Chapter 6

ICT in Africa:

A Status Report

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Environment and Readiness

The environment for networked readiness has improved relatively rapidly in most urban areas in Africa. Five years ago, only a handful of countries had local Internet access or mobile telephones; now, devices and access are available in virtually every major city. Hundreds of new radio stations and newspapers have been licensed over the last few years and digital satellite television has also become widely available. The "digital divide" however, is still at its most extreme in Africa. In absolute terms, networked readiness is still at a very early stage of development compared to other regions of the world. Of the approximately 816 million people in Africa in 2001, it is estimated[1] that only:

one in four have a radio (200 million);

one in 13 have a television (62 million);

one in 35 have a mobile telephone (24 million);

one in 39 have a fixed line (21 million);

one in 130 have a personal computer (PC) (5.9 million);

one in 160 use the Internet (5 million);

one in 400 have pay-television (2 million).

These figures do not take into consideration the widespread sharing of media that takes place in Africa (often ten people may read the same newspaper or share an Internet account, and a whole village may use a single telephone line or crowd around a television set at night); nevertheless, it appears that sub-Saharan Africa may be slipping behind when compared to south Asia, the other least developed region. As Table 1 shows, the two regions are at the bottom of the list in Internet usage surveys around the world, but south Asia has caught up considerably since 1998.

Table 1. **Internet Users as Percentage of Total Population**

Region	1998	2000
United States	26.30	54.3
High-income OECD (excluding the U.S.)	6.90	28.2
Latin America and the Caribbean	0.80	3.2
East Asia and the Pacific	0.50	2.3
Eastern Europe and CIS	0.80	3.9
Arab States	0.20	0.6
Sub-Saharan Africa	0.10	0.4
South Asia	0.04	0.4
World	2.40	6.7

Source: United Nations Development Program, *World Development Report 2001.*

Because the region is so diverse, it can be misleading to generalize about Africa. The averages given above obscure the great variation between countries, but it can be said that most of the continent's population are amongst the poorest

in the world (Africa had US$766 in gross domestic product (GDP) per person in 2000), with the divide between urban and rural areas being particularly marked. Most services are concentrated in the towns, while the majority of Africans (70 to 80 percent) reside in smaller communities scattered across the vast rural areas. In some countries, more than 75 percent of the country's telephone lines are concentrated in the capital city. Irregular or nonexistent electricity supplies are also common in Africa, especially outside major towns.

Another systemic problem is that road, rail, and air transport networks are limited, costly to use, and often in poor condition, resulting in barriers to the increased movement of people and goods; increased mobility is needed to implement and support a pervasive network infrastructure and also for the increased economic and social activity that would occur with greater physical movement of people. Visa requirements and congested border posts add to these difficulties. Furthermore, many tax regimes still treat computers and cellular telephones as luxury items, which makes these imported items all the more expensive.

Another problem is that the brain drain and generally low levels of education and literacy have together resulted in a great scarcity of skills and expertise (at all levels, from policy making down to the end user). Rural areas in particular have limited human resources. Along with the very low pay scales in the African civil service, this is a chronic problem for governments that are continually losing their brightest and most experienced to the private sector. The fact that this situation is not unique to Africa or other developing countries, but is also being faced by the developed world, is simply exacerbating the situation in Africa, because experienced professionals are able to find much higher paying jobs in Europe and North America.

Finally, while a good business climate is acutely needed or the information and communications sector, the general investment climate in Africa often suffers from the well-known problems of small markets, nontransparent and time-consuming business procedures, limited opportunities (partly due to the historic pattern of state monopolies), scarce local capital, currency instability, exchange controls, and inflation.

