstanding the progress made, almost all countries in Africa have an Internet penetration that lies well below the world's 2008 penetration of 23 per cent. (Chart 1.10). This is entirely consistent with the limited availability of fixed telephone networks in the region, which are necessary for Internet dial-up and fixed broadband access.[6] Indeed, in the majority of African countries less than five per cent of the population use the Internet.

Chart 1.8

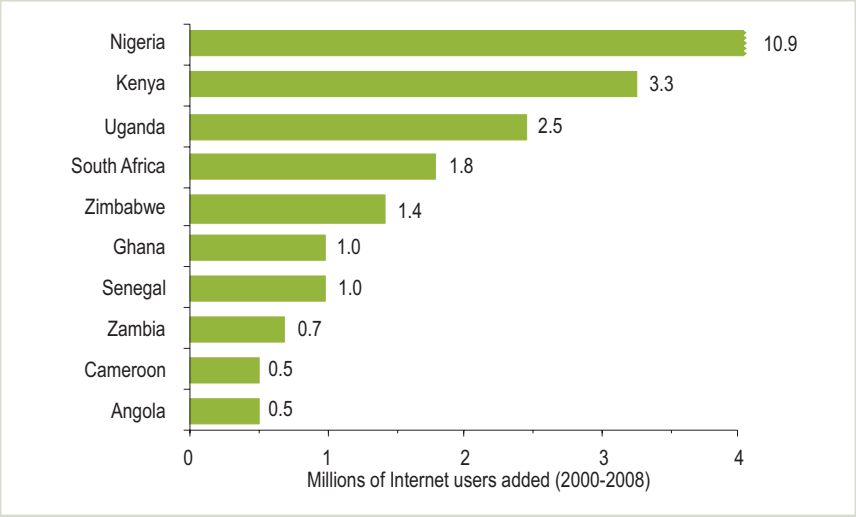
Internet user growth by region, 2000-2008



Source: ITU World Telecommunication/ICT Indicators database.

Chart 1.9

Countries with the highest net additions of Internet users in Africa, 2000-2008



Source: ITU World Telecommunication/ICT Indicators database.

Most African countries have an Internet penetration equal to or below 11%, a far cry from the global average of 23%

A closer look at Internet user penetration shows major differences in uptake across countries in the region, ranging from 38 per cent in Seychelles and 30 per cent in Mauritius to less than 0.5 per cent in the Democratic Republic of Congo, Ethiopia, the Central African Republic and Sierra Leone. The relatively high values for Seychelles and Mauritius (as well as São Tomé and Principe) could be related to their small land and population size, which makes it easier to provide Internet access to a significant part of the population. The rest of African countries have an Internet penetration equal to or below 11 per cent, a far cry from the global average of 23 per cent.

Internet users per 100 inhabitants in Africa, 2008

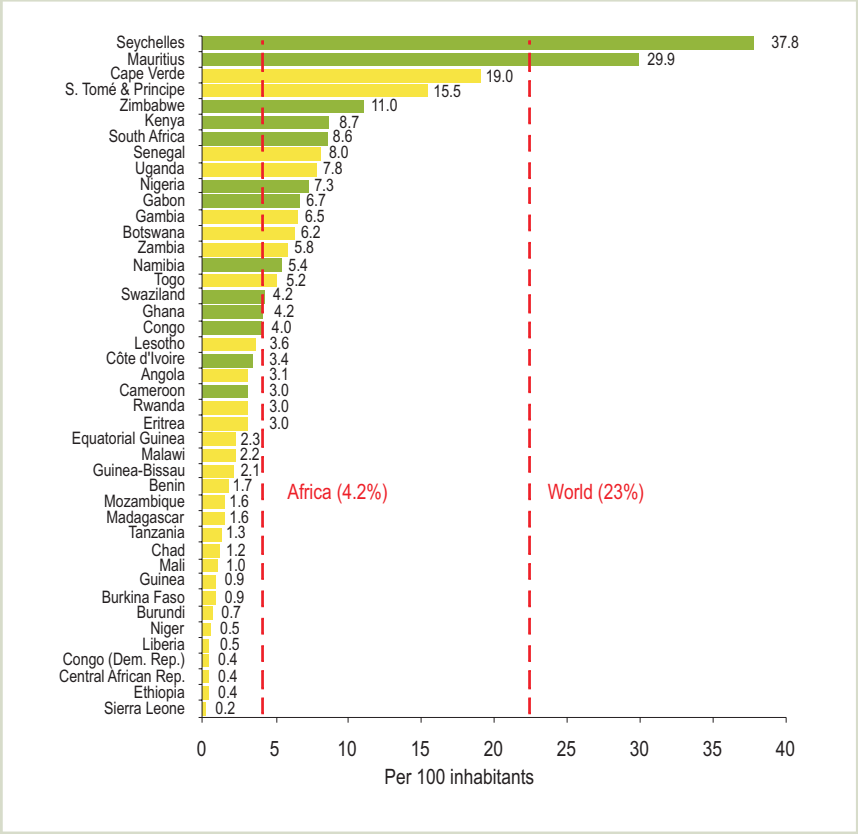


Chart 1.10

Least Developed Countries

Source: ITU World Telecommunication/ICT Indicators database.

The figures presented in Chart 1.10 are partly explained by the differences in the percentage of households with a computer in African countries. Those countries with the highest Internet user penetration in Africa, such as Seychelles, Mauritius or South Africa, are also among the region's top in terms of household computer penetration (Chart 1.11). However, the link is not as clear for other African countries and it appears that household computer penetration is more dependent on income than Internet user penetration, which in turn suggests that public Internet access centers and other points of access account for a significant part of Internet usage in Africa. According to a recent household survey conducted by Research ICT Africa,[7] the main location of Internet use in such countries as Benin, Burkina Faso, Cameroon, Côte d'Ivoire, Ethiopia, Ghana, Kenya, Nigeria, Rwanda, Senegal, Tanzania and Zambia is the cyber/Internet café. This finding is most valuable for policy makers since it highlights the importance of providing public access to the Internet. Continued action is needed to boost Internet access through public facilities, especially through such measures as the full liberalization of public access licensing procedures.

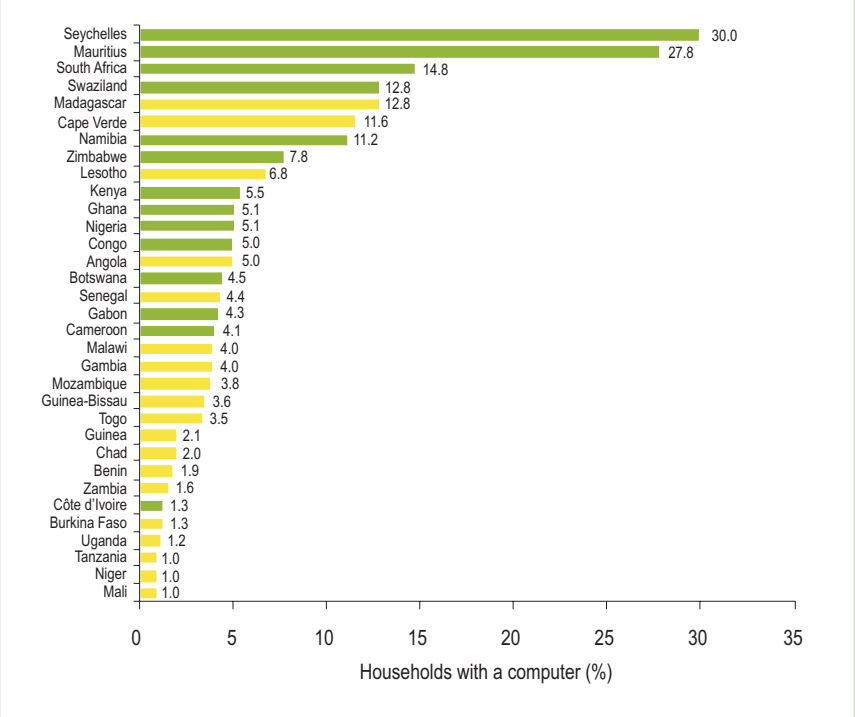
Public Internet access centers account for a significant part of Internet usage in Africa

As far as broadband is concerned, fixed broadband Internet services were first launched in Africa in 2000, and, by 2008, the region had 635'000 fixed broadband subscribers, less than a tenth of the population of the city of Lagos, the former capital of Nigeria. Fixed broadband penetration therefore remains very low in Africa

By 2008, the region had 635'000 fixed broadband subscribers, less than a tenth of the population of Lagos

Chart 1.11

African countries with more than 1 % of households with a computer, 2007



Least Developed Countries

Source: ITU World Telecommunication/ICT Indicators database.

(0.1 per cent), and much lower than in the developing countries (2.9 per cent) and the world (6 per cent) (Chart 1.12). Only Cape Verde, Mauritius and Seychelles, already noted for their island state particularities with small land areas and populations, have a fixed broadband penetration above one per cent.

The limited number of fixed telephone lines constrains the deployment of broadband access via ADSL

There are a number of challenges for the development of fixed broadband. One is the limited availability, poor condition and the lack of competition in the public switched telephone network market. Since there are practically no cable television networks in Africa, broadband access via cable modem is generally not available, and the most popular method for broadband Internet access is via Asymmetric Digital Subscriber Lines (ADSL). The limited number of fixed telephone lines, however, constrains the deployment of broadband access via ADSL, and largely limits it to urban areas. With the absence of cabled access and the limited availability of DSL in many countries, there is virtually no fixed broadband inter-modal or intra-modal competition to drive take-up. As a result, fixed broadband prices are very high in many African countries, and penetration is low.[8]

Compared to fixed broadband, 3G mobile cellular networks seem to be holding greater potential for Africa

Compared to fixed broadband, third-generation (3G) mobile cellular networks seem to be holding greater potential for many countries in the region.

In November 2004, EMTEL in Mauritius was the first operator to launch mobile broadband[9] in Africa. By the end of 2008, there were twelve countries in the region with commercially available mobile broadband networks, and a total of seven million

mobile broadband subscriptions. Although penetration levels in Africa (0.9 per cent) remain below those of developing countries (1.5 per cent), and that of the world (6 per cent), mobile broadband growth has been much stronger than that of fixed broadband (Chart 1.13). By 2008, all African countries that had deployed mobile broadband, albeit with the exception of Madagascar, Cape Verde, Rwanda, and Seychelles, had more mobile broadband than fixed broadband subscriptions.

Mobile broadband growth has been much stronger than that of fixed broadband

As an increasing number of countries in Africa are deploying IMT-2000/3G networks, and fixed telephone line networks remain underdeveloped, mobile broadband has the potential of becoming Africa's main broadband Internet access method in the future.[10]

Fixed broadband growth, 2000-2008

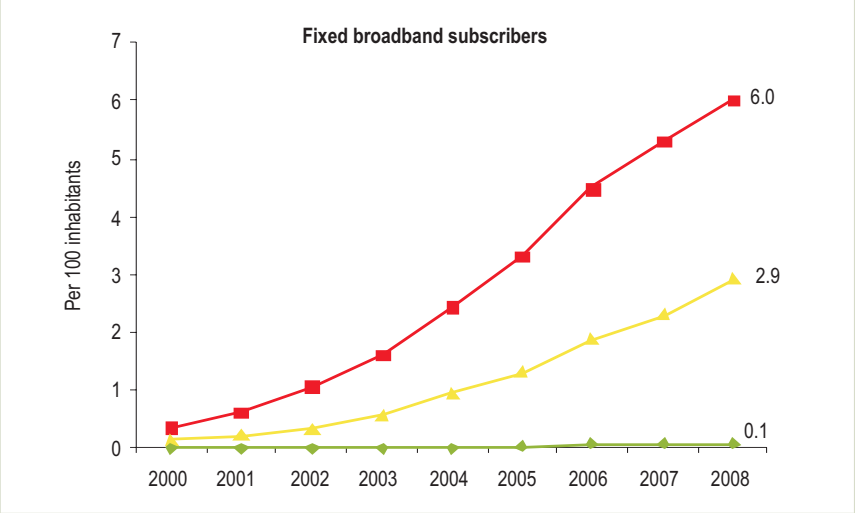


Chart 1.12

World
Developing countries
Africa

Source: ITU World Telecommunication/ICT Indicators database.

Mobile broadband growth, 2000-2008

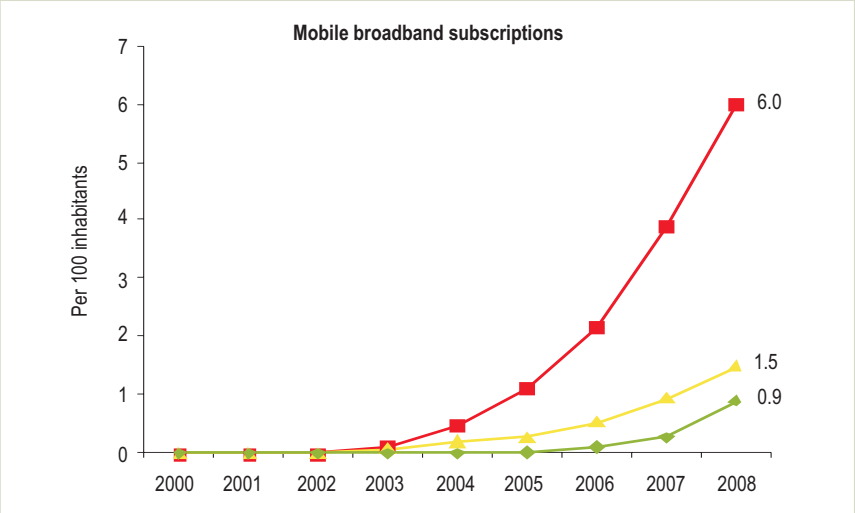


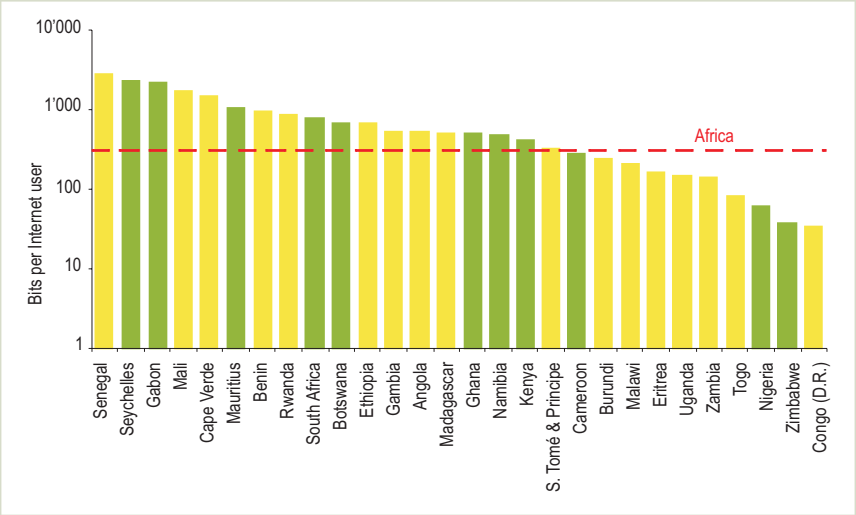
Chart 1.13

World
Developing countries
Africa

Source: ITU World Telecommunication/ICT Indicators database.

Chart 1.14

International Internet bandwidth (bits per Internet user), 2008



Least Developed Countries

Note: Logarithmic scale.
Source: ITU World Telecommunication/ICT Indicators database.

In 2008, Africa as a whole had around 12 Gbps of international bandwidth, less than one third of India's total international connectivity

Similar to broadband, levels of international Internet connectivity are relatively low in most African countries. In 2008, Africa as a whole had around 12 Gbps of international bandwidth, which corresponds to less than one third of India's total international connectivity. Countries with access to undersea fiber optic cable networks have significantly higher levels of per capita bandwidth than those without. Therefore, coastal countries generally enjoy greater bandwidth and connectivity than landlocked countries in Africa's interior. There is an enormous gap between countries in the region in international Internet bandwidth (Chart 1.14), which is a critical impediment for Africa. Chapter 3 further analyses international Internet bandwidth in Africa.

Endnotes

[1] Africa in this report refers to the countries served by the ITU Regional Office in Addis Ababa (see Annex 1 for the list of countries included).

[2] See Chapter 2 for more details on m-banking in Africa.

[3] In Angola, for example, the Portal do Governo was inaugurated in 2006 (http://www.governo.gov.ao/). The site provides 132 governmental services, 65 downloadable forms, and a lengthy list of public interest services. In addition, all governmental and provincial executives in the country have a portal with specific information.

[4] See, for example, the press release from the UN Press Conference on the Millennium Development Goals Africa steering group, September 2007, at http://www.un.org/News/briefings/docs/2007/070912_MDGs.doc.htm.

[5] Nigeria is the largest country in Africa in terms of population. In 2008, it accounted for 19.6 per cent of the population of the whole region. Therefore, although it added more Internet users than Kenya, Nigeria reached a lower Internet user penetration in 2008 (7.3 compared to 8.7 per cent).

[6] Dial-up (i.e. narrowband) remains the most common Internet subscriber access in Africa. In some countries, however, dial-up has been largely replaced by fixed broadband, for example, in Senegal (97 per cent of all Internet subscribers are broadband subscribers), Ghana (69 per cent) and Seychelles (60 per cent). Among fixed broadband technologies, DSL is the most popular access method worldwide, and also in Africa.

[7] Stork, C. & Schmidt, J. P., 2009.

[8] See Chapter 3, Regional analysis of the ICT Price Basket, for a more detailed analysis of fixed broadband prices in Africa.

[9] W-CDMA, one of the broadband technologies included in the family of standards IMT-2000/3G.

[10] Although IMT-2000/3G networks have been developed anticipating access through mobile phones, they are also often used for Internet access from fixed locations using PC data cards, particularly where fixed broadband access is unavailable. This is also the case with CDMA2000 1x, which is widely used as a Wireless Local Loop (WLL) system throughout Africa. Most IMT-2000/3G offerings in Africa include an option to buy data cards for installation in a PC or a USB modem for connecting a IMT-2000/3G handset to a laptop. See ITU (2008a) for more details.

Chapter 2.

Mobile growth: achievements and challenges[1]

2.1 Overview

When the first mobile networks were launched in Africa two decades ago, few people imagined that mobile phones would become Africa's communications device of choice. In 1989, only South Africa had an operative mobile cellular network, and there were less than 4'000 subscriptions. It took seven years to surpass one million mobile subscriptions. The 100 million barrier was shattered in 2006, and by the end of 2008 there were 246 million mobile subscriptions in Africa (Chart 2.1).