Usage

Telecommunication

Overall, a substantial increase in the rate of expansion and modernization of fixed networks is currently taking place, along with an explosion of mobile networks. The number of main lines in Africa grew about 9 percent per year between 1995 and 2001, although the overall fixed line teledensity as of 2001 is still only about one in 40 inhabitants, and one in 130 in sub-Saharan Africa (excluding South Africa). Taking into account population growth, the effective annual increase in lines is only 6 percent. Also, much of the existing telecommunications infrastructure is out of the reach of most people—50 percent of the available lines are in the capital cities, where only about 10 percent of the population lives. In more than fifteen countries in Africa, including Côte d'Ivoire, Ghana, and Uganda, more than 70 percent of the fixed lines are still located in the largest city (International Telecommunication Union [ITU] 2002).

Overall, the number of fixed lines increased from 12.5 million to 21 million across Africa between 1995 and 2001, a teledensity growth rate of 6.7 percent (i.e., taking into account population growth). North Africa had 11.4 million of these fixed lines and South Africa, 5 million lines; this means there were only 4.6 million lines in the rest of the continent. Therefore, while the sub-Sahara has about 10 percent of the world's population (626 million), it has only 0.2 percent of the world's 1 billion fixed telephone lines. Compared to all of the low-income countries (which house 50 percent of the world's population and 10 percent of the telephone lines), the penetration of telephone lines on the subcontinent is about three times worse than the "average" low-income country.

The situation is not quite as bad as it would appear, however, because of the penetration of mobile networks, where subscribers (now numbering 23.5 million) have surpassed fixed line users in most countries; this demonstrates that there is pent-up demand for basic voice services. Most of the subscribers use prepaid accounts, and because of the low cost and long range of the cellular base stations, many rural areas have also been covered. But the high cost of mobile usage (US$0.25 to US$0.50/minute) makes it too expensive for regular local calls or Internet access. A common response to this is the use of text messaging; in some countries, for example, Uganda, Kenya, and South Africa, text messaging now includes delivery of information services such as news, weather, and market prices.

Even if telecommunications infrastructure is beginning to spread, domestic use has, until recently, been largely confined to the small proportion of the population that can actually afford their own telephone—the cost of renting a connection averages almost 20 percent of GDP per capita, versus a world average of 9 percent and only 1 percent in high-income countries.[2] Despite these high charges relative to income levels, the number of public telephones is still much lower than elsewhere. According to the ITU (2001), there are approximately 350,000 public telephones in the whole continent of Africa—75,000 of which are in the sub-Sahara—or about one telephone for every 8,500 people, compared to a world average of one to 500 and a high-income average of one to 200.

However, an increasing number of operators in Africa are now passing the responsibility for maintaining public telephones to the private sector, and this has resulted in a rapid growth of public "phone shops" and "telecenters" in many countries; the most well-known case is that of Senegal, which now has more than 10,000 commercially-run public phone bureaus employing more than 15,000 people and generating more than 30 percent of the entire network's revenues. While most of these are in urban areas, a growing number are being established in more remote locations, and some networks also provide Internet access and other more advanced ICT services to the public.

Public telephone operators (PTOs) in some countries, such as Botswana and South Africa, are now launching prepaid fixed line services, or providing a "virtual telephone" alternative for those unable to obtain their own telephone. Subscribers are issued their own unique phone number and pay a small rental for a voice mailbox, from which they can retrieve their messages from any telephone. A pager can also be tied to the system to immediately inform the subscriber that a voice message is waiting.

Although there is substantial gray-market use of Voice over Internet Protocol (VoIP) services in Africa wherever international bandwidth allows, these are not officially permitted for the end user anywhere in the region except in Egypt and Nigeria. In Egypt, the national telecommunications operator provides a PC-to-phone service, and in Nigeria, the regulator has sanctioned all licensed cybercafes to provide VoIP. However, many telecommunications operators are now using or planning to use VoIP as a transport layer on their international and national links, and operators in countries such as Egypt, Gambia, Nigeria, Senegal, South Africa, and Zimbabwe have established joint ventures with international VoIP companies such as ITXC, GatewayIP, and Ibasis to implement these facilities.

Nevertheless, high telecommunications charges (often up to ten times greater than rates for equivalent services in Europe or North America) and limited service are still generally prevalent, largely because of the monopoly environment in which most national state-run providers operate. This is now slowly changing, with the first step usually being to seek an international strategic equity partner in a partial-privatization process. Generally, there have been two modes of partial privatization; selling less than (some countries are selling 30 to 33 percent) or more than 51 percent of shares. The largest international partners and their ownership levels are currently as follows: France Telecom (Côte d'Ivoire Telecom, 51 percent; SONATEL [Senegal], 33 percent; Mauritius Telecom, 40 percent); Malaysia Telecom (Telkom SA [South Africa], 30 percent; Ghana Telecom, 30 percent; SOTELGUI [Guinea Conakry], 60 percent); Maroc Telecom (Mauritel [Mauritania], 54 percent); Vivendi Universal (Maroc Telecom, 35 percent).

While most African PTOs are, or will shortly be, partially privatized, there are still a few countries lagging behind in privatizations, notably Nigeria, Gambia, Democratic Republic of the Congo, the Comoros Islands, Sierra Leone, Liberia, Zimbabwe, and Libya. Of worldwide distribution of privatization in the year 2000 (by region, based on ninety-eight countries), the African continent represented 15 percent; Europe, 35 percent; the Americas, 24 percent; the Asia Pacific region, 20 percent; and the Arab states accounted for 6 percent. In terms of the percentage of privatized operators, in 2000 Africa had 35 percent; Europe, 63 percent; the Americas, 74 percent; Asia Pacific, 53 percent; and the Arab states, 29 percent.

The availability of specialist training in telecommunications is currently extremely limited on the continent. In Africa, there are only two major regional centers for training in telecommunications: ESMT in Senegal for francophone countries, and AFRALTI in Kenya for Anglophone countries. It is expected that these centers, with the support of an ITU program, will be transformed into Centers of Excellence in Telecommunications Administration (CETA). CETA is intended to provide senior-level, advanced training, and professional development in the areas of telecommunications policies, regulatory matters, and the management of telecommunications networks and services.

A number of telecommunication operators maintain their own training schools but these, similar to the operators, usually lack financial resources. Over the last twenty years, the German international technical training assistance agency, Carl Duisberg Gesellschaft, has sent a large number of telecommunications trainees from Africa to Germany; many other development agencies have similar, if smaller, programs. At a global level, one initiative that may have an impact in the future is the ITU's Global Telecommunications Academy. This will operate as a brokerage service for distance-learning courses. Once established, the Academy is to be self-financed through a fee payable by every course participant. The aim of the Academy is to create a cooperative network of partners by pooling existing resources in universities, training institutes, financing bodies, governments, regional organizations, and telecommunications operators.