By the end of 2008, there were 246 million mobile subscriptions in Africa

Overall, the population covered by a mobile cellular signal in Africa increased from 25 per cent in 2000 to 58.5 per cent in 2008 (Chart 2.2), with a slow-down in growth since 2005. Due to mobile competition and despite numerous barriers (e.g., lack of electricity, difficult terrain, lack of transport), some African countries, such as Botswana, Mauritius, Seychelles and South Africa, are approaching full mobile coverage of all inhabited areas.

Some African countries are approaching full mobile population coverage

While mobile population coverage in most African urban areas is adequate, mobile population coverage in rural areas is much lower. Nevertheless, mobile communications have made huge inroads in providing connectivity to villages and rural areas. It is estimated that there are around 400'000 localities in Africa and that of these less than three percent have a fixed line telephone connection, and less than one percent

Mobile cellular subscriptions in Africa

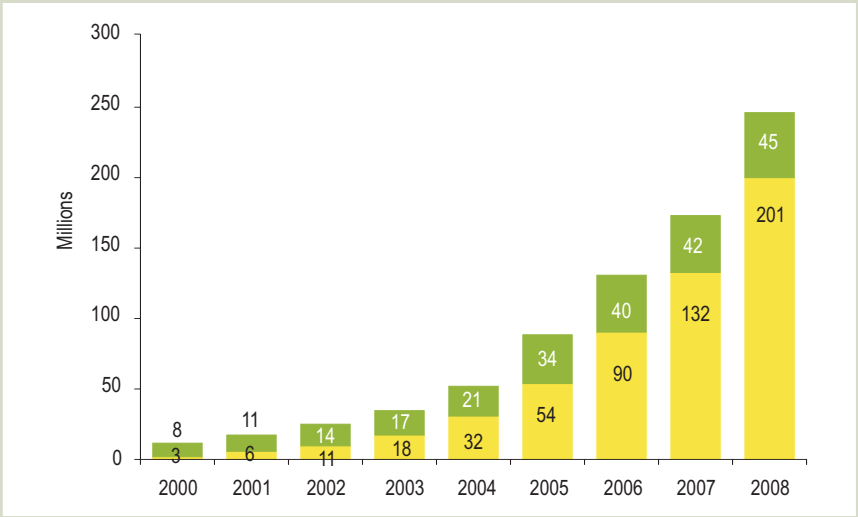


Chart 2.1

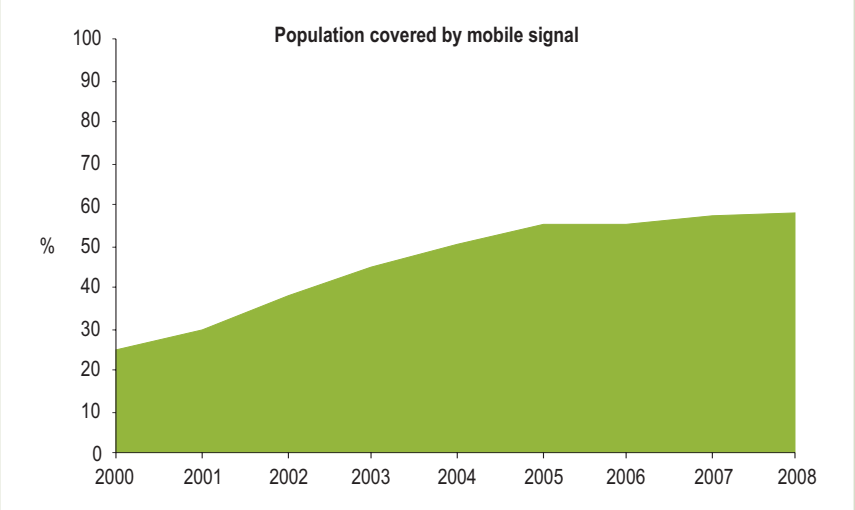
Africa excluding South Africa

South Africa

Source: ITU World Telecommunication/ICT Indicators database.

Chart 2.2

Mobile population coverage, Africa



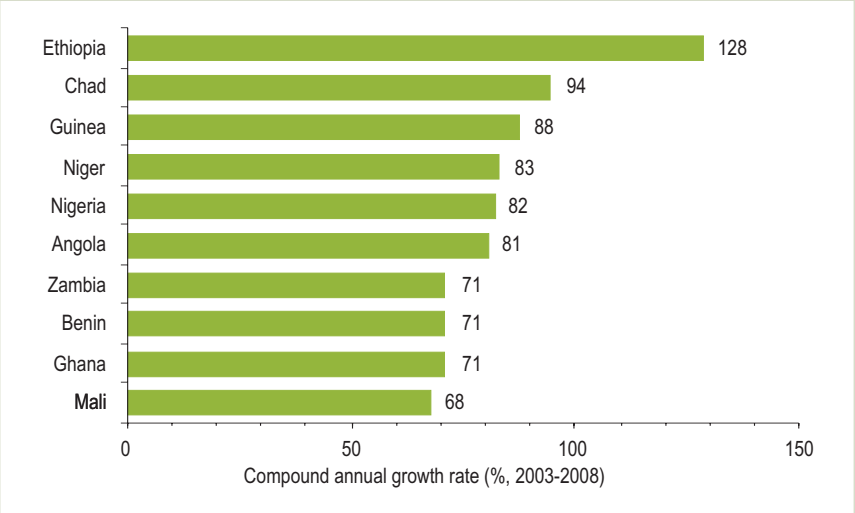
Source: ITU World Telecommunication/ICT Indicators database.

have a public Internet facility. At the same time, over 40 per cent of the rural population in the region was covered by a mobile signal in 2006.[2] Sor far, the rise in mobile population coverage has come about in rural areas, largely in the absence of specific universal access and service (UAS) policies. Instead, growing competition among mobile providers has provided the impetus to increase coverage.

As illustrated in chapter 1 (chart 1.7), mobile subscriptions are now more evenly distributed in Africa. Until 2003, South Africa accounted for more than half the mobile subscriptions in Africa, but only 7 per cent of the population. Notwithstanding the

Chart 2.3

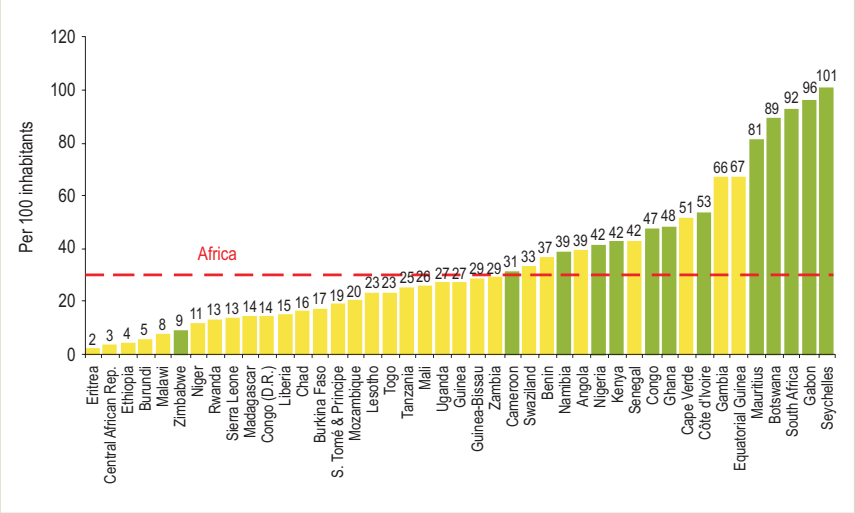
Mobile cellular growth in Africa, top ten countries, 2003-2008[3]



Source: ITU World Telecommunication/ICT Indicators database.

Mobile cellular penetration in Africa, 2008

Chart 2.4



Source: ITU World Telecommunication/ICT Indicators database.

continuous growth in South Africa's mobile cellular base, higher growth in other African countries (Chart 2.3) had reduced South Africa's share to 19 per cent of Africa's mobile subscriptions by 2008. Among the top ten countries with the highest annual growth rate, Ethiopia and Nigeria, the two most populous countries in Africa, stand out and further increasing the number of mobile cellular subscriptions in these two countries will have a significant impact on mobile cellular penetration in the entire region.[4]

Countries with low mobile penetration have limited competition in the sector

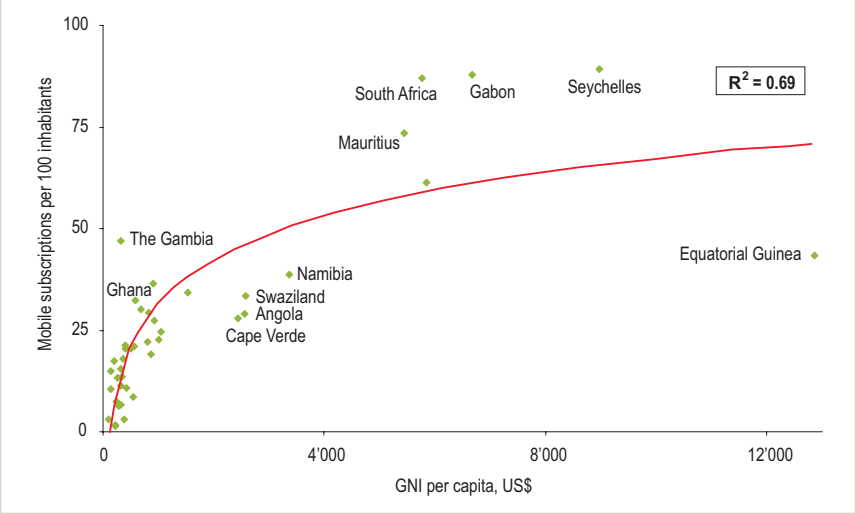
As shown in Chapter 1, high growth in Africa's mobile cellular market has boosted mobile penetration in the region up to nearly a third of the population. Nevertheless, today there is still considerable variation in mobile penetration among African countries. While the regional average number of mobile subscriptions per 100 inhabitants had grown to 33 in 2008, penetration rates ranged from more than 90 in the Seychelles, Gabon, and South Africa to less than five in Eritrea, Ethiopia and the Central African Republic. The level of development plays a role in the spread of mobile telephony, and 23 out of 30 African LDCs have a mobile cellular penetration rate below that of the regional average (Chart 2.4).

The results of the regression analysis in Chart 2.5 (showing an R squared value of 0.69) imply that income plays a role in terms of mobile cellular penetration levels in African countries.[5] The fit is not perfect, though. This suggests that other factors are also impacting the spread of mobile cellular telephony.

A key factor for increasing mobile penetration rates is the *degree of* competition adopted by countries. Most countries where mobile performance is poor relative to per capita income have limited competition. For example, in 2008 Eritrea and Ethiopia had the lowest level of mobile penetration in the region and only one mobile operator each. This was in sharp contrast with Liberia, which is emerging from civil war and in 2008 had a lower per capita income than Eritrea or Ethiopia. With four mobile operators, Liberia had a mobile penetration more than seven times higher than Eritrea and more than three times higher than Ethiopia. Other similar examples exist, across a range of

Chart 2.5

Mobile subscriptions per 100 inhabitants and GNI per capita, 2008



Note: Logarithmic scale.
Source: ITU World Telecommunication/ICT Indicators database.

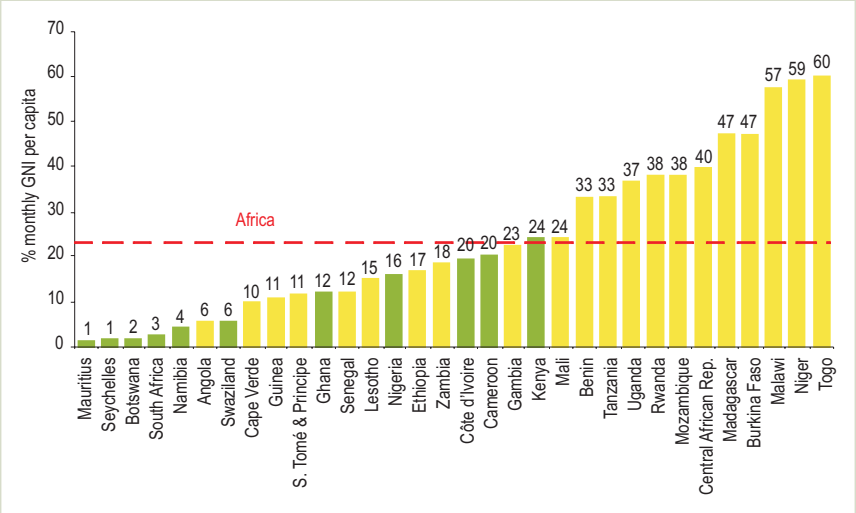
countries with different income levels. Take Equatorial Guinea, with its petroleum-based economy results and the highest per capita income in the region. Equatorial Guinea has only one mobile operator and, in 2008, its penetration was considerably lower than that of South Africa, which had a much lower per capita income, but where three facilities-based mobile operators, and a Mobile Virtual Network Operator (MVNO) are active.

Competition has been a key driver in reducing mobile prices across the region

Competition has been a key driver in reducing mobile prices across the region. Tariffs have dropped, as networks expand and operators compete for less affluent customers. In Kenya, for example, Safaricom has reacted to increased competition by reducing

Chart 2.6

Monthly mobile basket, Africa, 2008



Source: ITU World Telecommunication/ICT Indicators database.

call charges by up to 70 per cent for intra-Safaricom calls and up to 40 per cent for calls to other networks.

A monthly prepaid basket that incorporates the variety of different prices depending on the call destination (e.g., to own network, other mobile networks, fixed network) and the time of the call (e.g., peak, off-peak, weekend) has been computed by ITU to compare mobile tariffs in Africa.[6] In 2008, the average monthly cost of a mobile cellular basket corresponded to 23 per cent of monthly Gross National Income (GNI) per capita, ranging from 1.0 per cent in Mauritius to 60 per cent in Togo (Chart 2.6).

In 2008, the average monthly cost of a mobile cellular basket corresponded to 23% of monthly GNI per capita

Although mobile prices are decreasing, there is further room for improvement, given the high termination rates in some countries, as well as high tax rates. Expanding competition, *ex ante* monitoring of termination rates and reductions in value-added and excise taxes will help ensure continued growth in the mobile market and promote widespread universal access to communications in Africa (see section 2.3).

In addition, a reduction in the price of handsets could further stimulate the market, especially in the case of low-income groups, which often perceive the cost of the end-user device as the main entry barrier. In order to tackle this problem, some mobile component manufacturers, such as Texas Instruments, Motorola, and Philips, have started to develop less costly chips and other electronic components to replace those used in full-featured phones. Another strategy to reduce the price of handsets is subsidizing them in specific cases.[7] For instance, in 2008 the Government of Rwanda launched an initiative to subsidize the cost of mobile phones in rural areas. The implementation was run by the local GSM operator, MTN, in association with the Rwanda Development Bank (BRD).

In 2008, an estimated 95% of mobile subscriptions in the region were using prepaid services

2.2 Mobile applications

Operators in Africa have developed different services to meet the unique circumstances of the region and boost mobile uptake and usage. The most widespread of these services is prepaid; an estimated 95 per cent of mobile subscriptions in the region were using prepaid services in 2008. Providers have searched for ways to enhance the ease of use of prepaid services and to make it more convenient for low-income users. This includes offering features such as low denomination airtime recharges and per second billing. In Nigeria, for example, recharges are available for as little as N50 (US$0.40).

Text messaging is another area being used to enhance customer satisfaction. Some mobile operators allow free text messages to be sent from their web sites. In Kenya, mobile operator Safaricom offers the "Flashcom 130" service which provides an alternative to calling someone, and letting their mobile phone ring just long enough to know they should call back (so-called "flash calling"). Flashcom 130 allows users to send a free text message asking for someone to call. Operators are also offering services that allow users to transfer airtime to other users via a text message. For instance, Zain provides the Me2U service (CpourToi, in French-speaking countries), where a user can send a text message to charge another Zain user's airtime in any amount desired, and which is subsequently deducted from the sender's account.

Africa has pioneered the uptake of new innovative services based on SMS

Short Message Service (SMS) or text messages have become a common means of communication in Africa, and the region has pioneered the uptake of new innovative

services based on SMS. For instance, in South Africa, agricultural contract workers are often required to have a mobile phone in order to receive text messages from companies indicating when they are needed. Not being able to operate a mobile phone and to read and write text messages would exclude a person from employment by those companies. The perception that using a mobile phone helps finding a job is widespread in several African countries, as shown by recent surveys carried out by Research ICT Africa.[8]

Mobile subscribers can use their phone as a virtual bank by depositing and withdrawing funds through the value stored on their mobile phone

Mobile cellular phones are also increasingly being used for local m-commerce applications, such as pricing information for rural farmers and to pay for goods and services. In a region where a significant part of its inhabitants have a mobile cellular telephone but do not have a bank account, there is a huge opportunity to bring financial services to a largely untapped consumer base. Mobile operators have acknowledged this opportunity and have launched several m-banking services. Some international initiatives to support ICT for development projects have been launched, such as the Mobile Money for the Unbanked (MMU) programme.[9]

The most successful m-banking experience up-to-date is the M-PESA system, launched by the Kenyan mobile operator Safaricom in March 2007. It allows subscribers to use their phone as a virtual bank by depositing and withdrawing funds through the value stored on their mobile phone. As of May 2009, M-PESA has around 6.5 million subscribers, 9'000 distribution agents around Kenya, and handles US$ 10 million in transactions each day.[10] Another important m-banking initiative is Zap Mobile Banking, launched in February 2009 by the Kuwaiti operator Zain. Initially available in Kenya and Tanzania, it will be expanded to Uganda and aims to bring mobile banking services to over 100 million people in East Africa.

2.3 Policy challenges

Almost all African countries have attracted private investors to their mobile markets

While Africa's mobile cellular sector has shown outstanding growth recently, sustaining this level of growth in the future may prove difficult. Additional subscriptions and use of ICT services will come from lower-income segments of the population, typically including people in rural and remote areas. This segment is harder for operators to address, because the costs of infrastructure provision are high. These customers are also highly sensitive to pricing and small price changes can have a significant impact. Some policy challenges to be faced in Africa to push mobile cellular uptake and development, including in terms of mobile broadband, include: regulation to enhance competition and develop mobile broadband, roaming agreements and taxation.