Table 2. **Telecommunications Usage in Africa, 2001**

Country	Fixed Lines (000)	Fixed Line Penetration (% of Population)	Public Telephones (000)	Mobile Users (000)	Mobile Penetration (% of Population)
Algeria	1,880.0	6.04	5.00	100.0	0.32
Angola	80.0	0.59	0.27	86.5	0.64
Benin	59.3	0.92	0.51	125.0	1.94
Botswana	150.3	9.27	3.00	278.0	16.65
Burkina Faso	57.6	0.47	1.44	75.0	0.61
Burundi	20.0	0.29	0.08	20.0	0.29
Cameroon	101.4	0.67	6.55	310.0	2.04
Cape Verde	62.3	14.27	0.39	31.5	7.21
Central Africa	10.0	0.26	0.09	11.0	0.29
Chad	11.0	0.14	0.06	22.0	0.27
Comoros	8.9	1.22	0.17	—	—
Republic of Congo	22.0	0.71	—	150.0	4.82
Côte d'Ivoire	293.6	1.80	1.93	728.5	4.46
Djibouti	9.9	1.54	0.42	150.0	0.29
D. R. C.	20.0	0.04		3.0	0.47
Egypt	6,650.0	10.30	21.99	2,793.8	4.33
Equatorial Guinea	6.9	1.47	—	15.0	3.19
Eritrea	32.0	0.84	0.42	—	—
Ethiopia	310.0	0.48	1.56	27.5	0.04
Gabon	37.2	2.95	0.83	258.1	20.45
Gambia	35.0	2.62	0.68	43.0	3.22
Ghana	242.1	1.16	3.18	193.8	0.93
Guinea	25.5	0.32	0.85	55.7	0.69
Guinea Bissau	12.0	0.98	0.20	—	—
Kenya	313.1	1.00	9.03	500.0	1.60
Lesotho	22.2	1.03	0.37	33.0	1.53
Liberia	6.7	—	—	—	—
Libya	610.0	10.93	0.45	50.0	0.90
Madagascar	58.4	0.36	0.46	147.5	0.90
Malawi	54.1	0.47	0.54	55.7	0.48
Mali	49.9	0.43	2.37	45.3	0.39
Mauritania	19.0	0.72	0.89	—	—
Mauritius	306.8	25.56	2.92	300.0	25.00
Mayotte	10	6.98	—	—	—
Morocco	1,193.3	3.92	46.84	4,771.7	15.68
Mozambique	89.4	0.44	1.86	169.9	0.84
Namibia	117.4	6.57	5.30	100.0	5.59
Niger	21.7	0.19	0.06	1.8	0.02
Nigeria	500.0	0.43	1.60	330.0	0.28
Réunion	268.5	—	—	—	—
Rwanda	21.5	0.27	0.40	65.0	0.82
SaoTomé	5.4	3.63	0.08	—	—
Senegal	237.2	2.45	13.49	390.8	4.04
Seychelles	21.4	26.73	0.22	44.1	55.15
Sierra Leone	22.7	0.47	0.31	26.9	0.55
Somalia	15.0	—	—	—	—
South Africa	4,969.0	11.35	178.11	9,197.0	21.00
Sudan	453.0	1.42	5.25	105.0	0.33
Swaziland	32.0	3.14	0.83	66.0	6.47
Tanzania	148.5	0.41	0.72	427.0	1.19
Togo	48.1	1.03	0.16	95.0	2.04
Tunisia	1,056.2	10.89	19.31	389.2	4.01
Uganda	63.7	0.28	1.38	322.7	1.43
Zambia	85.4	0.8	0.87	98.3	0.92
Zimbabwe	253.7	1.86	3.23	328.7	2.41
Total	**21,210.3**	**3.52**	**346.67**	**23,545.2**	**2.95**

Source: International Telecommunication Union

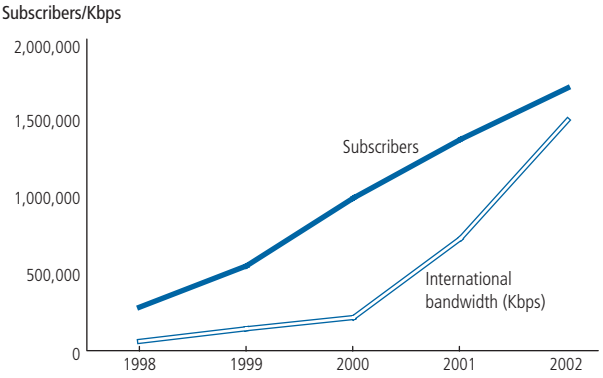
Countries with Advanced Data Services

Botswana—ISDN, Frame Relay
Egypt—ISDN, Frame Relay, ATM, DSL
Kenya—ISDN, DSL
Ghana—Frame Relay
Mauritius—ISDN, Frame Relay, DSL, ATM
Morocco—ISDN, GPRS, Frame Relay
Senegal—ISDN
Seychelles —ISDN
South Africa—ISDN, GPRS, Frame Relay
Tunisia—ISDN
Uganda—ISDN, DLS

The Internet

The use of the Internet is a good indicator of the use of information and communication technologies, as such use requires the integration of many of individual components—electricity, telecommunications infrastructure, computers, and the skills to use them. As the Figure 1 shows, both the number of Internet users and the amount of international bandwidth is still growing strongly across the continent.

Figure 1. **Growth of Internet Use in Africa**



Source: Sangonet http://www3.sn.apc.org/africa

In Africa, the pattern of Internet diffusion has been similar to that of the mobile telephone networks. Although the Internet is not quite as widespread, it preceded the mobile telephone explosion; its greatest impact is at the top end of business and in wealthy families, primarily in major urban areas.

The rates of growth seen in the 1990s have slowed in most countries, because most users who can afford a computer and telephone have already obtained connections. However, although the total number of dial-up subscriber accounts is readily available, the large number of shared dial-up accounts, along with the relatively high use of public access services such as telecenters, and cybercafes, make it difficult to measure the total number of Internet users. Because the total number of dial-up accounts is only a partial gauge of the size of the Internet sector, the sector should be looked at along

with other factors, such as the quantity of international traffic each country generates.

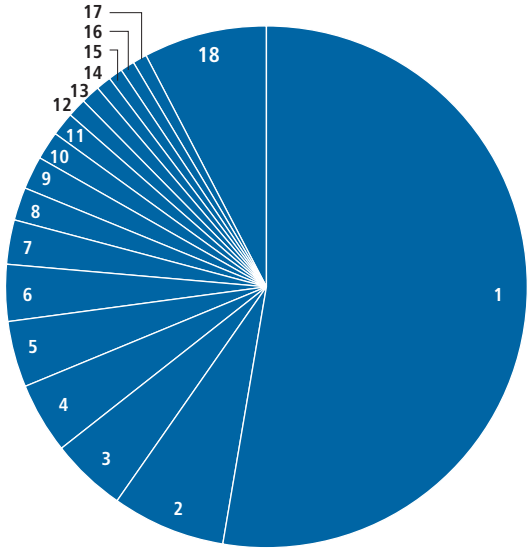
As measured by Network Wizards,[3] the total number of computers permanently connected to the Internet in Africa (excluding South Africa) exceeded 35,000 in 2001. However, such figures are becoming increasingly meaningless in Africa, with the widespread use of dot-com and dot-net domains along with the frequent re-use of Internet address space behind firewalls due to the difficulties of obtaining public Internet space. As a result, many African countries surveyed by Network Wizards show zero or only a handful of hosts, when in actual fact there might be hundreds, if not thousands, of machines connected to the Internet in each country.

As of mid-2002, the number of dial-up Internet subscribers was close to 1.7 million, which is 20 percent up from 2001, an increase mainly bolstered by growth in a few countries, such as Nigeria. North Africa and South Africa are responsible for about 1.2 million of these subscribers, leaving about 500,000 for the remaining forty-nine sub-Saharan African countries. If we assume that each computer with an Internet or e-mail connection supports a range of three to five users, this puts current estimates of the number of African Internet users at about 5 to 8 million. About 1.5 to 2.5 million of these users are outside North and South Africa; this suggests one user for every 250 to 400 people. The world average, in contrast, is one user for every fifteen people; the North American and European average is about one user in every two to three people. No studies have been made in Africa of the number of rural versus urban users, but it is safe to say that users in the cities and towns vastly outnumber rural users.

The use of public access facilities and corporate or academic networks is continuing to grow at greater rates than the number of dial-up users. Evidence of this pattern can be seen in the deployment of international Internet bandwidth, which is still expanding faster than the number of dial-up subscribers. International Internet bandwidth increased by more than 100 percent last year, from 700 Mbps of available outgoing bandwidth in 2001 to 1,500 Mbps in 2002. However, this is still slower growth than the rest of the world, which averaged 174 percent growth in 2001; further, some international links may only be as big as the circuit used by a small- or medium-sized business, or even a broadband home user, in a developed country—that is, about 128 Kbps. In most cases these circumstances are confined to very small and poor African countries, but there are many other regulatory, historic, and social factors that also influence slow growth.