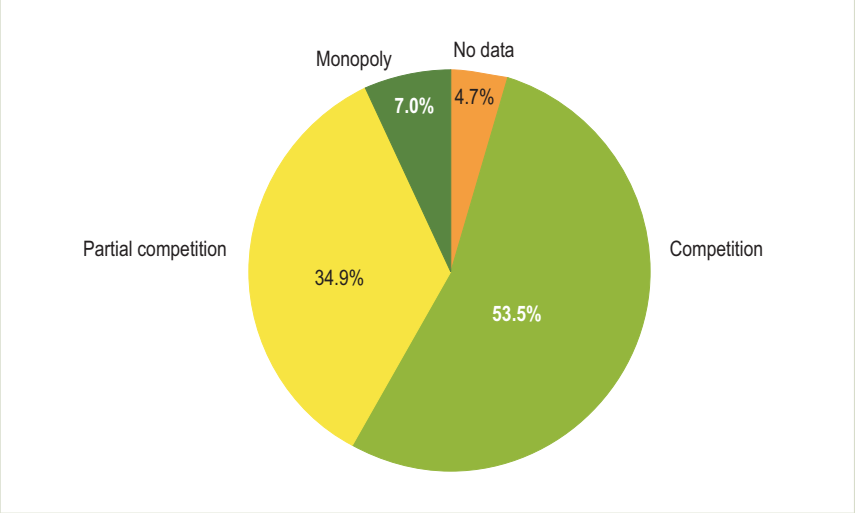
Regulation

There has been significant progress in regulatory reform across the region, including initial steps towards liberalization and the introduction of competition. Almost all African countries have introduced private investment and competition into their mobile markets (Chart 2.7). Most mobile operators in Africa are controlled by strategic operators with regional operations (Table 2.1). In 2008, the top 9 strategic mobile investors accounted for more than 80 percent of all mobile subscriptions in Africa.

Although liberalization has promoted the growth of mobile telephony, advanced features of competition such as Mobile Virtual Network Operators (MVNOs), Mobile

Level of competition in the mobile cellular market, African countries, 2008

Chart 2.7



Source: ITU World Telecommunication Regulatory Database.

Strategic mobile investors in Africa, 2008

Table 2.1

Strategic investor	Subscriptions (000s)	Number of countries	Revenue (US$ m)	Capital expenditure (US$ m)
MTN (South Africa)	64'306	15	12'088	3'176
Zain (Celltell) (Kuwait)	41'018	15	4'169	1'957
Vodacom (South Africa)*	33'995	5	6'841	603
Vodafone (UK)* **	21'090	2	1'609***	204***
France Telecom	16'962	14	2'330	NA
Millicom (Luxembourg)****	9'039	7	711	601
Portugal Telecom	6'032	4	1'661	358
Moov (UAE)*****	1'500	7	NA	NA
Vivendi / Maroc Telecom	1'011	2	202	NA

Note: * Financial data refer to year ending March 2008. **Vodafone's data include subscriptions in South Africa and Kenya as they stood in March 2008. *** Includes only operations in South Africa. **** Financial data are proportionate. ***** Refers to 2007.
Source: ITU, adapted from company reports.

Number Portability (MNP) and the regulation of Mobile Termination Rates (MTR) are not widespread.

Mobile Virtual Network Operators (MVNOs) have proved to be an effective way to enhance commercial competition in a market. In Africa, there are few examples of MVNOs. In 2005, ZanTel launched operations in mainland Tanzania using Vodacom's infrastructure. In the same year, Virgin Mobile became the second *de facto* MVNO in Africa,[11] as it began operations in South Africa using the infrastructure of one of the licensed mobile operators in the country, Cell C. In addition, two independent service providers, Autopage Cellular and Nashua Mobile, operate in South Africa. Finally, in July 2008 a MVNO was launched in Cameroon, under the brand name Yemba.

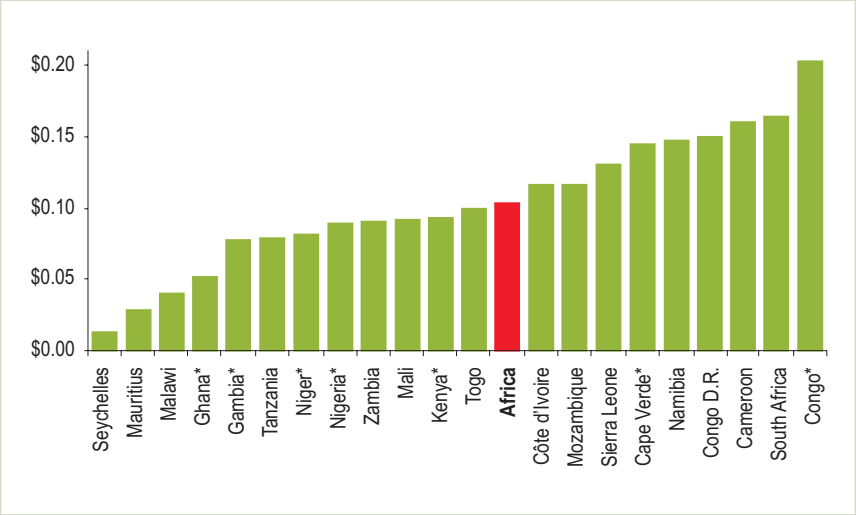
South Africa is the only country in the region that has launched Mobile Number Portability (MNP)

Mobile Number Portability (MNP) enables users to retain their telephone number when switching operators and results in more competitive markets, as users are less hesitant to switch operators if they can keep their number. The first MNP implementation in Africa was launched in South Africa in November 2006. By April 2009, there had been 391'000 portings[12] with the newest operator, Cell C, having the highest net gain in subscribers. Although some other African countries, such as Ghana, Kenya and Nigeria, have been mulling the implementation of MNP, no other country in the region has yet implemented it.

Mobile interconnection has proved problematic in Africa, as elsewhere. There have been ongoing disputes among operators about the prices to charge for terminating calls on mobile networks (i.e. **mobile termination rate, MTR**). Often rates are unrelated to costs and can be used to discourage competition through different own network and off-network pricing structures. Although retail mobile competition may exist, regulators in a number of countries around the world have determined that mobile operators exercise a monopoly over the termination of calls on their networks and have begun to regulate MTRs. Although MTRs in US$ in Africa are low compared with other regions (given

Chart 2.8

Mobile Termination Rates, US$ per minute, 2008



Note: * 2007 data.
Source: TMG, Inc.

lower incomes in the region), there is a need to keep termination rates as cost-based as possible. There is also considerable variation in the region (Chart 2.8).

In Africa, the complexities involved in mobile interconnection have generally been left to operators to resolve, with regulatory authorities only becoming involved where operators cannot agree. This approach has rarely worked well and some regulators are now taking a more proactive approach establishing MTR ceilings. The Nigerian Communications Commission has intervened several times, establishing MTR targets.[13] The Communications Commission of Kenya established a ceiling MTR, as well as a cap on retail off-net call prices.[14] The regulator claims that MTR regulation has contributed to Kenya's mobile market doubling in 2007.[15] In 2008 the Information & Communication Technologies Authority (ICTA) of Mauritius passed a new directive to reduce the standard interconnection user charge.[16]

Infrastructure-sharing can reduce costs and prices, making ICTs more affordable for a wider segment of the population

Infrastructure-sharing – the topic of the ITU Global Symposium for Regulators 2008 – is particularly relevant for the telecommunication sector in Africa (Box 2.1). Given the need for investment in ICT infrastructure in the region, it is logical to minimize duplication and share facilities, where practical. This can reduce costs and prices, making ICTs more affordable for a wider segment of the population. Regulators can help by creating a trusting environment among operators and developing policies that promote infrastructure-sharing.

Wireless broadband networks offer promising solutions for increasing broadband access in the region

The deployment of IMT-2000/3G technologies, such as EVDO, W-CDMA and HSDPA, in several African countries has fostered the growth of mobile broadband services in the region (see Chapter 1 for more details). In addition, WiMAX is gaining momentum as a wireless broadband technology in Africa.[17] Wireless broadband networks offer promising solutions for increasing broadband access in the region. However, they greatly depend on efficient spectrum allocation and liberal licensing. Governments should promote competitive allocation of adequate spectrum for a full range of broadband wireless technologies. Moreover, operators should be encouraged to roll-out coverage of advanced wireless technologies beyond urban areas through tax incentives, license conditions and initiatives to promote infrastructure-sharing.

Roaming

Regional roaming received a big boost with the launch of Celtel's One Network in 2006

Given the high penetration of mobile communications in the region, **roaming agreements** – which allow users in one country to use their mobile phones in another – should be encouraged. The lack of agreements and high prices have discouraged regional roaming. Regional roaming received a big boost with the launch of Celtel's[18] One Network in 2006, allowing mobile users in the East African countries of Kenya, Tanzania and Uganda to use their mobile phones in any of the countries at local rates free from roaming charges, subject to taxes.[19] After successive enlargements of the One Network (the latest being the addition of Ghana, in December 2008), 12 African countries and 5 Arab States currently participate in it.[20]

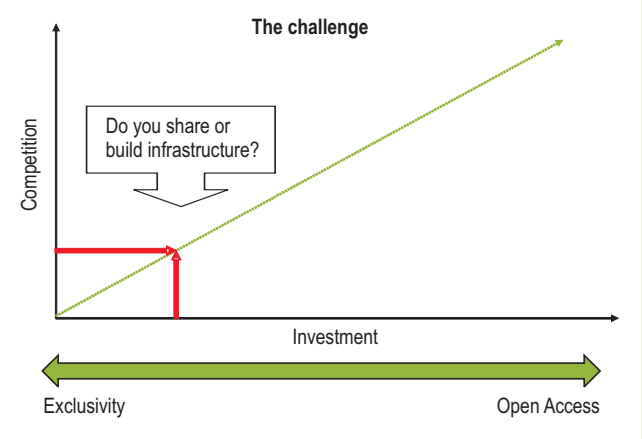
In Eastern Africa, several operators have cooperated to launch a similar service, dubbed "Kama Kawaida". With the latest addition of Vodacom Tanzania to the roaming agreement in April 2009, Kama Kawaida subscribers can enjoy roaming services with MTN Uganda, MTN Rwanda, MTL Uganda, Safaricom Kenya, UCom Burundi and Vodacom Tanzania.

Box 2.1

Let's do it together! Infrastructure Sharing for Africa

Key policies in the first wave of regulation, market liberalization and privatization were the separation of networks and interconnection agreements. Many incumbents in developed economies have been forced to open up their networks to competitors and new market entrants on a non-discriminatory basis and functional or operational separation continue to be key regulatory steps to increase competition, bring down prices and address consumer needs.

However, in markets where new infrastructure deployment is needed either to upgrade existing networks like fibre optic or roll out infrastructure to previously (usually rural) unconnected areas, functional separation is not necessarily the ideal remedy since operators have little (financial) incentives to invest in these areas.



Source: Dr. Tracy Cohen and Russell Southwood, Sharing National Fibre in Developing Countries, Presentation at the 8th Global Symposium of the Regulators, Thailand 2008.

To address these challenges, a number of countries have adopted regulations to encourage and support infrastructure sharing. The idea is not to go back one step and concentrate market power within one monopoly, but rather, to share the infrastructure, and its cost, and to compete on the service level. Governments should closely examine their specific market environments and intervene where market failures occur. Infrastructure sharing could help developing countries lower the cost of deploying fixed broadband and encourage second generation mobile operators to mitigate to wireless broadband technologies.[21]

Infrastructure sharing has been identified as a valid alternative for fixed networks, mobile base stations but also for international gateways. It also helps to address environmental concerns or local planning aspects like passage rights or geographic situations that encourage the cooperation of providers. Cooperation can take place in the form of passive infrastructure sharing – e.g. poles, equipment rooms, and passage rights – and active infrastructure sharing of network elements such as base stations.[22] Passive infrastructure is estimated to reduce deployment costs by 40 percent and active infrastructure by 60 percent.

It is up to governments to create the right regulatory framework to encourage and allow operators to engage in infrastructure sharing. It is also up to governments to identify market failures and those areas that could benefit most from infrastructure sharing. To raise awareness and to highlight regulatory possibilities, technicalities and advantages, ITU's last Global Symposium for Regulators, held in Thailand in 2008, focused on infrastructure sharing. A key objective of the meeting was to highlight alternative regulations, including private public partnerships and investments to extend infrastructure availability, especially in developing countries. As for any regulatory environment, the success of infrastructure sharing will largely depend on the ability of governments to create trust through transparency, accountability and non-discriminatory actions.

There are various examples in the area of infrastructure sharing in Africa:

- In Tanzania, the regulator allowed Zanzibar Telecom Ltd (Zantel) to provide a mobile service to the mainland from its base in Zanzibar using Vodacom Tanzania's mobile network. This

Let's do it together! Infrastructure Sharing for Africa (continued)

Box 2.1

has lowered costs for Zantel's subscribers on Zanzibar who travel to the mainland and also provided mainland users with additional competition. Another example of mobile infrastructure sharing is collaboration among mobile operators to provide regional roaming services .

- Local loop unbundling (LLU), where the incumbent's network is shared among competing operators, is largely absent in Africa. However, the Economic Community of West African States (ECOWAS) is mandating LLU for dominant operators in member states.

- In addition to cost savings, another motive for infrastructure sharing relates to environmental concerns. The Nigerian Communications Commission has issued guidelines on shared infrastructure stating that one aim is to "protect the environment by reducing the proliferation of infrastructure and facilities installations."

- In many African countries, a lack of cooperation among operators has resulted in a proliferation of backbone transmission infrastructure. Two consequences of this are that nationwide connectivity has often been neglected as the networks often consist of bits and pieces clustered around urban areas, and that in many instances, backhaul infrastructure is microwave and not higher capacity fiber optic. In South Africa, the government has created a company to operate the national fiber backbones of the power utility and telecommunications arm of the railway company. It will then be leased to the second fixed-line operator, Neotel, who can in turn sell capacity to other service providers.

Source: Based on ITU (2008a).

Taxes

Taxes on communication services strongly influence ICT use in Africa, given the low average income levels in the region. Import duties on IT equipment, VAT on goods and services and excise taxes on communications services raise prices, limiting take-up and discouraging use.

VAT and excise taxes add significantly to the cost of calls in some countries

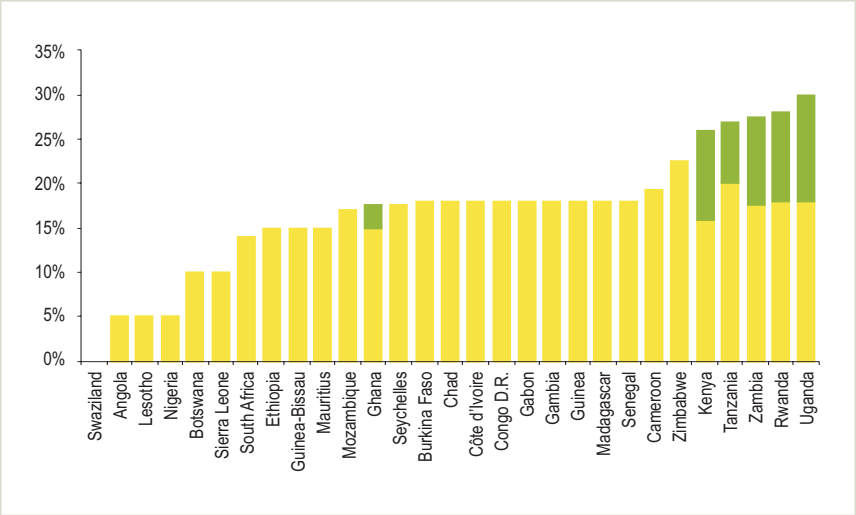
VAT on communication services range from 5 to 23 per cent across the region. In addition, some countries, particularly in East Africa, add an excise charge on mobile and sometimes fixed calls. The combination of VAT and excise taxes adds significantly to the cost of calls in some countries (Chart 2.9).

A reduction in customs duty resulting in a 1% drop in the price of a handset in Africa could boost mobile penetration by 2.4%

The combination of import duties, VAT and excise taxes increases the cost of mobile ownership. The GSM Association has conducted several studies on the impact of taxes on mobile penetration based on the Total Cost of Mobile Ownership (TCMO, which is made up of taxes applied to handsets, subscription and airtime). In the latest study, two African countries, Tanzania and Uganda, are among the top five in terms of tax as a percentage of TCMO. The GSM Association study found that a reduction in customs duty resulting in a 1 per cent drop in the price of a handset in Africa could boost mobile penetration by 2.4 per cent. The GSM Association concluded that a 1 per cent reduction in overall TCMO taxes could lead to an average increase in penetration of 0.5 per cent. Moreover, the study observes that "*elasticity of demand is estimated to be higher in Africa than elsewhere, reflecting the potential for further marginal consumers, and hence to increase penetration greatly by a reduction in the TCMO.*"[23] Another regional

Chart 2.9

Airtime Value-Added Tax (VAT) and excise taxes in Africa,[24] 2007



Source: GSM Association.

study carried out by the GSM Association found that a reduction in excise taxes would lead to a 4-8 per cent increase in penetration, while boosting medium-term tax revenues for governments due to a larger number of users and spillover effects throughout the economy.[25]

In Uganda, the elimination of the mobile excise tax could result in a more than 50% increase in demand between 2007 and 2010

Despite Uganda being one of the most competitive markets in Africa, with five licensed mobile operators, the Uganda Communications Commission has become concerned about low mobile penetration rates and commissioned a study, which concluded that high taxes play a significant role in suppressing mobile penetration: "*…there has been a slowdown in uptake of mobile phone services over the recent past, suggesting that tax increases result in a significant discouraging effect on uptake and consumption of services.*"[26] The study also found that consumers are using payphones more, due to higher taxes on mobile services. Further, the study notes excise taxes have a disproportionate impact on lower income users: "*…poorer households bear a higher burden than their higher income counterparts.*" It concludes that the elimination of the mobile excise tax would result in a more than 50 per cent increase in demand between 2007 and 2010.

In Namibia, the incumbent decided to absorb the cost of a recently introduced 15 per cent tax on pre-paid communications airtime. Telecom Namibia noted that otherwise, the rise in prices would impact "*…ordinary Namibians, mainly students, the elderly and the unemployed as they make up a huge number of pre-paid card users.*"[27] This suggests that taxes pose a serious barrier to increasing ICT use in Africa, as remaining potential customers originate in the lowest income segments of the population.

As the President of Rwanda declared: "*In ten short years, what was once an object of luxury and privilege, the mobile phone, has become a basic necessity in Africa.*"[28] By adjusting taxes to this new reality, tax analysis and simulations estimate that African countries could attract an additional 43.4 million mobile subscriptions in the period 2007-2012, increasing mobile penetration and hence tax receipts in the medium term.[29]

To sum up, Africa has seen remarkable growth in the mobile cellular market, with significant progress in population coverage, a more even distribution of subscriptions in the region, and higher mobile cellular penetration. These achievements have been supported by the development of mobile services that meet the requirements of the region, such as prepaid, text messaging, and m-banking. Despite the progress, Africa still needs to face some challenges in order to upgrade its infrastructure, and achieve similar mobile cellular uptake levels as those of the rest of the world. In particular, further growth in the region requires extending access to lower income segments of the population. To meet these new targets, some policy challenges remain to be tackled, such as enhancing competition in services, making better usage of Universal Access and Service Funds (UASFs), sharing infrastructure, and regulation in the area of roaming agreements, and taxation. These changes may be politically difficult in some cases, but they are vital for the long-term growth of the African mobile cellular sector.

Some regulatory changes may be politically difficult, but they are vital for the long-term growth of the African mobile cellular sector

Endnotes

1 This chapter is based on ITU (2008a), updated with the latest figures and information.

2 See ITU (2008b) for more details.

3 The country with highest compound annual growth rate in the five-year period is Guinea-Bissau (230 per cent). However, this high annual growth rate is due to the fact that the country had very few mobile cellular subscriptions in 2003 (1'275 compared to 500'000 in 2008), which makes it difficult to compare it with other countries in the region.

4 Ethiopia had only 51'000 mobile cellular subscriptions in 2003, compared to more than 3 million subscriptions in Nigeria in the same year. Therefore, although Ethiopia's annual mobile cellular growth was higher, the country reached only 3.2 million mobile cellular subscriptions in 2008 – or 3.7 per cent of its population –, while Nigeria had 63 million cellular subscriptions and 42 per cent penetration in 2007.

5 The R squared value of a logarithmic regression provides a measure of how well the trendline approximates the real data points. It varies from 0 to 1, 1 being the value obtained by a perfect fit of the data points.

6 See Chapter 3 for more details.

7 See ITU (2008a), and John Blau. "Talk Is Cheap." *IEEE Spectrum Online*. October 2006. Available at: http://spectrum.ieee.org/oct06/4662.

8 See Stork, C. & Schmidt, J. P. (2009).

9 The Mobile Money for the Unbanked (MMU) programme is an initiative of the Bill & Melinda Gates Foundation and the GSM Association. The MMU programme will support approximately 20 projects in developing countries, focusing on Africa, Asia and Latin America, with the goal of reaching 20 million previously unbanked people with mobile financial services by 2012.

10 See http://wirelessfederation.com/news/15801-m-pesa-still-not-profitable-despite-high-growth-rate-safaricom-ceo/ for a recent update on M-PESA figures.

11 South Africa has no MVNO licenses. However, operators are allowed to have agreements with service providers to resell their services, which is what Virgin mobile does on Cell C network. As a result, Virgin Mobile is not considered a MVNO according to South Africa's regulation, but *de facto* it acts as such.

12 See http://number-portability.co.za/.

13 Nigerian Communications Commission. 2006. *Determination of Interconnection Rate.* http://www.ncc.gov.ng/interconnection/Interconnect%20Rate%20Determination%202006.pdf.

14 Communications Commission of Kenya. "Implementation of the Telecommunications Network cost study Results". February 23, 2007. *Press Statement.* http://www.cck.go.ke/UserFiles/Image/news23_feb07.jpg.

15 "Kenya sees 107% rise in mobile users." *TeleGeography's CommsUpdate.* March 7, 2008. http://www.telegeography.com/cu/article.php?article_id=22090&email=html.

16 See news release from the ICTA: http://www.icta.mu/mediaoffice/2008/iuc_04_08.htm.

17 According to Maravedis, by the end of 2007 there were some 20'000 WiMAX subscribers in the African continent. See "WiMAX Opportunities in Africa" available at: http://www.maravedis-bwa.com/article-38.html.

18 Mobile operator Zain rebranded its "Celtel Africa" operations to "Zain" in August 2008.

19 Celtel International, September 27, 2006: "Celtel launches One Network: The world's first borderless mobile phone network", *Press Release*, available at: http://www.celtel.com/en/news/press-release41/index.html.

20 For more details, see Zain's press release, 1st August 2008: http://www.ke.zain.com/en/about-us/news/press-release24/index.html.

21 Tracy Cohen and Russell Southwood: Extending Open access to National Fibre Backbones in Developing Countries, Discussion Paper, 8th Global Symposium for Regulators, February 2008, ITU, Geneva.

22 Susan Schorr: What do we mean by 6 Degrees of Sharing?, Discussion Paper, 8th Global Symposium for Regulators, February 2008, ITU, Geneva.

[23] See GSM Association (2007a).

[24] Excise tax is an additional tax to VAT, usually applied to luxury goods and services, which in some countries is applied to mobile calls.

[25] See GSM Association (2007b).

[26] See Eria Hisali (2007).

[27] "Telecom Namibia to absorb 15% VAT cost on pre-paid telecommunication airtime", *Press Release*, Telecom Namibia, January 31, 2008.

[28] See the "Welcome Remarks by His Excellency Paul Kagame, President of the Republic of Rwanda At Connect Africa Summit", available at http://www.gov.rw/government/president/speeches/2007/29_10_07_itu.html.

[29] According to GSM Association (2008), by removing all non-VAT taxes relating to handsets, subscriptions and connections, 43.4 million additional mobile subscriptions in Sub-Saharan Africa could be added in the period 2007-2012. Moreover, the cost of owning and using a mobile phone would drop substantially in such countries as the Republic of Congo (-25 per cent), Cameroon (-24 per cent), Chad (-22 per cent), and Malawi (-18 per cent), among others.

Chapter 3.

Benchmarking ICT developments in Africa

3.1 Regional analysis of the ICT Development Index (IDI)

In response to the calls for benchmarking information society developments made at the international level during the World Summit on the Information Society (WSIS)[1], the ITU presented the ICT Development Index (IDI) in March 2009.[2] The IDI is a useful tool to benchmark and assess the information society developments of economies, as well as to monitor the progress of the digital divide. The IDI is a composite index made up of eleven different indicators, grouped in three sub-indices. The sub-indices measure ICT infrastructure and access (sub-index access)[3], ICT use and intensity of use (sub-index use)[4], and the capacity to use ICTs effectively (sub-index skills)[5].

Table 3.1 shows the results of the IDI in Africa[6] for two benchmarking years, 2002 and 2007, with countries ranked by their 2007 values (for tables on the three sub-indices see Annex 2). Overall, all countries improved their scores. This is to be expected, as growth in ICT access and usage is globally increasing.

The top ten 2007 IDI economies in Africa comprise all of the region's upper-middle economies included in the IDI, topped by Seychelles. Seychelles is the smallest country in terms of population in the region (less than 100'000 inhabitants in 2007). As most indicators used to compute the IDI are measured by number of inhabitants or households, countries with smaller populations will find it easier to improve their IDI score. That is why those three large countries in terms of population that rank among Africa's top ten 2007 IDI, stand out: South Africa (48 million inhabitants), Ghana (23 million), and Kenya (38 million). Ghana and Kenya stand out also for being the only two lower-income countries among the top ten.

Ghana and Kenya stand out for being the only two lower-income countries among the top ten

The IDI can be used to measure the magnitude of the digital divide within and across regions. Chart 3.1 shows that the digital divide between the African region and the rest of the world (the digital divide value is 2.5) is much more pronounced than the divide within the region (which has a digital divide value of 1.1).

Chart 3.2 shows the relationship between the IDI and GNI per capita (expressed in US$) in Africa. The logarithmic model presented in the chart provides a good fit for those countries with low income levels, but does not fully explain the differences of higher-income countries.

Among African countries with less than US$ 2'000 GNI per capita, The Gambia stands out positively above the rest of countries, while Congo has lower-than-expected ICT levels (i.e. IDI value). Amongst African countries with higher income, Mauritius, South Africa, and Botswana have nearly the same income, yet quite different IDI values.

Table 3.1

ICT Development Index (IDI), 2002 and 2007, Africa

Country	Rank 2007	IDI 2007	Rank 2002	IDI 2002	Rank change 2002-2007	IDI change 2002-2007
Seychelles	1	3.60	1	2.59	0	1.01
Mauritius	2	3.45	2	2.45	0	1.00
South Africa	3	2.70	3	2.11	0	0.60
Cape Verde	4	2.18	5	1.67	1	0.51
Gabon	5	2.14	7	1.48	2	0.66
Botswana	6	2.10	4	1.70	-2	0.40
Namibia	7	1.92	6	1.58	-1	0.34
Swaziland	8	1.73	8	1.32	0	0.41
Ghana	9	1.63	14	1.10	5	0.53
Kenya	10	1.62	10	1.21	0	0.41
Gambia	11	1.49	22	0.96	11	0.53
Lesotho	12	1.48	11	1.15	-1	0.32
Cameroon	13	1.46	12	1.12	-1	0.34
Zimbabwe	14	1.46	9	1.29	-5	0.16
Côte d'Ivoire	15	1.41	18	1.01	3	0.40
Zambia	16	1.39	16	1.08	0	0.31
Nigeria	17	1.39	15	1.09	-2	0.30
Senegal	18	1.38	25	0.95	7	0.42
Congo	19	1.37	13	1.10	-6	0.26
Madagascar	20	1.36	23	0.96	3	0.40
Benin	21	1.28	30	0.76	9	0.52
Togo	22	1.26	17	1.03	-5	0.23
Uganda	23	1.21	26	0.92	3	0.29
Malawi	24	1.17	24	0.95	0	0.22
Rwanda	25	1.17	19	0.99	-6	0.18
Tanzania	26	1.13	21	0.96	-5	0.17
Mali	27	1.12	31	0.75	4	0.37
Ethiopia	28	1.03	28	0.78	0	0.25
Mozambique	29	1.02	29	0.77	0	0.26
Eritrea	30	1.00	20	0.96	-10	0.04
Burkina Faso	31	0.97	32	0.68	1	0.29
D.R. Congo	32	0.95	27	0.92	-5	0.04
Guinea-Bissau	33	0.90	34	0.56	1	0.35
Chad	34	0.83	33	0.65	-1	0.17
Niger	35	0.82	35	0.51	0	0.31

Source: ITU.

The Seychelles stands out positively among countries with higher-than-expected ICT levels given its income.

Overall, the relation between GNI per capita and IDI value is not as strong in Africa (R squared value of 0.69) as in the world (R squared value of 0.88) or as, for example,

Magnitude of the digital divide, Africa and the rest of the world, 2007

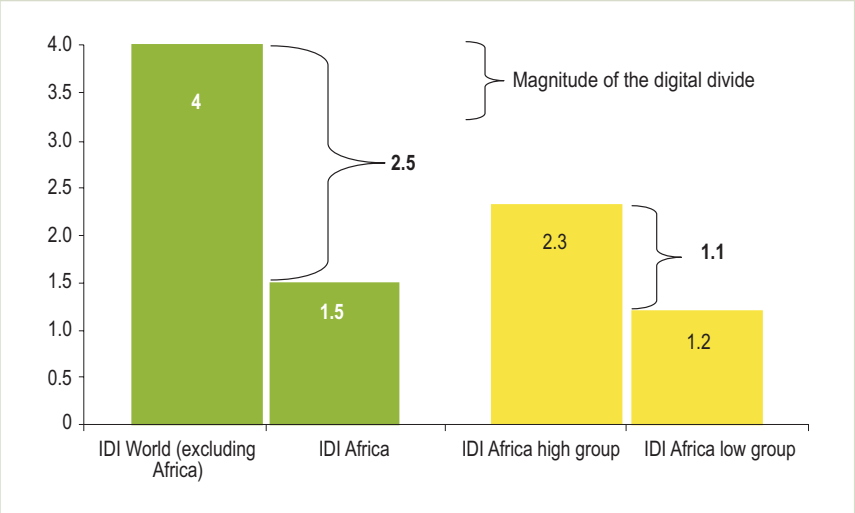


Chart 3.1

Note: The magnitude of the digital divide between Africa and the rest of the world is the difference in the average 2007 IDI values for these two regions. To measure the magnitude of the digital divide within Africa, average 2007 IDI values for two groups of countries were computed: one group including African countries with high IDI values (i.e. above the African IDI average) and another group including African countries with low IDI values (i.e. below the African IDI average). The magnitude of the digital divide within Africa is the difference in the IDI values for these two groups.
Source: ITU.

in Asia and the Pacific (R squared value of 0.93).[7] This suggests that other factors play an important role in the uptake of ICTs in many African countries. For example, the structures of the economies in the region are quite different from other regions since many Africa economies are dominated by agricultural production and commodity exports. Compared to Asia-Pacific (a region that is also home to many developing countries), Africa's ICT industry is small. The relatively weak link between income levels and IDI values also suggests that government policies can have an important impact on the development of ICTs.

IDI and GNI per capita, 2007

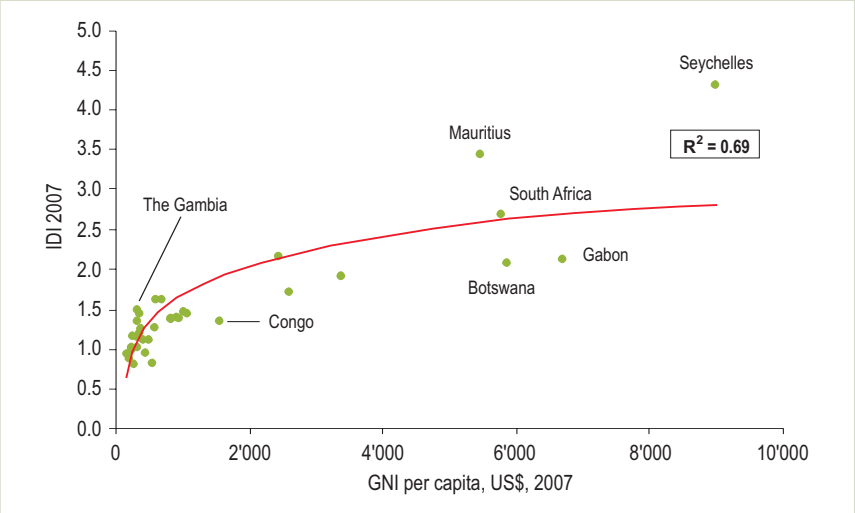


Chart 3.2

Source: ITU.

Table 3.2

IDI changes 2002-2007

	Africa			World	
	Average value 2002	Average value 2007	Change in value 2002-2007	Average value 2007	Change in value 2002-2007
IDI	1.15	1.52	0.37	3.40	0.92
Sub-index access	1.12	1.72	0.61	3.91	1.23
Sub-index use	0.06	0.20	0.14	1.43	0.89
Sub-index skills	3.38	3.74	0.36	6.31	0.37

Source: ITU.

In 2007, only Mauritius and Seychelles reached sub-index access and use values comparable to the world's average

Table 3.2 summarizes the average changes for the five-year period in each of the three IDI sub-indices. The dynamics of the different IDI sub-indices in Africa are in line with the three-stage model on which the index is based.[8] The approach is a sequential one: countries with low levels of ICT development will progress towards an Information Society by improving first ICT access, and then ICT use. Most African countries are at the first stage of this evolution, with advances in the sub-index access, but very limited improvements in the sub-index use. The increase in Africa's sub-index access was significant (and well above the world's change in value), yet in 2007 Africa's value still represented less than half of the world's value. In the sub-index use, progress in Africa was very modest, eight times lower than the world's average. As a result, in 2007 only Mauritius and Seychelles reached sub-index access and use values comparable to the world's average.

On the other hand, improvements in education and literacy are generally less dynamic, and therefore value changes in the sub-index skills tend to be lower than in the other sub-indices. However, in Africa the improvement in skills was remarkable, in line with the dynamics of developing countries, and comparable to the world's average.

Internet bandwidth per Internet user more than doubled from 2002 to 2007 but its shortage remains a critical impediment for Africa

Africa's progress in the **sub-index access** was mainly due to improvements in two indicators: mobile cellular subscriptions per 100 inhabitants, and international Internet bandwidth per Internet user. Growth in mobile cellular subscriptions has been analysed in chapters 1 and 2. Chart 3.3 shows the evolution of international Internet bandwidth in Africa. The region passed from 1000 Mbps in 2002 to more than 10'000 Mbps in 2007. As the number of Internet users also grew significantly in the period, international Internet bandwidth per Internet user grew at a slower rate, yet it more than doubled from 2002 to 2007.

The shortage of international Internet bandwidth has been acknowledged as a critical impediment for Africa, especially in landlocked countries and others that do not have access to the scarce undersea fibre-optic networks, such as the SAT-2 and the SAT-3/WASC/SAFE systems in the western coast, and the SAS-1 in the eastern coast. East Africa is particularly afflicted by a shortage of fiber-based international Internet connectivity, resulting in high retail prices.

International Internet bandwidth in Africa, 2002-2007

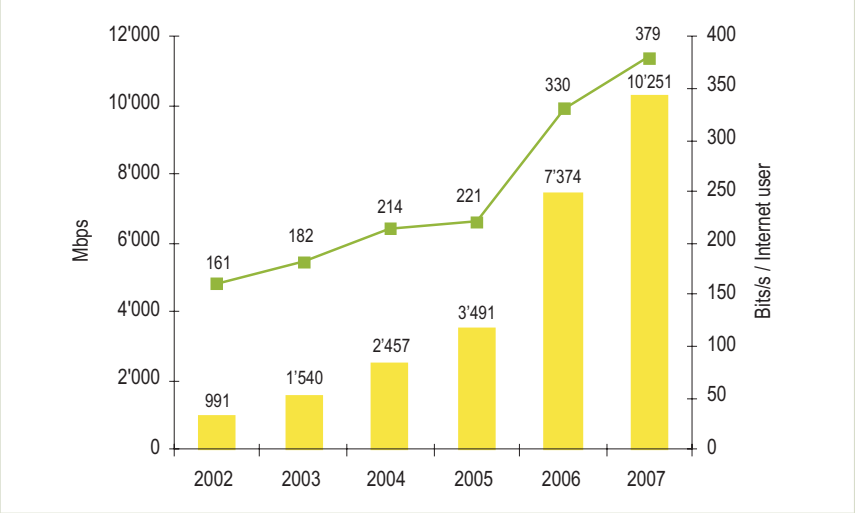


Chart 3.3

International Internet bandwidth

International Internet bandwidth per Internet user

Source: ITU.

The increase in international Internet bandwidth (Chart 3.3) reflects the efforts undertaken by several African governments to develop continental broadband infrastructure. These efforts are likely to show its full results in the coming years, once some of the most ambitious initiatives come into operation. The Seacom, and the TEAMS submarine cables are scheduled to be landed in Kenya by mid-year 2009,[9] and alleviate the shortage of international Internet bandwidth in East Africa. Other submarine cables that are currently deployed and are scheduled for later dates include EASSy (scheduled for 2010), also targeting Africa's eastern coast, and WACS (scheduled for 2011), which will link South Africa and Europe through Africa's western coast.