Due to high international tariffs and lack of circuit capacity, obtaining sufficient international bandwidth is a major problem in most countries, and although conditions have improved recently, users generally still have to contend

Figure 2. **Countries with More Than 10,000 Internet Subscribers**



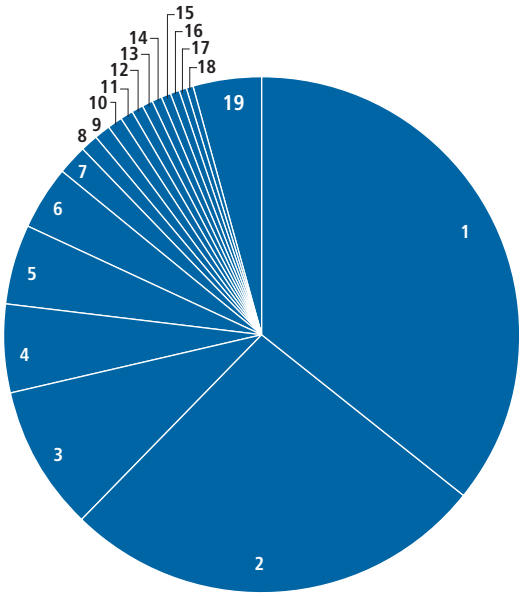
Dial-up subscriptions

1	South Africa	900,000
2	Egypt	120,000
3	Morocco	80,000
4	Algeria	75,000
5	Tunisia	7,0000
6	Nigeria	60,000
7	Reunion	47,000
8	Kenya	35,000
9	Mauritius	35,000
10	Tanzania	30,000
11	Zimbabwe	25,000
12	Botswana	20,000
13	Swaziland	20,000
14	Angola	16,000
15	Senegal	15,000
16	Ghana	15,000
17	Namibia	15,000
18	The rest	130,535

Source: Sangonet

with substantial congestion at peak times. This year, Egypt overtook South Africa as the country with the most international bandwidth (550 Mbps vs. 380 Mbps), following the launch of Nile-Online, a government-backed international connectivity provider. Today, twenty countries have links carrying 5 Mbps or more, and thirteen countries—Algeria, Botswana, Egypt, Kenya, Mauritius, Morocco, Nigeria, Senegal, South Africa, Sudan, Tanzania, Tunisia and Zimbabwe—have outgoing links of 10 Mbps or more. Also of note is that while the range in available international bandwidths continues to increase, eight countries in Africa (Liberia, Republic of Congo, Chad, Equatorial Guinea, Comoros, and São Tomé and Príncipe) are still on international links of 256 Kbps—less than that used by the average small- or medium-sized business user in Europe or North America.

Figure 3. **Countries with More Than 5 Mbps International Outgoing Bandwidth**



Total outbound bandwidth in Kbps

1	Egypt	535,000
2	South Africa	398,512
3	Morocco	136,000
4	Algeria	83,000
5	Tunisia	75,000
6	Senegal	60,000
7	Kenya	28,000
8	Gabon	16,384
9	Nigeria	15,000
10	Botswana	14,000
11	Tanzania	12,000
12	Zimbabwe	11,000
13	Sudan	10,000
14	Uganda	9,250
15	Cameroon	9,000
16	Namibia	8,500
17	Angola	7,000
18	Cote D'Ivoire	6,500
19	The Rest	64,334

Source: http://www3.sn.apc.org/africa

Incoming bandwidth is about 50 percent greater, but is not as easy to monitor because much of it comes in via variable (uncommitted) bitrate satellite broadcast circuits. Use of this type of circuitry is a common response to the bandwidth problem; Internet service providers (ISPs) in Africa are now installing data broadcasting services. A basic satellite dish can be used to receive a stream of popular Web data for caching locally, as well as to receive encoded broadcasts of other user traffic. These can often provide far cheaper incoming bandwidth than that available via local operators.

Two-way satellite-based Internet services using very small aperture terminals (VSAT) to connect directly to the United States or Europe have also been quickly adopted by ISPs wherever regulations allow—namely, in Democratic Republic of the Congo, Mozambique, Nigeria, Tanzania, and Zambia, which all have ISPs that are not dependent on the local telecommunications operator for their international bandwidth. Uganda used to allow public VSAT Internet services, but following the sale of the second operator license the issuing of new VSAT licenses has been suspended.