In 2007, Africa had less international Internet bandwidth than the Dominican Republic, yet more than 70 times its population

Notwithstanding the progress made in the last five years, until these new submarine cable projects are completed Africa's international connectivity will remain low. In 2007, Africa had less international Internet bandwidth than the Dominican Republic, yet more than 70 times its population.

Africa's slow progress in the **sub-index use** can be explained by the low broadband penetration (both fixed and mobile) in the region. Most of the increase in the sub-index is due to the growth in Internet user penetration, which has been analysed in Chapter 1.

Concerning the **sub-index skills**, the region improved in secondary enrolment rate and in adult literacy, while much less progress was achieved in tertiary enrolment rate.

The following section takes a closer look at the IDI ranking in Africa, and highlights selected countries:[10]

- **Seychelles** tops the regional ranking, unchanged from 2002. The country has greatly improved in the sub-indices access and use, reaching the highest values

in Africa in both sub-indices. In the sub-index access, Seychelles significantly improved in mobile cellular penetration (from 57 to 89 per cent), in the proportion of households with a computer (from 12 to 30 per cent), and in the proportion of households with Internet access at home (from 11 to 20 per cent). In the sub-index use, in 2007 the country reached 37 Internet users per 100 inhabitants, by far the highest Internet penetration in the region. Fixed broadband, although low (4 per cent in 2007), was the second highest in Africa. On the other hand, mobile broadband penetration stood at only 1.2 per cent in 2007. Despite its leading position in Africa, Seychelles is still far from IDI levels of leading countries in other regions.[11]

Mauritius had the highest fixed telephone penetration of Africa, as well as the second highest proportion of households with a computer

- **Mauritius** ranks second in the regional IDI 2007, the same place it had in 2002. The country stood out in the improvements made in the sub-index use (1 point, the highest of the region), reaching in 2007 the highest values in the region in fixed broadband penetration (5 per cent) and mobile broadband subscriptions per 100 inhabitants (6 per cent). Internet usage improved also significantly (from 10 to 27 Internet users per 100 inhabitants). These results are explained by the improvements made in the sub-index access: the country had the highest fixed telephone penetration (29 per cent in 2007) of Africa, as well as the second highest proportion of households with a computer (28 per cent in 2007) and households with Internet access at home (19 per cent in 2007). Despite the progress made, the country still has ample room for improvement to reach the ICT levels of developed economies.

- **South Africa** ranks third in 2007, the same position it had in 2002. The country improved mainly in the sub-index access, due to remarkable gains in mobile cellular penetration (from 30 to 87 per cent), and in international Internet bandwidth per Internet user (182 to 852 bits/s/user), although the total international Internet bandwidth per Internet user remained rather low (and comparable to that of Ethiopia, for example). On the other hand, little progress was achieved in the percentage of households with access to the Internet (4.8 in 2007), and in the number of Internet users per 100 inhabitants (from 6.7 to 8.2 per cent).

South Africa has made remarkable gains in mobile cellular penetration

- Among the top ten in the regional IDI 2007, **Ghana** is the country that has made most progress in terms of ranking, reaching in 2007 the ninth place, up from the 14th place in 2002. Moreover, it is the first ranked low-income country in the region. Ghana's IDI gain in the five-year period was based on improvements in the sub-index access and the sub-index skills. Mobile cellular penetration reached 32 per cent in 2007, compared to less than 2 per cent in 2002. The proportion of households with computer also increased significantly (from nearly 0 to 5 per cent), but is still lower than in other low-income African countries, such as Madagascar, Benin or Senegal. In the sub-index skills, Ghana gained 0.64 points, only surpassed in gain by Seychelles, Cape Verde and Ethiopia.

- **The Gambia** has moved up 11 places to rank 11 in 2007, the highest rank gain of any country in the region. Most of the improvement is due to higher mobile cellular penetration (from 7 to 47 per cent), but the number of Internet users per 100 inhabitants (from 2 to 6 per cent) and literacy rates have also increased, contributing to the relative higher ranking. On the other hand, in 2007 the number

of fixed telephone lines had stagnated at 4.5 per cent, fixed broadband penetration was negligible, and mobile broadband was not available in the country.

- **Nigeria** ranks 17th in 2007, down two places from 2002. The country experienced moderate growth in all three sub-indices. The main source of growth was its mobile cellular penetration, which reached 27 per cent in 2007, from 1 per cent in 2002. Internet users per 100 inhabitants reached 6.8 per cent in 2007, and mobile broadband became available, yet with a negligible penetration (0.1 per cent). The main gain in the skills sub-index was in adult literacy. However, fixed broadband penetration was nil in 2007, and the growth in Internet users did not correspond to an equal growth in international Internet bandwidth, which made the ratio of international Internet bandwidth per Internet user decrease in the five-year period.

Between 2002 and 2007, The Gambia has moved up 11 places in the IDI, the highest rank gain of any country in the region

- **Senegal** advanced from the 25th place in 2002 to the 18th place in 2007. As in most African countries, the improvements were driven by an increase in mobile cellular penetration (from 5 to 29 per cent). In addition, Senegal reached 7.8 per cent of households with a computer, a relatively high value taking into account the values of other countries in the region. Although there was some increase in fixed broadband penetration, it remained low (0.3 per cent), and mobile broadband was not available.

- **Benin** ranks 21st in the regional IDI 2007, up from the 30th place in 2002. In the five-year period, among all African low-income countries, only The Gambia experienced a higher growth in the sub-index access. Benin's increase in that sub-index was due to a remarkable improvement in international Internet bandwidth (from 2 to 155 Mbps), and, to a lesser extent, to an improvement in mobile cellular penetration (from 3 to 21 per cent). In the skills sub-index, the country also progressed, especially in terms of secondary enrolment rate. On the other hand, in 2007 mobile broadband was not available in the country, fixed broadband was negligible, Internet usage was below 2 per cent, and fixed line penetration was only 1.2 per cent.

Benin witnessed remarkable improvement in international Internet bandwidth

- **Mali** moved up four places to rank 27th in 2007. The country advanced 0.7 points in the sub-index access and 0.5 points in the sub-index skills, while little progress was achieved in the sub-index use. The gain in the sub-index access was due to an increase in international Internet bandwidth per Internet user (from 240 to 2'130 bits/s/user), and to progress in mobile cellular penetration (from 0.4 to 21 per cent). On the other hand, household indicators remained very low (1 per cent of households with a computer and 0.5 per cent of households with Internet access at home in 2007). Furthermore, fixed line penetration stagnated below 1 per cent in 2007, and Internet usage remained also below 1 per cent.

3.2 Regional analysis of the ICT Price Basket

In order to raise awareness of the importance of ICT prices for ICT usage and to allow policy makers to evaluate the cost of ICTs in their country and benchmark them against those of other countries, ITU presented the ICT Price Basket in March 2009.[12]

The ICT Price Basket is made up of three sub-baskets, which measure the prices of fixed telephone, mobile cellular and fixed broadband Internet services. Each sub-basket is presented in US$[13], in PPP$[14] and as a percentage of monthly GNI per capita. The three sub-baskets are combined into a single ICT Price Basket value, based on which countries are ranked. For the ranking, prices of each sub-basket are expressed as a percentage of GNI per capita, thus pointing to the relative cost (or affordability) of ICT services within a country. This section analyses the results of the 2008 ICT Price Basket in Africa.[15]

The 2008 ICT Price Basket value in Africa corresponds to as much as 41% of the countries' average GNI per capita

Overall results of the ICT Price Basket

On average, the 2008 ICT Price Basket value in Africa corresponds to as much as 41 per cent of the countries' average GNI per capita. However, it varies from 3.3 per cent in Seychelles, to 72.4 per cent in Niger. The ICT Price Basket values represent much too high a share of GNI per capita for the majority of inhabitants in the region to benefit from those services, which suggests that high prices are a major barrier for further ICT uptake.

Compared to the world, the 2008 ICT Price Basket is on average significantly more expensive in Africa. Whereas at the global level, it represents 15 per cent of the monthly GNI per capita, in Africa it represents 41 per cent.

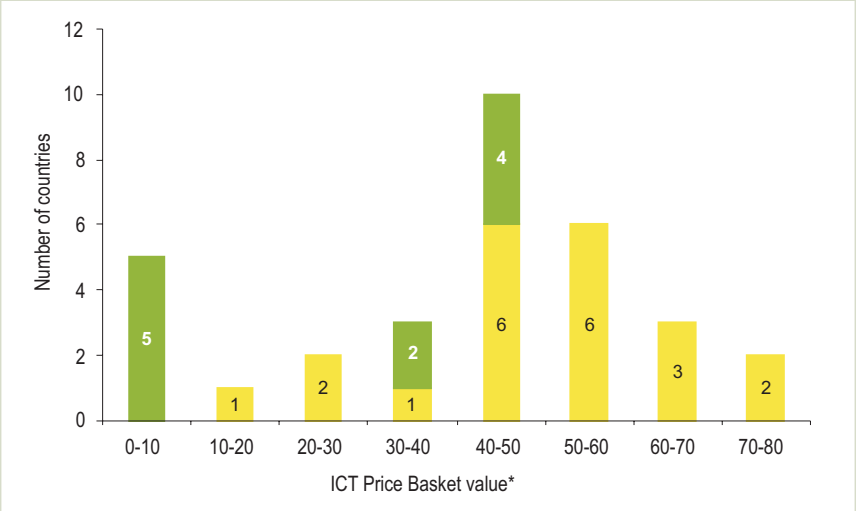
High prices are a major barrier for further ICT uptake in the region

Chart 3.4 shows in more detail the distribution of the ICT Price Basket according to countries' level of development. More than half of the economies of the region have an ICT Price Basket that corresponds to more than 40 per cent of their GNI per capita. On the other hand, only non-LDCs in Africa fall into the 0-10 per cent interval (all of them are actually below 5).

As further analysed below, the high value of the ICT Price Basket in nearly all low-income African countries is partly explained by very high fixed Internet broadband

Chart 3.4

ICT Price Basket by level of development in Africa, 2008



Least Developed Countries

Note: * The ICT Price Basket Value is the sum of the three sub-baskets as a percentage of GNI per capita, divided by three.
Source: ITU.

prices. This finding is consistent with the limited development of fixed telephone networks (necessary for DSL connections, the most popular fixed broadband technology worldwide) as well as with the shortage of international connectivity in the region, which makes bandwidth very expensive.

Table 3.3 presents the results of the ICT Price Basket in Africa. The ranking is topped by Seychelles followed by the region's remaining upper-middle income

ICT Price Basket 2008, Africa

Table 3.3

Rank	Economy	ICT Price Basket Value**	Sub-baskets			GNI per capita*, USD
			Fixed (% of GNI per capita*)	Mobile (% of GNI per capita*)	Broadband (% of GNI per capita*)	
1	Seychelles	3.3	1.6	1.5	6.8	8'960
2	Botswana	3.8	3.5	1.7	6.1	5'840
3	South Africa	4.2	4.7	2.6	5.5	5'760
4	Mauritius	4.4	1.2	1.0	11.1	5'450
5	Namibia	8.6	5.2	4.1	16.5	3'360
6	Cape Verde	11.3	4.2	9.9	19.6	2'430
7	Senegal	26.7	25.4	12.2	42.6	820
8	Lesotho	29.6	15.0	15.1	58.7	1'000
9	Angola	30.6	9.5	5.5	76.7	2'560
10	Swaziland	36.0	2.2	5.6	873.2	2'580
11	Côte d'Ivoire	37.0	30.0	19.5	61.4	910
12	Guinea	40.2	10.2	10.6	2400.0	400
13	Ghana	40.5	9.5	12.0	131.0	590
14	Ethiopia	41.6	8.1	16.6	3512.8	220
15	S. Tomé & Principe	42.0	14.6	11.4	377.2	870
16	Nigeria	43.0	13.3	15.6	890.4	930
17	Cameroon	45.8	16.9	20.3	210.0	1'050
18	Gambia	45.9	15.1	22.6	1439.3	320
19	Kenya	48.0	20.4	23.7	296.1	680
20	Mali	49.3	23.7	24.0	139.6	500
21	Benin	49.5	15.8	32.7	220.4	570
22	Zambia	53.4	41.6	18.5	137.2	800
23	Rwanda	55.0	27.3	37.6	344.4	320
24	Tanzania	55.4	32.8	33.3	204.0	400
25	Central African Rep.	57.7	33.4	39.8	4407.7	380
26	Malawi	57.8	16.1	57.4	4320.0	250
27	Burkina Faso	58.6	28.7	47.1	5193.6	430
28	Uganda	60.4	44.5	36.8	600.0	340
29	Togo	67.9	43.6	60.1	352.8	360
30	Mozambique	68.0	66.2	37.9	375.3	320
31	Madagascar	71.7	68.5	46.6	450.2	320
32	Niger	72.4	58.2	59.0	249.2	280
	AFRICA	**41.2**	**22.2**	**23.2**	**857.2**	**1'563**
	WORLD	15.1	7.3	7.6	218.9	11'189

Note: *The GNI per capita is based on the World Bank's Atlas Method.
** The ICT Price Basket Value is the sum of the three sub-baskets as a percentage of GNI per capita, divided by three.
Source: ITU.

countries included in the ICT Price Basket: Botswana, South Africa, and Mauritius. Namibia, and Cape Verde, although having lower GNI per capita than those countries, still have prices that correspond to about 10 per cent of their monthly GNI per capita, which is less than the average value of the world (15 per cent). All other African countries included in the ICT Price Basket have prices that represent more than 25 per cent of their monthly GNI per capita, which is already a relatively high value compared to the average of the world. The main reason for such high ICT Price Baskets in the region is the high cost of the fixed broadband sub-basket in many African countries (on average, it costs nearly four times as much in Africa as in the world).

The main reason for high ICT Price Baskets in the region is the high cost of the fixed broadband services

Fixed telephone sub-basket

The fixed telephone sub-basket represents the cost of local fixed residential telephone service. It includes the fee of the monthly subscription, plus the cost of 30 local calls to the same (fixed) network (15 peak and 15 off-peak calls) of three minutes each.[16]

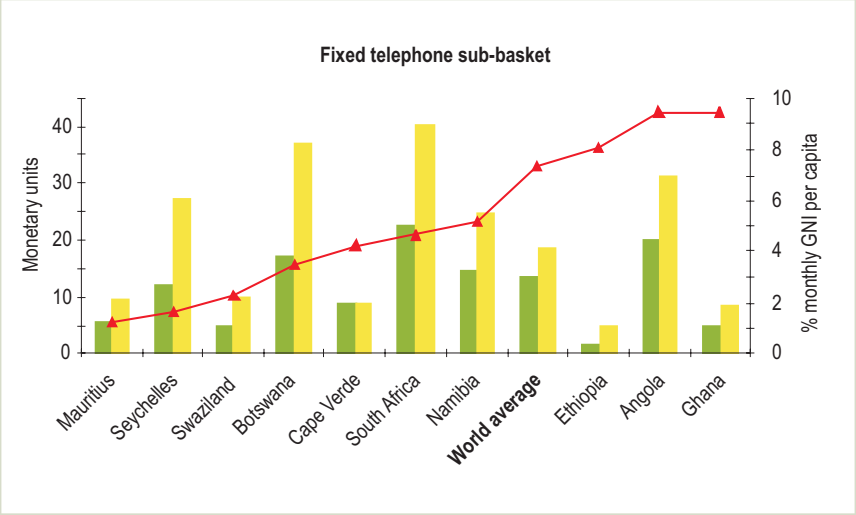
Fixed telephone prices in Africa vary from US$ 1.5 in Ethiopia to US$ 28 in Zambia

Fixed telephone prices in Africa vary from US$ 1.5 in Ethiopia to US$ 28 in Zambia. In PPP terms, Ethiopia ranks first (PPP$ 5), while South Africa has the highest prices (PPP$ 40). Nevertheless, relative to GNI per capita, fixed telephone prices in South Africa (4.7 per cent) are considerably lower than in most African countries, which makes them more affordable. On the other hand, Niger, Mozambique, and Madagascar have a fixed telephone sub-basket that corresponds to more than 50 per cent of their monthly GNI per capita.

Chart 3.5 shows the ten African countries with the least costly fixed telephone prices as a percentage of GNI per capita. The ranking is topped by Mauritius (1.2 per cent), and includes Ethiopia (8.0 per cent) and Ghana (9.5 per cent) as the only low-income countries among the top ten.

Chart 3.5

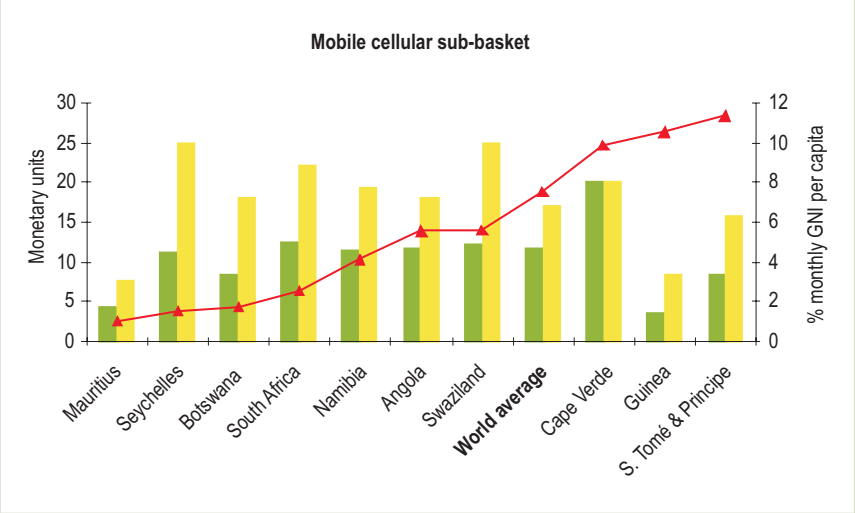
Top ten economies with the least costly fixed telephone sub-basket, 2008



Source: ITU.

Top ten economies with the least costly mobile cellular sub-basket, 2008

Chart 3.6



Source: ITU.

Mobile cellular sub-basket

The mobile cellular sub-basket corresponds to the price of a standard (low-user) basket of mobile monthly usage determined by the OECD. It includes 25 outgoing calls per month (on-net, off-net and to a fixed line), in predetermined ratios, plus 30 Short Message Service (SMS) messages.[17]

The mobile cellular sub-basket has a similar range in Africa as the fixed telephone one, but with less dispersion in prices: from US$ 3 in Ethiopia to US$ 20 in Cape Verde; from PPP$ 8 in Mauritius to PPP$ 37 in Burkina Faso.

Chart 3.6 shows the ten African countries with the least costly mobile cellular prices in terms of GNI per capita. The ranking is topped by Mauritius (1.0 per cent), followed by the remaining three upper-middle income countries in the region. The list includes Guinea (10.5 per cent) and São Tomé and Principe (11.4 per cent) as the low-income African countries with lowest mobile cellular prices.

The fixed broadband sub-basket displays the greatest differences between countries in the region

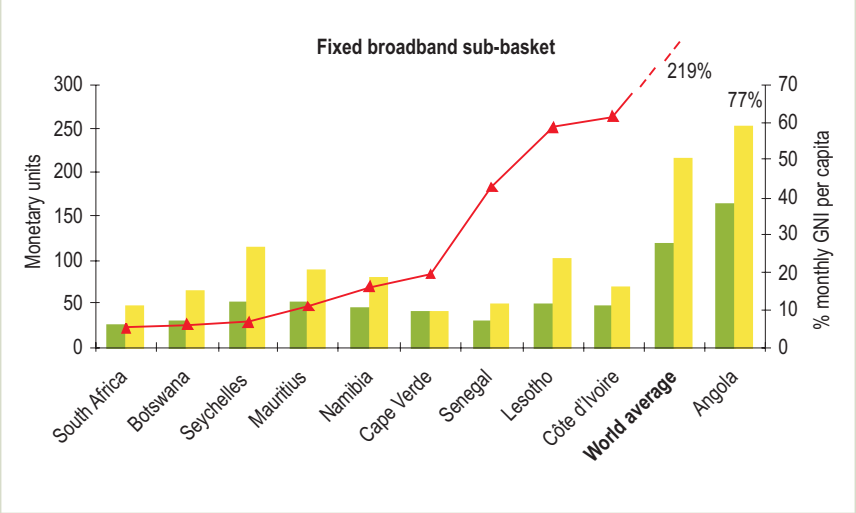
Fixed broadband Internet sub-basket

The fixed broadband Internet sub-basket is calculated based on the price of the monthly subscription to an entry level fixed broadband plan.[18]

The fixed broadband Internet sub-basket is in all African countries expensive in terms of GNI per capita. Even in those countries that have less costly fixed broadband prices, such as South Africa, Botswana, and Seychelles, it corresponds to more than 5 per cent of the monthly GNI per capita (Chart 3.7). Compared to the world, this is a relatively high value, as the world's 15 least costly countries in fixed broadband prices have a sub-basket that represents less than 1 per cent of their GNI per capita.[19]

Chart 3.7

Top ten economies with the least costly fixed broadband Internet sub-basket, 2008



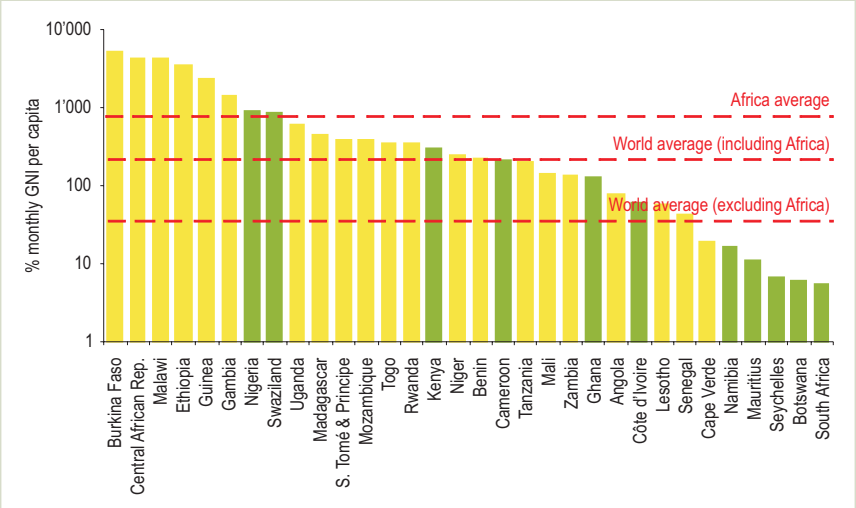
Source: ITU.

22 out of 32 African countries have a fixed broadband sub-basket that corresponds to more than 100% of their monthly GNI per capita

Moreover, the fixed broadband sub-basket displays the greatest differences between countries in the region. Senegal, the low-income African country with the least costly fixed broadband prices, has a fixed broadband sub-basket nearly four-times more expensive than that of Mauritius, the upper-middle-income African country with most expensive fixed broadband prices. Furthermore, there are as many as 22 out of 32 African countries included in the ICT Price Basket that have a fixed broadband sub-basket that corresponds to more than 100 per cent of their monthly GNI per capita (Chart 3.8). In many of these countries fixed broadband is only available through leased lines, WDSL, SDSL, and other expensive broadband technologies. This makes fixed broadband prices unaffordable for the majority of the population, and thus limited to businesses and selected organizations.

Chart 3.8

Fixed broadband sub-basket, Africa, 2008



Source: ITU.

In US$ terms, a fixed broadband entry plan may cost between US$ 26 per month in South Africa, to more than US$ 1'000 in the Central African Republic, Burkina Faso and Swaziland. In purchasing power parity, prices range from PPP$ 40 in Cape Verde to more than 1'000 in eight African countries.

Endnotes

1 For more information on the WSIS and its outcome documents, see http://www.itu.int/wsis/index.html.

2 See ITU (2009a).

3 The sub-index access includes the following indicators: fixed telephone lines per 100 inhabitants, mobile cellular telephone subscriptions per 100 inhabitants, international Internet bandwidth (bits/s) per Internet user, proportion of households with a computer, and proportion of households with Internet access at home.

4 The sub-index use includes the following indicators: Internet users per 100 inhabitants, fixed broadband Internet subscribers per 100 inhabitants, and mobile broadband subscribers per 100 inhabitants.

5 The sub-index skills includes the following indicators: adult literacy rate, secondary gross enrolment ratio, and tertiary gross enrolment ratio.

6 The following countries were not included in the regional IDI because of lack of data: Angola, Burundi, Central African Republic, Equatorial Guinea, Guinea, Liberia, São Tomé & Principe, and Sierra Leone.

7 The R square value of a logarithmic regression provides a measure of how well the trendline approximates the real data points. It varies from 0 to 1, 1 being the value obtained by a perfect fit of the data points. For a more detailed analysis of the link between income and IDI in the world, see ITU (2009a). For an analysis of the same variables in Asia and the Pacific, see ITU (2009b).

8 See Chapter 3 ITU (2009a) for more details on the conceptual framework of the IDI.

9 The Seacom cable is a wholly private initiative with 76 per cent of its shareholders based in Africa. It will link South Africa, Madagascar, Mozambique, Tanzania, and Kenya with India and Europe. TEAMS is an initiative spearheaded by the Government of Kenya, which includes as shareholders mobile service provider Safaricom, Telkom Kenya, Kenya Data Network, Africa Fibre Net of Uganda and Etisalat of the United Arab Emirates. The cable will link Kenya with the United Arab Emirates. For recent updates on the deployment of both cables, see: http://www.computerworld.co.ke/articles/2009/04/21/africas-teams-cable-project-takes and http://www.telegeography.com/cu/article.php?article_id=27519&email=html.

10 References to rankings made in this section apply to rankings of economies within the region. It is to be noted that these rankings may differ from the world IDI ranking, which includes 154 economies (see ITU, 2009a).

11 Seychelles 2007 IDI value (3.60) would rank 57th in the world IDI ranking, below such countries as Jamaica (3.78), Russia (3.83) or Argentina (4.12), and far from Sweden and the Republic of Korea, which top the world's ranking with IDI values above seven (see ITU, 2009a).

12 See ITU (2009a) for more details.

13 The average United Nations operational rate of exchange from January 2008 to September 2008 was used (the month when prices were gathered).

14 Current international dollars (PPP $) are calculated using Purchasing Power Parity (PPP) conversion factors instead of regular exchange rates. The use of PPP exchange factors helps screening price and exchange rate distortions, thus providing a measure of the cost of a given service taking into account the purchasing power equivalences between countries. PPP data used in the ICT Price Basket were provided by the World Bank. For more information on PPP methodology and data, see http://go.worldbank.org/UI22NH9ME0 and the World Bank (2008).

15 The following economies included in the ITU World Telecommunication/ICT Indicators database were not included in the ICT Price Basket because of lack of data: Burundi, Chad, Congo, Congo (Dem. Rep.), Equatorial Guinea, Eritrea, Gabon, Guinea-Bissau, Liberia, Sierra Leone, and Zimbabwe.

16 See ITU (2009a), Annex 2, for more details.

17 See ITU (2009a), Annex 2, for more details.

18 See ITU (2009a), Annex 2, for more details.

19 See ITU (2009a), Chapter 6, for a thorough analysis of the fixed broadband sub-basket worldwide.

Chapter 4.

Conclusions

During the past years, ICT developments in the African region have been characterized by high growth, and the number of mobile cellular subscriptions and Internet users has grown faster than in other regions of the world. However, Africa started out with very low ICT levels and despite rapid growth, in 2009, Africa's ICT penetration levels are still far behind the rest of the world. Indeed, the digital divide between the African region and the rest of the world is much more pronounced than the divide within the region, with very few countries reaching ICT levels comparable to global averages.

The digital divide between the African region and the rest of the world is much more pronounced than the divide within the region

The fixed line sector remains very limited and is stagnating, which also constraints fixed broadband deployment through ADSL, the world's most widely deployed fixed broadband technology. In addition, there are practically no cable networks and many countries are facing a shortage of international Internet bandwidth. As a result, fixed broadband penetration is low and broadband prices are beyond the reach of the majority of the population. The large majority of countries (22 out of 32 included in the ICT Price Basket) have fixed broadband prices that correspond to more than 100 per cent of their monthly GNI per capita. Mobile broadband is in its very initial stage but has shown higher growth than fixed broadband and may be Africa's most promising broadband access technology of the future.

Important progress in the mobile sector includes increased access to mobile networks - from 25 per cent population coverage in 2000 to 58.5 per cent in 2008 -, and a mobile cellular penetration rate of 31 per cent in 2008 (up from 12.5 per cent in 2005). Mobile subscriptions today are also more evenly distributed across countries than they were in 2005. These achievements have been greatly supported by the development of mobile services and applications that meet the requirements of users in the region, such as prepaid services, text messaging, and m-banking. Despite this important progress, the region needs to make an effort to upgrade its infrastructure and achieve mobile cellular levels similar to the rest of the world.

The cost of ICT services remains a major barrier in the region, even among wealthier countries

Results of the regional IDI analysis show that Africa is still at an early stage of ICT development. During the five-year period covered by the IDI, most growth occurred in the IDI sub-index access, with nearly negligible growth in the sub-index use. The average IDI value of the region is much lower than the world average, which shows that although there has been remarkable growth in some ICT services, the region still has a long way to go before reaching the ICT levels of the rest of the world.

The analysis of the ICT Price Basket suggests that the cost of ICT services remains a major barrier in the region, even among wealthier countries. In Africa's upper-middle-income countries, the ICT Price Basket corresponds to 4 per cent of GNI per capita, compared to around 1 per cent in countries with the highest ICT levels globally. Fixed

broadband Internet is particularly expensive and only three countries in the region have monthly prices that represent less than 10 per cent of their monthly GNI per capita.

The analysis presented in the report has demonstrated that there are two main areas of ICT policy concern for the region: (a) to sustain mobile cellular and Internet user growth and extend access to lower-income segments of the population; and (b) to take the necessary steps to enable greater broadband access.

Africa must take the necessary steps to enable greater broadband access

In order to face these challenges, a number of recommendations are provided.[1]

- *Enhance liberalization and privatization and strengthen regulatory agencies.* Despite the evidence, some countries in the region have yet to take the basic steps of establishing a genuinely independent regulator, allowing unrestrictive private sector investment and introducing unfettered competition. Countries that have not yet privatized incumbent operators should do so, in order to reduce government influence, encourage a more level-playing field and attract investment and innovation. In addition, regulatory agencies should be strengthened and allowed to operate independently. Countries that have introduced the basic building blocks of regulatory reform need to pursue deeper liberalization to sustain market growth and extend access, including steps such as the abolition of remaining exclusivities on market entry, introduction of number portability, and the simplification of licensing procedures.

Some countries in the region have yet to take the basic steps of establishing a genuinely independent regulator, allowing unrestrictive private sector investment and introducing unfettered competition

- *Promote infrastructure sharing.* Given the need for more investment in ICT infrastructure and lower prices, infrastructure sharing is a good way of minimizing duplication and sharing facilities. Regulators need to create a trusting environment among operators and develop policies that promote infrastructure sharing and allow operators to compete on the service, rather than on the infrastructure level.

- *Lower costs.* Efforts should be made to reduce prices for telecommunications services, especially broadband Internet. Apart from the regulatory policies mentioned above, lower taxes, interconnection rates and regulatory fees can all help reduce prices, making services more affordable.

- *Promote wireless broadband.* Third-generation mobile networks and WiMAX offer promising solutions for increasing broadband access in Africa. These technologies are beginning to take root in some countries. Governments should promote wireless broadband through efficient spectrum allocation and liberal licensing. Operators should be encouraged to roll out coverage of advanced wireless technologies beyond urban areas through tax incentives, license conditions and initiatives to promote infrastructure-sharing. Wireless broadband deployment could be included in universal access policies.

Governments should promote wireless broadband through efficient spectrum allocation and liberal licensing

- *Incorporate mobile cellular into universal access policies.* The success of mobile communications should be leveraged to promote universal access across the region. For the most part, mobile operators have not been involved in formal universal access programmes. Universal access policies could require mobile operators to expand coverage through license conditions or by allowing mobile operators to receive money from universal service funds to expand coverage.

- *Better use of Universal Access and Service Funds (UASFs).* UASFs can contribute to spreading the access and use of ICTs in rural and remote areas by including broadband, promoting the development of applications (such as e-learning, e-health, e-agriculture) and local content, and supporting institutions with limited resources (such as schools and hospitals in rural areas).[2]

- *Expand public Internet access.* Levels of home computer ownership and Internet access are extremely low in most of Africa and will remain so for years to come. Higher levels of ICT access will only be achieved through public facilities such as community access centers, Internet cafes and schools.

Universal Access and Service Funds can contribute to spreading the access and use of ICTs in rural and remote areas

Endnotes

[1] Several of these recommendations are based on the recommendations made in ITU (2008a).

[2] For more information and further recommendations in the area of UASF, see ITU (2009c).

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Annex 1. List of countries in Africa

Least Developed Countries (LDCs)	Non-LDCs
Angola	Botswana
Benin	Cameroon
Burkina Faso	Congo
Burundi	Côte d'Ivoire
Cape Verde*	Gabon
Central African Rep.	Ghana
Chad	Kenya
Congo (Dem. Rep.)	Mauritius
Equatorial Guinea	Namibia
Eritrea	Nigeria
Ethiopia	Seychelles
Gambia	South Africa
Guinea	Swaziland
Guinea-Bissau	Zimbabwe
Lesotho	
Liberia	
Madagascar	
Malawi	
Mali	
Mozambique	
Niger	
Rwanda	
S. Tomé & Principe	
Senegal	
Sierra Leone	
Tanzania	
Togo	
Uganda	
Zambia	

Note: Countries are grouped based on the United Nations list of Least Developed Countries (LDC). *Cape Verde graduated from the list of LDCs in December 2007. However, it is currently in a transition state, and therefore still on the official LDC list.

Annex 2. IDI sub-indices (access, use, skills) for African countries

IDI access sub-index (2002 and 2007)

Country	Rank 2007	Access 2007	Rank 2002	Access 2002	Rank change 2002-2007	Access change 2002-2007
Seychelles	1	4.32	1	3.21	0	1.11
Mauritius	2	4.04	2	2.81	0	1.24
South Africa	3	3.04	3	1.88	0	1.16
Gabon	4	2.75	7	1.39	3	1.36
Cape Verde	5	2.41	4	1.66	-1	0.74
Botswana	6	2.31	5	1.49	-1	0.82
Namibia	7	2.12	6	1.42	-1	0.70
Gambia	8	2.01	19	0.96	11	1.05
Senegal	9	1.97	8	1.33	-1	0.64
Swaziland	10	1.96	10	1.11	0	0.85
Côte d'Ivoire	11	1.86	9	1.15	-2	0.72
Benin	12	1.76	32	0.75	20	1.01
Ghana	13	1.72	29	0.82	16	0.91
Cameroon	14	1.69	18	0.96	4	0.73
Madagascar	15	1.69	16	0.98	1	0.71
Mali	16	1.66	14	0.99	-2	0.66
Burkina Faso	17	1.60	11	1.08	-6	0.52
Niger	18	1.49	22	0.86	4	0.63
Lesotho	19	1.45	25	0.85	6	0.60
Kenya	20	1.40	26	0.84	6	0.56
Mozambique	21	1.33	15	0.98	-6	0.35
Malawi	22	1.32	27	0.83	5	0.50
Nigeria	23	1.31	20	0.94	-3	0.36
Tanzania	24	1.30	13	1.00	-11	0.31
Uganda	25	1.30	31	0.79	6	0.51
Rwanda	26	1.26	12	1.07	-14	0.19
Ethiopia	27	1.23	21	0.94	-6	0.29
Zambia	28	1.19	24	0.86	-4	0.33
Togo	29	1.15	30	0.81	1	0.34
Zimbabwe	30	1.05	23	0.86	-7	0.19
Congo	31	1.01	33	0.69	2	0.31
Guinea-Bissau	32	0.99	35	0.29	3	0.70
Chad	33	0.87	34	0.63	1	0.24
Eritrea	34	0.86	17	0.97	-17	-0.12
D.R. Congo	35	0.80	28	0.82	-7	-0.01

Note: Based on ITU (2009).

IDI use sub-index (2002 and 2007)

Country	Rank 2007	Use 2007	Rank 2002	Use 2002	Rank change 2002-2007	Use change 2002-2007
Seychelles	1	1.48	1	0.49	0	0.99
Mauritius	2	1.37	2	0.35	0	1.03
South Africa	3	0.40	3	0.22	0	0.18
Zimbabwe	4	0.34	4	0.13	0	0.21
Kenya	5	0.30	12	0.04	7	0.26
Cape Verde	6	0.25	7	0.11	1	0.14
Senegal	7	0.24	14	0.03	7	0.20
Nigeria	8	0.23	22	0.01	14	0.22
Gabon	9	0.21	10	0.06	1	0.15
Gambia	10	0.20	11	0.06	1	0.14
Botswana	11	0.19	6	0.11	-5	0.07
Togo	12	0.17	5	0.12	-7	0.06
Namibia	13	0.16	8	0.09	-5	0.08
Zambia	14	0.15	19	0.02	5	0.13
Ghana	15	0.13	16	0.03	1	0.10
Swaziland	16	0.12	9	0.06	-7	0.06
Uganda	17	0.12	21	0.01	4	0.11
Lesotho	18	0.12	13	0.04	-5	0.08
Côte d'Ivoire	19	0.10	18	0.02	-1	0.08
Cameroon	20	0.10	20	0.01	0	0.09
Guinea-Bissau	21	0.09	15	0.03	-6	0.05
Congo	22	0.09	32	0.00	10	0.08
Eritrea	23	0.08	26	0.01	3	0.07
Rwanda	24	0.07	24	0.01	0	0.06
Benin	25	0.06	17	0.02	-8	0.03
Mozambique	26	0.05	25	0.01	-1	0.04
Tanzania	27	0.04	28	0.01	1	0.03
Malawi	28	0.03	27	0.01	-1	0.03
Mali	29	0.03	30	0.01	1	0.02
Chad	30	0.03	31	0.01	1	0.02
Burkina Faso	31	0.03	29	0.01	-2	0.02
Madagascar	32	0.02	23	0.01	-9	0.01
Niger	33	0.01	33	0.00	0	0.01
D.R. Congo	34	0.01	34	0.00	0	0.01
Ethiopia	35	0.01	35	0.00	0	0.01

Note: Based on ITU (2009).

IDI skills sub-index (2002 and 2007)

Country	Rank 2007	Skills 2007	Rank 2002	Skills 2002	Rank change 2002-2007	Skills change 2002-2007
South Africa	1	6.39	1	6.26	0	0.13
Mauritius	2	6.40	2	5.93	0	0.47
Seychelles	3	6.39	3	5.56	0	0.83
Cape Verde	4	5.58	6	4.81	2	0.77
Botswana	5	5.49	4	5.28	-1	0.21
Namibia	6	5.03	5	4.90	-1	0.13
Gabon	7	4.75	7	4.49	0	0.26
Kenya	8	4.70	9	4.27	1	0.43
Congo	9	4.65	11	4.11	2	0.54
Zimbabwe	10	4.50	8	4.49	-2	0.01
Swaziland	11	4.48	10	4.27	-1	0.21
Ghana	12	4.46	13	3.82	1	0.64
Zambia	13	4.30	14	3.67	1	0.62
Lesotho	14	4.24	12	3.99	-2	0.26
Nigeria	15	3.88	16	3.55	1	0.33
Cameroon	16	3.72	15	3.64	-1	0.08
Togo	17	3.65	17	3.32	0	0.33
Madagascar	18	3.38	22	2.81	4	0.57
Uganda	19	3.22	19	3.01	0	0.21
Rwanda	20	3.17	24	2.78	4	0.39
Malawi	21	3.15	18	3.11	-3	0.04
D.R. Congo	22	3.14	20	2.94	-2	0.20
Eritrea	23	3.13	21	2.85	-2	0.27
Côte d'Ivoire	24	3.12	26	2.73	2	0.39
Gambia	25	3.03	25	2.76	0	0.27
Tanzania	26	2.97	23	2.79	-3	0.18
Benin	27	2.76	27	2.27	0	0.49
Ethiopia	28	2.69	30	2.04	2	0.65
Senegal	29	2.48	29	2.04	0	0.43
Mozambique	30	2.36	32	1.86	2	0.50
Guinea-Bissau	31	2.35	28	2.13	-3	0.22
Chad	32	2.33	31	2.00	-1	0.34
Mali	33	2.24	33	1.76	0	0.48
Burkina Faso	34	1.61	34	1.25	0	0.36
Niger	35	1.08	35	0.82	0	0.25

Note: Based on ITU (2009).

Annex 3. Statistical tables

Introduction

Data generally refer to the end of the calendar year indicated in the table *List of economies*.

The following signs and symbols are used in the document:

*	Estimate or refers to years other than those specified
000s	Thousands (e.g., 1'000)
M	Millions (e.g., 1'000'000)
B	Billions (e.g., 1'000'000'000)
US$	United States dollars. See the *Technical notes* for how US$ figures are obtained.
%	Per cent
-	Zero or a quantity less than half the unit shown.
...	Data not available
CAGR	Compound Annual Growth Rate. See the *Technical notes* for how this is computed.

The absence of any sign or symbol indicates that data are in units.

List of economies

Full designation	Designation in document	Fiscal year
Angola (People's Republic of)	Angola	Ending 31.12
Benin (Republic of)	Benin	Ending 31.12
Botswana (Republic of)	Botswana	Beginning 01.04
Burkina Faso	Burkina Faso	Ending 31.12
Burundi (Republic of)	Burundi	Ending 31.12
Cameroon (Republic of)	Cameroon	Ending 31.12
Cape Verde (Republic of)	Cape Verde	Ending 31.12
Central African Republic	Central African Rep.	Ending 31.12
Chad (Republic of)	Chad	Ending 31.12
Congo (Republic of the)	Congo	Ending 31.12
Democratic Republic of Congo	Congo (Dem. Rep.)	Ending 31.12
Djibouti (Republic of)	Côte d'Ivoire	Ending 31.12
Equatorial Guinea (Republic of)	Equatorial Guinea	Ending 31.12
Eritrea	Eritrea	Ending 31.12
Ethiopia	Ethiopia	Ending 31.12
Gabonese Republic	Gabon	Ending 31.12
Gambia (Republic of the)	Gambia	Beginning 01.04
Ghana	Ghana	Ending 31.12
Guinea (Republic of)	Guinea	Ending 31.12
Guinea-Bissau (Republic of)	Guinea-Bissau	Ending 31.12
Kenya (Republic of)	Kenya	Ending 30.06
Lesotho (Kingdom of)	Lesotho	Beginning 01.04
Liberia (Republic of)	Liberia	Ending 31.12
Madagascar (Democratic Republic of)	Madagascar	Ending 31.12
Malawi	Malawi	Ending 31.12
Mali (Republic of)	Mali	Ending 31.12
Mauritius (Republic of)	Mauritius	Ending 31.12
Mozambique (Republic of)	Mozambique	Ending 31.12
Namibia (Republic of)	Namibia	Ending 30.09
Niger (Republic of the)	Niger	Ending 31.12
Nigeria (Federal Republic of)	Nigeria	Ending 31.12
Rwandese Republic	Rwanda	Ending 31.12
Sao Tome & Principe (Democratic Republic of)	S. Tomé & Principe	Ending 31.12
Senegal (Republic of)	Senegal	Ending 31.12
Seychelles (Republic of)	Seychelles	Beginning 01.04
Sierra Leone	Sierra Leone	Ending 31.12
South Africa (Republic of)	South Africa	Beginning 01.04
Swaziland (Kingdom of)	Swaziland	Beginning 01.04
Tanzania (United Republic of)	Tanzania	Ending 31.12
Togolese Republic	Togo	Ending 31.12
Uganda (Republic of)	Uganda	Ending 30.06
Zambia (Republic of)	Zambia	Beginning 01.04
Zimbabwe (Republic of)	Zimbabwe	Ending 30.06
Africa		

1. Main (fixed) telephone lines

		Main (fixed) telephone lines (000s)			Main (fixed) telephone lines per 100 inhabitants		
				CAGR (%)			CAGR (%)
		2003	2008	2003-2008	2003	2008	2003-2008
1	Angola	85.0	114.3	6.1	0.6	0.7	2.9
2	Benin	66.5	110.8 *	13.6 *	0.8	1.2 *	9.9 *
3	Botswana	131.4	142.3	1.0	7.4	7.5	-0.4
4	Burkina Faso	66.6	121.8 *	16.3 *	0.5	0.8 *	8.9 *
5	Burundi	23.9	30.4	4.9	0.3	0.3	0.2
6	Cameroon	97.4	198.3	15.3	0.6	1.0	11.1
7	Cape Verde	71.7	72.0	0.1	14.8	13.3	-2.2
8	Central African Rep.	9.5	...	...	0.2	...	...
9	Chad	12.5	...	...	0.1	...	...
10	Congo	7.0	...	...	0.2	...	...
11	Congo (Dem. Rep.)	9.7	37.3	30.8	0.0	0.1	26.3
12	Côte d'Ivoire	238.0	356.5	8.4	1.4	1.8	6.1
13	Equatorial Guinea	9.6	...	...	2.0	...	...
14	Eritrea	38.1	40.4	1.2	0.9	0.8	-3.0
15	Ethiopia	404.8	908.9	17.6	0.5	1.1	14.2
16	Gabon	38.4	26.5 *	-8.9 *	2.9	2.0 *	-8.7 *
17	Gambia	42.0	48.9	3.1	2.9	2.8	-0.9
18	Ghana	291.0	143.9	-13.1	1.4	0.6	-15.2
19	Guinea	26.2	50.0 *	17.6 *	0.3	0.5 *	16.4 *
20	Guinea-Bissau	10.6	4.6	-15.1	0.7	0.3	-17.7
21	Kenya	328.4	252.3	-5.1	1.0	0.7	-8.2
22	Lesotho	35.1	...	...	2.0	...	...
23	Liberia	6.9	2.0 *	-21.6 *	0.2	0.1 *	-24.0 *
24	Madagascar	59.6	164.9	22.6	0.3	0.8	19.3
25	Malawi	85.0	175.2 *	19.8 *	0.7	1.3 *	16.3 *
26	Mali	60.9	82.8	6.3	0.5	0.7	6.4
27	Mauritius	348.2	364.5	0.9	28.5	28.7	0.1
28	Mozambique	77.6	78.3	0.2	0.4	0.4	-2.5
29	Namibia	127.4	138.1 *	2.0 *	6.4	6.7 *	0.9 *
30	Niger	23.0	...	...	0.2	...	...
31	Nigeria	888.5	1'307.6	8.0	0.7	0.9	4.1
32	Rwanda	25.6	16.8	-8.1	0.3	0.2	-10.5
33	S. Tomé & Principe	7.0	7.7 *	2.4 *	4.7	4.9 *	1.0 *
34	Senegal	228.8	237.8	0.8	2.1	1.9	-1.9
35	Seychelles	21.2	23.2	1.8	26.8	27.4	0.5
36	Sierra Leone	24.0	...	...	0.5 *	...	...
37	South Africa	4'821.0	4'532.0 *	-1.5 *	10.3	9.3 *	-2.4 *
38	Swaziland	46.2	...	...	4.5	...	...
39	Tanzania	147.0	123.8	-3.4	0.4	0.3	-5.6
40	Togo	61.1	99.5 *	13.0 *	1.0	1.5 *	9.6 *
41	Uganda	61.0	168.5	22.5	0.2	0.5	18.4
42	Zambia	88.4	90.6	0.5	0.8	0.7	-1.0
43	Zimbabwe	300.9	344.5 *	3.4 *	2.3	2.6 *	2.5 *
	Africa	**9'552.7**	**10'617.0**	**2.5**	**1.4**	**1.5**	**-**

Note: For data comparability and coverage, see the technical notes.
* Figures are estimates or refer to years other than those specified.
Source: ITU World Telecommunication/ICT Indicators Database.

2. Mobile cellular subscriptions

		Mobile cellular subscriptions (000s)			Mobile cellular subscriptions per 100 inhabitants		
		2003	2008	CAGR (%) 2003-2008	2003	2008	CAGR (%) 2003-2008
1	Angola	350.0	6'773.4	80.9	2.3	38.7	75.5
2	Benin	236.2	3'435.0 *	70.8 *	3.0	36.9 *	65.4 *
3	Botswana	445.0	1'485.8	27.3	25.1	78.0	25.4
4	Burkina Faso	238.1	2'553.0 *	60.7 *	1.9	16.8 *	54.3 *
5	Burundi	64.0	480.6	49.7	0.9	5.4	42.9
6	Cameroon	1077.0	6'160.9	41.7	6.8	32.6	36.6
7	Cape Verde	53.3	277.7	39.1	11.0	51.2	35.9
8	Central African Rep.	40.0	154.0 *	30.9 *	1.0	3.5 *	27.9 *
9	Chad	65.0	1'809.0 *	94.5 *	0.7	16.3 *	87.1 *
10	Congo	330.0	1'807.0 *	40.5 *	8.8	47.0 *	39.9 *
11	Congo (Dem. Rep.)	1246.2	9'262.9	49.4	2.3	14.3	44.2
12	Côte d'Ivoire	1280.7	10'449.0	52.2	7.3	53.2	48.9
13	Equatorial Guinea	41.5	346.0 *	52.8 *	8.6	66.6 *	50.5 *
14	Eritrea	...	108.6	...	...	2.2	...
15	Ethiopia	51.3	3'168.3	128.1	0.1	3.7	121.6
16	Gabon	300.0	1'300.0 *	34.1 *	22.4	96.3 *	33.9 *
17	Gambia	149.3	1'166.1	50.8	10.4	66.5	45.0
18	Ghana	795.5	11'570.4	70.8	3.8	48.3	66.7
19	Guinea	111.5	2'600.0 *	87.7 *	1.2	27.2 *	85.4 *
20	Guinea-Bissau	1.3	500.2	230.2	0.1	28.6	220.0
21	Kenya	1590.8	16'233.8	59.1	4.9	42.1	54.0
22	Lesotho	126.0	581.0 *	35.8 *	7.0	28.8 *	32.7 *
23	Liberia	47.3	732.0 *	73.0 *	1.5	18.6 *	66.2 *
24	Madagascar	283.7	4'835.2	76.3	1.6	23.9	71.6
25	Malawi	135.1	1'781.0 *	67.5 *	1.1	12.5 *	62.6 *
26	Mali	247.2	3'267.2	67.6	1.9	25.7	67.6
27	Mauritius	462.4	1'033.3	17.4	37.9	81.3	16.5
28	Mozambique	435.8	4'405.0	58.8	2.3	20.2	54.6
29	Namibia	223.7	1'052.0 *	36.3 *	11.3	50.0 *	34.8 *
30	Niger	82.4	1'677.0 *	82.7 *	0.6	11.4 *	78.3 *
31	Nigeria	3149.5	62'988.5	82.1	2.5	41.6	75.4
32	Rwanda	130.7	1'322.6	58.9	1.5	13.2	54.7
33	S. Tomé & Principe	4.8	49.0 *	59.0 *	3.2	30.6 *	56.8 *
34	Senegal	782.4	5'389.1	47.1	7.0	42.5	43.3
35	Seychelles	49.2	85.3	11.6	62.2	100.9	10.2
36	Sierra Leone	113.2	1'008.8 *	54.9 *	2.2	16.9 *	50.2 *
37	South Africa	16860.0	45'000.0	21.7	35.9	92.2	20.7
38	Swaziland	85.0	457.0 *	40.0 *	8.2	39.8 *	37.1 *
39	Tanzania	1942.0	13'006.8	46.3	2.4	31.4	67.9
40	Togo	243.6	1'547.0 *	44.7 *	4.2	22.9 *	40.5 *
41	Uganda	776.2	8'554.9	61.6	2.9	26.8	56.1
42	Zambia	241.0	3'539.0	71.1	2.1	29.1	68.6
43	Zimbabwe	363.7	1'654.7	35.4	2.8	13.1	35.9
	Africa	**35'251.4**	**245'608.1**	**47.4**	**5.3**	**32.5**	**44.0**

Note: For data comparability and coverage, see the technical notes.
* Figures are estimates or refer to years other than those specified.
Source: ITU World Telecommunication/ICT Indicators Database.

2. Mobile cellular subscriptions (continuation)

		Mobile cellular subscriptions			Mobile broadband subscriptions		
		Prepaid subscriptions (%)	Population coverage (%)	As % of total telephone subscribers	(000s)		Per 100 inhabitants
		2008	2007	2008	2003	2008	2008
1	Angola	70.4 *	40.0	98.3	-	139.3	0.8
2	Benin	99.5 *	80.0	96.9 *	-	-	-
3	Botswana	97.9	99.0	91.3	-	-	-
4	Burkina Faso	99.2 *	61.1	95.4	-	-	-
5	Burundi	99.6	82.0	94.0	-	-	-
6	Cameroon	99.0	58.0	96.9	-	34.4	0.2
7	Cape Verde	99.5	87.0	79.4	-	4.9	0.9
8	Central African Rep.	...	19.3	90.2 *	-	-	-
9	Chad	100.0 *	24.0	97.3 *	-	-	-
10	Congo	99.0 *	53.0	97.2 *	-	-	-
11	Congo (Dem. Rep.)	99.6	50.0	99.6 *	-	-	-
12	Côte d'Ivoire	98.9	59.0	96.7	-	-	-
13	Equatorial Guinea	97.5 *	...	90.6 *	-	-	-
14	Eritrea	100.0	1.7	72.9	-	-	-
15	Ethiopia	87.2 *	10.0	77.7	-	-	-
16	Gabon	99.2 *	79.0	98.0 *	-	-	-
17	Gambia	100.0	85.0	96.0	-	-	-
18	Ghana	94.1	68.0	98.8	-	-	-
19	Guinea	95.0 *	80.0	98.1	-	-	-
20	Guinea-Bissau	100.0	65.0	99.1	-	-	-
21	Kenya	98.7	77.0	98.5	-	20.6	0.1
22	Lesotho	85.6 *	55.0	87.1 *	-	-	-
23	Liberia	...	...	99.7	-	-	-
24	Madagascar	98.2	23.0	96.7	-	4.3	-
25	Malawi	99.1 *	93.0	91.0 *	-	-	-
26	Mali	99.7	21.5	97.5	-	-	-
27	Mauritius	93.9	99.0	73.9	-	90.0	7.1
28	Mozambique	80.0 *	44.0	98.3	-	-	-
29	Namibia	87.6 *	95.0	88.4	-	-	-
30	Niger	92.4 *	45.0	93.1 *	-	-	-
31	Nigeria	99.0	60.0	98.0	-	3'671.5	2.4
32	Rwanda	99.0	90.0	98.7	-	0.7	-
33	S. Tomé & Principe	98.9 *	19.5	86.5	-	-	-
34	Senegal	99.3	85.0	95.8	-	-	-
35	Seychelles	76.9	98.0	78.6	-	0.1	0.1
36	Sierra Leone	...	70.0	...	-	-	-
37	South Africa	81.9 *	99.8	90.9 *	-	2'471.3	5.1
38	Swaziland	95.0 *	90.0	85.0	-	-	-
39	Tanzania	96.7 *	65.0	99.1	-	175.6	0.4
40	Togo	99.8 *	85.0	94.0	-	-	-
41	Uganda	95.0	80.0	98.1	-	214.3	0.7
42	Zambia	99.6	50.0	97.5	-	-	-
43	Zimbabwe	79.1 *	75.0	83.7 *	-	-	-
	Africa	**94.8**	**58.5**	**95.6**	**-**	**6'827.0**	**0.9**

Note: For data comparability and coverage, see the technical notes.
* Figures are estimates or refer to years other than those specified.
Source: ITU World Telecommunication/ICT Indicators Database.

3. Internet users

		Internet users (000s)			CAGR (%)	Internet users per 100 inhabitants			CAGR (%)
		2003	2008		2003-2008	2003	2008		2003-2008
1	Angola	58	550		56.8	0.4	3.1		52.1
2	Benin	70	160	*	18.0	0.9	1.7	*	14.2
3	Botswana	60	118	*	14.6	3.4	6.2	*	12.9
4	Burkina Faso	48	140	*	23.9	0.4	0.9	*	18.9
5	Burundi	14	65	*	35.9	0.2	0.7	*	29.8
6	Cameroon	100	548	*	53.0	0.6	3.0	*	47.4
7	Cape Verde	20	103		38.7	4.1	19.0		35.6
8	Central African Rep.	6	19	*	25.9	0.2	0.4	*	23.0
9	Chad	30	130	*	34.1	0.3	1.2	*	29.0
10	Congo	15	155	*	59.5	0.4	4.0	*	58.9
11	Congo (Dem. Rep.)	75	290	*	31.1	0.1	0.4	*	26.5
12	Côte d'Ivoire	140	660	*	36.4	0.8	3.4	*	33.4
13	Equatorial Guinea	3	12	*	32.0	0.6	2.3	*	29.9
14	Eritrea	30	150		38.0	0.7	3.0		32.3
15	Ethiopia	75	360		36.9	0.1	0.4		33.0
16	Gabon	35	90	*	20.8	2.6	6.7	*	20.6
17	Gambia	35	114	*	26.7	2.4	6.5	*	21.7
18	Ghana	250	997		31.9	1.2	4.2		28.7
19	Guinea	40	90	*	17.6	0.4	0.9	*	16.2
20	Guinea-Bissau	19	37		14.3	1.3	2.1		10.8
21	Kenya	1'000	3'360		27.4	3.1	8.7		23.3
22	Lesotho	30	73	*	19.6	1.7	3.6	*	16.8
23	Liberia	1	20	*	111.5	-	0.5	*	...
24	Madagascar	71	316	*	35.0	0.4	1.6	*	31.3
25	Malawi	36	316		54.4	0.3	2.2	*	50.0
26	Mali	35	125		29.0	0.3	1.0		29.0
27	Mauritius	150	380		20.4	12.3	29.9		19.5
28	Mozambique	83	350		33.4	0.4	1.6		29.8
29	Namibia	65	114	*	11.8	3.3	5.4	*	10.5
30	Niger	19	80	*	33.3	0.1	0.5	*	30.1
31	Nigeria	750	11'000		71.1	0.6	7.3		64.9
32	Rwanda	31	300		57.5	0.4	3.0		53.3
33	S. Tomé & Principe	15	25	*	10.6	10.0	15.5	*	9.1
34	Senegal	225	1'020	*	35.3	2.0	8.0	*	31.8
35	Seychelles	12	32	*	21.7	15.2	37.8	*	20.1
36	Sierra Leone	9	14	*	9.1	0.2	0.2	*	5.8
37	South Africa	3'283	4'187	*	5.0	7.0	8.6	*	4.1
38	Swaziland	27	48	*	12.3	2.6	4.2	*	10.0
39	Tanzania	250	520	*	15.8	0.7	1.3	*	13.1
40	Togo	210	350	*	10.8	3.6	5.2	*	7.5
41	Uganda	125	2'500		82.1	0.5	7.8		75.9
42	Zambia	110	700		44.8	1.0	5.8		42.7
43	Zimbabwe	800	1'481	*	13.1	6.2	11.0	*	12.0
	Africa	**8'460**	**32'098**		**30.6**	**1.3**	**4.2**		**27.0**

Note: For data comparability and coverage, see the technical notes.
* Figures are estimates or refer to years other than those specified.
Source: ITU World Telecommunication/ICT Indicators Database.

4. International Internet bandwidth

		International Internet bandwidth					
		Mbps		CAGR (%)	Bits/s per Internet user		CAGR (%)
		2003	2008	2003-2008	2003	2008	2003-2008
1	Angola	7.0	290.0 *	153.7 *	121	582 *	48.2 *
2	Benin	47.0	155.0 *	34.8 *	671	1'033 *	11.4 *
3	Botswana	23.0	81.0 *	37.0 *	383	810 *	20.6 *
4	Burkina Faso	12.0	215.0 *	78.1 *	250	1'955 *	67.2 *
5	Burundi	4.0	15.5	31.1	286	238	-3.6
6	Cameroon	45.0	155.0	28.1	450	283	-8.9
7	Cape Verde	8.0	155.0	80.9	400	1'508	30.4
8	Central African Rep.	1.0	1.5 *	11.4 *	167	96 *	-12.9 *
9	Chad	0.5	6.0 *	85.0 *	17	67 *	40.6 *
10	Congo	0.6	1.0 *	15.4 *	38	10 *	-27.8 *
11	Congo (Dem. Rep.)	5.0	10.0	14.9	67	34	-12.4
12	Côte d'Ivoire	40.5	310.0 *	66.4 *	289	689 *	24.2 *
13	Equatorial Guinea	1.0	16.8 *	102.5 *	333	1'680 *	49.8 *
14	Eritrea	2.0	24.0	64.4	67	160	19.1
15	Ethiopia	10.0	245.0 *	122.5 *	133	842 *	58.5 *
16	Gabon	45.0	200.0 *	45.2 *	1'286	2'439 *	17.4 *
17	Gambia	2.1	62.0 *	134.5 *	59	618 *	80.3 *
18	Ghana	28.9	497.0 *	103.6 *	116	565 *	48.7 *
19	Guinea	2.0	2.0 *	...	50	27 *	-14.5 *
20	Guinea-Bissau	0.1	2.0 *	136.4 *	3	59 *	104.4 *
21	Kenya	26.0	1'421.2	171.9 *	26	423	100.8 *
22	Lesotho	1.0	4.3 *	43.9 *	33	61 *	16.4 *
23	Liberia	0.3 *	...	...	...	...	...
24	Madagascar	20.0	162.0	51.9	284	512	12.6
25	Malawi	3.5	67.0 *	109.5 *	97	480 *	49.3 *
26	Mali	6.0	213.0	144.1	171	1'704	58.3
27	Mauritius	63.0	400.0	58.7	420	1'053	20.2
28	Mozambique	18.5	72.0 *	40.5 *	223	360 *	12.7 *
29	Namibia	8.8	56.0 *	58.8 *	135	554 *	42.3 *
30	Niger	2.0	30.0 *	96.8 *	105	543 *	50.7 *
31	Nigeria	92.0	693.0 *	65.7 *	123	69 *	-13.3 *
32	Rwanda	10.0	267.0	127.3 *	323	890	28.9 *
33	S. Tomé & Principe	2.0	8.0 *	41.4 *	133	348 *	27.1 *
34	Senegal	310.0	2'900.0	56.4	1'378	2'843	15.6
35	Seychelles	6.0	74.0	65.3	500	2'313	35.8
36	Sierra Leone	...	...	...	...	...	...
37	South Africa	625.5	3'380.0 *	52.5 *	191	852 *	45.4 *
38	Swaziland	1.0	1.0 *	...	37	21 *	-13.0 *
39	Tanzania	16.0	100.0 *	58.1 *	64	250 *	40.6 *
40	Togo	14.3	28.5 *	18.9 *	68	84 *	5.3 *
41	Uganda	10.0	369.0	146.5	80	148	13.0
42	Zambia	12.0	100.0	69.9	109	143	5.5
43	Zimbabwe	...	57.0 *	...	...	42 *	...
	Africa	**1'532.4**	**12'846.8**	**52.9**	**203**	**433**	**16.3**

Note: For data comparability and coverage, see the technical notes.
* Figures are estimates or refer to years other than those specified.
Source: ITU World Telecommunication/ICT Indicators Database.

5. Fixed broadband Internet subscribers

		Fixed broadband Internet subscribers (000s)			Fixed broadband Internet subscribers per 100 inhabitants	
				CAGR (%)		
		2003	2008	2003-2008	2003	2008
1	Angola	-	11.7 *	...	-	0.1
2	Benin	-	2.0 *	...	-	-
3	Botswana	-	3.5 *	...	-	0.2
4	Burkina Faso	0.1	...	...	-	...
5	Burundi	-	0.2	...	-	-
6	Cameroon	-	...	...	-	...
7	Cape Verde	-	7.4	...	-	1.4
8	Central African Rep.	-	...	...	-	...
9	Chad	-	...	...	-	...
10	Congo	-	...	...	-	-
11	Congo (Dem. Rep.)	1.0	1.5 *	8.4 *	-	- *
12	Côte d'Ivoire	0.4	...	...	-	...
13	Equatorial Guinea	-	...	...	-	...
14	Eritrea	-	-	...	-	-
15	Ethiopia	0.1	0.3 *	52.3 *	-	- *
16	Gabon	0.2	2.0 *	63.4 *	-	0.1 *
17	Gambia	-	0.3 *	...	-	- *
18	Ghana	-	17.3	...	-	0.1
19	Guinea	-	...	...	-	...
20	Guinea-Bissau	-	-	...	-	-
21	Kenya	-	17.7 *	...	-	- *
22	Lesotho	-	...	...	-	...
23	Liberia	-	...	...	-	...
24	Madagascar	-	6.2	...	-	-
25	Malawi	0.1	1.6 *	119.1 *	-	- *
26	Mali	-	5.3	...	-	-
27	Mauritius	1.2	73.0	128.0	0.1	5.7
28	Mozambique	-	...	...	-	...
29	Namibia	-	0.3 *	...	-	- *
30	Niger	-	...	...	-	...
31	Nigeria	-	25.6	...	-	-
32	Rwanda	-	4.2	...	-	-
33	S. Tomé & Principe	-	0.3 *	...	-	0.2 *
34	Senegal	2.4	47.4	81.8	-	0.4
35	Seychelles	-	3.4	...	-	4.0
36	Sierra Leone	...	...	...	...	...
37	South Africa	20.3	378.0 *	107.7 *	-	0.8 *
38	Swaziland	-	...	...	-	...
39	Tanzania	-	...	...	-	...
40	Togo	-	...	...	-	...
41	Uganda	-	4.8	...	-	-
42	Zambia	0.1	5.7	128.5	-	-
43	Zimbabwe	6.4	15.2 *	24.2 *	-	0.1 *
	Africa	**32.2**	**634.9**	**82.1**	**-**	**0.1**

Note: For data comparability and coverage, see the technical notes.
* Figures are estimates or refer to years other than those specified.
Source: ITU World Telecommunication/ICT Indicators Database.

6. Households with access to computers and Internet

		Proportion of households with computer			Proportion of households with Internet		
		2002	2007	CAGR (%) 2002-2007	2002	2007	CAGR (%) 2002-2007
1	Angola	...	5.0	...	...	3.5	...
2	Benin	...	...	...	...	...	...
3	Botswana	0.8	4.5	43.2	0.1	0.1	-
4	Burkina Faso	2.0	3.0 *	8.4	0.3 *	1.8 *	43.4
5	Burundi	...	...	...	...	...	...
6	Cameroon	0.5 *	10.1	82.5	-	5.2	...
7	Cape Verde	4.6	11.6 *	20.3	2.3	11.4 *	37.7
8	Central African Rep.	...	...	...	...	...	...
9	Chad	0.3 *	2.0 *	46.8	0.1 *	0.1 *	...
10	Congo	1.5 *	5.0 *	27.5	- *	1.4 *	125.9
11	Côte d'Ivoire	2.9 *	6.2 *	16.5	0.6 *	3.6 *	43.4
12	D.R. Congo	0.2 *	0.3 *	2.6	-	0.2 *	...
13	Equatorial Guinea	...	...	...	...	...	...
14	Eritrea	0.2	0.2 *	0.9	...	...	...
15	Ethiopia	0.1	0.2	29.7	0.1	0.1	3.7
16	Gabon	0.8 *	4.3 *	41.9	0.6 *	3.6 *	43.4
17	Gambia	0.3 *	4.0 *	74.1	-	2.0 *	...
18	Ghana	0.3 *	5.1	82.8	0.1	1.8	64.8
19	Guinea	1.9	...	...	...	...	...
20	Guinea-Bissau	0.3 *	3.6 *	70.1	-	1.0 *	...
21	Kenya	1.0	5.5	40.5	0.7	2.2	25.7
22	Lesotho	1.0 *	6.8 *	46.5	-	0.9 *	...
23	Liberia	...	...	...	...	...	...
24	Madagascar	6.9 *	12.8 *	13.3	-	1.0 *	...
25	Malawi	0.1 *	4.0 *	140.2	-	1.4 *	...
26	Mali	1.0 *	1.0 *	0.0	-	0.5 *	...
27	Mauritius	16.2 *	27.8 *	11.4	11.1 *	19.1 *	11.4
28	Mozambique	0.2	3.8	80.6	-	0.9	...
29	Namibia	9.0 *	11.2	4.4	2.0 *	3.3	10.6
30	Niger	-	1.0 *	...	-	0.2	...
31	Nigeria	0.5 *	5.1		0.3 *	3.6 *	70.1
32	Rwanda	0.1	0.3 *	25.2	0.1	0.1 *	13.8
33	S. Tome and Principe	...	...	...	...	...	...
34	Senegal	1.7 *	7.8 *	36.2	0.5 *	1.0 *	14.9
35	Seychelles	12.1	30.0	19.9	...	...	...
36	Sierra Leone	...	...	...	...	...	...
37	South Africa	9.9 *	14.8	8.3	1.9 *	4.8	19.9
38	Swaziland	6.1	12.8	16.0	5.0 *	6.0 *	3.7
39	Tanzania	1.7	2.3 *	6.4	0.3	0.6 *	13.7
40	Togo	0.9	3.5 *	33.0	0.5 *	1.0 *	14.9
41	Uganda	0.3 *	5.1 *	82.8	0.1	...	...
42	Zambia	0.8 *	4.3 *	41.9	0.3 *	1.8 *	43.4
43	Zimbabwe	1.7 *	7.8 *	36.2	0.3 *	1.8	43.4
	Africa	**1.9**	**5.3**	**22.8**	**0.4**	**2.3**	**38.2**

Note: For data comparability and coverage, see the technical notes.
* Figures are estimates or refer to years other than those specified.
Source: ITU World Telecommunication/ICT Indicators Database.

Technical Notes

General methodology

The compound annual growth rate (CAGR) is computed by the formula:

$$[(P_v / P_0)^{(1/n)}]-1$$

where P_v = Present value
P_0 = Beginning value
n = Number of periods

The result is multiplied by 100 to obtain a percentage.

Regional aggregates are either *totals* or weighted *averages* depending on the indicator. For example, for main (fixed) telephone lines, the total number of *main (fixed) telephone lines* is shown, while for *main (fixed) lines per 100 inhabitants* the weighted average is shown. Growth rates generally refer to countries for which data are available for both years.

1. Main (fixed) telephone lines

The table shows the number of *main (fixed) telephone lines* and *main (fixed) telephone lines per 100 inhabitants* for the years indicated and corresponding compound annual growth rates (CAGR, see above for computation). *Main (fixed) telephone lines* refer to telephone lines connecting a customer's equipment (e.g., telephone set, facsimile machine) to the Public Switched Telephone Network (PSTN) and which have a dedicated port on a telephone exchange. Note that for most countries, main (fixed) lines also include public payphones. Many countries also include ISDN channels in main (fixed) lines (see below ISDN and ADSL). *Main (fixed) telephone lines per 100 inhabitants* is calculated by dividing the number of main (fixed) lines by the population and multiplying by 100.

2. Mobile cellular subscriptions

The table shows the number of *mobile cellular subscriptions* and *mobile cellular subscriptions per 100 inhabitants* for the years indicated and corresponding compound annual growth rates (CAGR, see above for computation). *Mobile cellular subscriptions* refers to users of portable telephones subscribing to an automatic public mobile telephone service using cellular technology that provides access to the PSTN. *Per 100 inhabitants* is obtained by dividing the number of mobile cellular subscriptions by the population and multiplying by 100. *Prepaid subscriptions* refers to the percentage of mobile cellular subscriptions using prepaid cards. *Population coverage* measures the percentage of inhabitants that are within range of a mobile cellular signal whether or not they are subscribers. This is calculated by dividing the number of inhabitants within range of a mobile cellular signal by the total population and multiplying by 100. *Mobile broadband subscriptions* refers to the number of subscriptions to mobile cellular networks with access to data communications (e.g. the Internet) at broadband speeds (greater than or equal to 256 kbit/s in one or both directions) such as WCDMA, HSDPA,

CDMA2000 1xEV-DO, CDMA 2000 1xEV-DV etc. *Per 100 inhabitants* is obtained by dividing the number of mobile broadband subscriptions by the population and multiplying by 100.

3. Internet users

Internet users is based on nationally reported data. In some cases, surveys have been carried out that give a more precise figure for the number of Internet users. However, surveys differ across countries in the age and frequency of use they cover. The reported figure for Internet users – which may refer to only users above a certain age – is divided by the total population and multiplied by 100 to obtain *Internet users per 100 inhabitants*. Countries that do not have surveys generally base their estimates on derivations from reported Internet Service Provider subscriber counts, calculated by multiplying the number of subscribers by a multiplier.

4. International Internet bandwidth

International Internet bandwidth refers to the amount of international Internet bandwidth measured in Mega Bits Per Second (Mbps). Data for Internet bandwidth originate from ITU's annual questionnaire supplemented with data from TeleGeography. *Bits/s per Internet user* is calculated by dividing the international Internet bandwidth (in bits/s) by the number of Internet users.

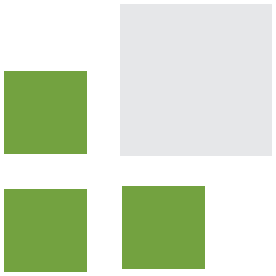
5. Fixed broadband Internet subscribers

Fixed broadband Internet subscribers refers to subscribers who pay for high-speed access to the public Internet (a TCP/IP connection) at speeds equal to, or greater than, 256 kbps in one or both directions. It includes the sum of DSL, cable modem and other fixed broadband subscribers. *Fixed broadband Internet subscribers per 100 inhabitants* is calculated by dividing the number of fixed broadband Internet subscribers by the population of the country and by multiplying by 100.

6. Households with access to computers and Internet

This table shows the latest available data for households with access to computers and Internet. Data are collected from National Statistical Offices and usually originate from national (household and individual) surveys.

For a more detailed description of the indicators, including definitions and methodological notes, please consult the *Core ICT Indicators* publication, available for free on the ITU ICT Statistics website (http://www.itu.int/ITU-D/ict/partnership/material/CoreICTIndicators_e_rev2.pdf).



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