With the exception of some ISPs in Southern Africa, most of the international Internet circuits in Africa connect to the United States and Canada; other connections are to Belgium, Germany, the Netherlands, the United Kingdom, Italy, and France. Outgoing bandwidth totals approximately 1.5 Gbps, of which 1 Gbps lands in the United States, 375 Mbps in Europe, and 2 Mbps in Asia. Only 13 Mbps of bandwidth is intra-African. High intraregional telecommunications prices have limited the establishment of links between neighboring countries to just five—the Gambia-Senegal link, and South Africa's links to Namibia, Lesotho, Swaziland, and Botswana. (In South Africa, the telecommunications operator instituted low tariffs for international links to neighboring countries.) As a result of the high international tariffs charged by most telecommunications operators, private ISPs are discouraged from establishing multiple international links; increasing amounts of intra-African traffic are therefore transmitted through high-cost cross-continental links.

The high tariffs are also the reason behind the common practice amongst popular African Internet sites of being hosted on servers that are in Europe or the United States. This is especially necessary for the many countries, such as Tanzania and Nigeria, where ISPs operate their own independent international links without local interconnections (a practice called peering). Peering means that traffic between the subscribers of two ISPs in the same city must travel to the United States or Europe and back. Out-of-country routing makes it more efficient to host outside-country; also, Web hosting costs can be very high in Africa, whereas there are even a number of free hosting sites in the United States and Europe.

Local peering problems are now being addressed in some countries through the establishment of national Internet Exchange Points (IXPs), where all of the ISPs transfer local traffic. IXPs have already been set up by national ISP associations in Kenya, Mozambique, and South Africa, and plans are at an advanced stage to establish similar facilities in Ghana and Uganda. Although local traffic is only 15 to 25 percent of total traffic, the use of IXPs can still result in significant savings on international bandwidth and improves performance for the user.

The major international Internet suppliers are AT&T, BT, UUNET/AlterNet (with parent company WorldCom/MCI),

NSN, Teleglobe, Verio, Verestar, and OpenTransit (France Telecom/FCR). A number of other links are provided by Intelsat, PanamSat, New Skies and Inmarsat, direct-to-private and PTO groundstations in North America, Europe, and the Middle East, circumventing local PTO infrastructure.

International bandwidth is increasingly being used as a better measure of networked readiness than the total number of users, because it takes into account the range of use, "from those who write a few e-mails a week, to those who spend many hours a day on the net browsing, transacting, streaming, or downloading" (IDRC 2002). As most of the Internet traffic is international (75 to 90 percent), the size of a country's international bandwidth compared to population size provides a ready indication of the extent of its Internet activity (IDRC 2002).

An index of bits per capita (BPC) can be calculated by dividing the total international Internet bandwidth in a country by its total population (IDRC 2002). As is evident from the map in Figure 4, which charts to exact area scale the BPC per country, there is extremely large variation in the BPC index, ranging from 0.02 to greater than 40—a factor of more than 1,000. These figures reflect the wide range of wealth in different countries; however, GDP per capita only varies by a factor of about 30, which indicates that other variables affect the index. Bandwidth price is a major factor that varies considerably on the continent; high price heavily impacts demand. Price, in turn, is influenced by the regulatory environment—the presence of competition, availability of wireless and VSAT licences, as well as access to international fibre optic bandwidth.

The recent establishment of West African Submarine Cable (WASC), also shown below, has already resulted in plans by operators in Gabon, Côte d'Ivoire, Namibia, Nigeria, Senegal, and South Africa to establish large international Internet links. This should substantially increase the available Internet bandwidth and drive down prices. Senegal has already moved in this direction; last year the country enabled a 45 Mbps Internet circuit to France via the recently-installed Atlantis-2 cable, which it now shares with neighboring Gambia. Senegal is planning to become a regional hub, and will shortly be linking its Internet backbone to Mauritania and Mali, much like South Africa has done with its neighboring countries.

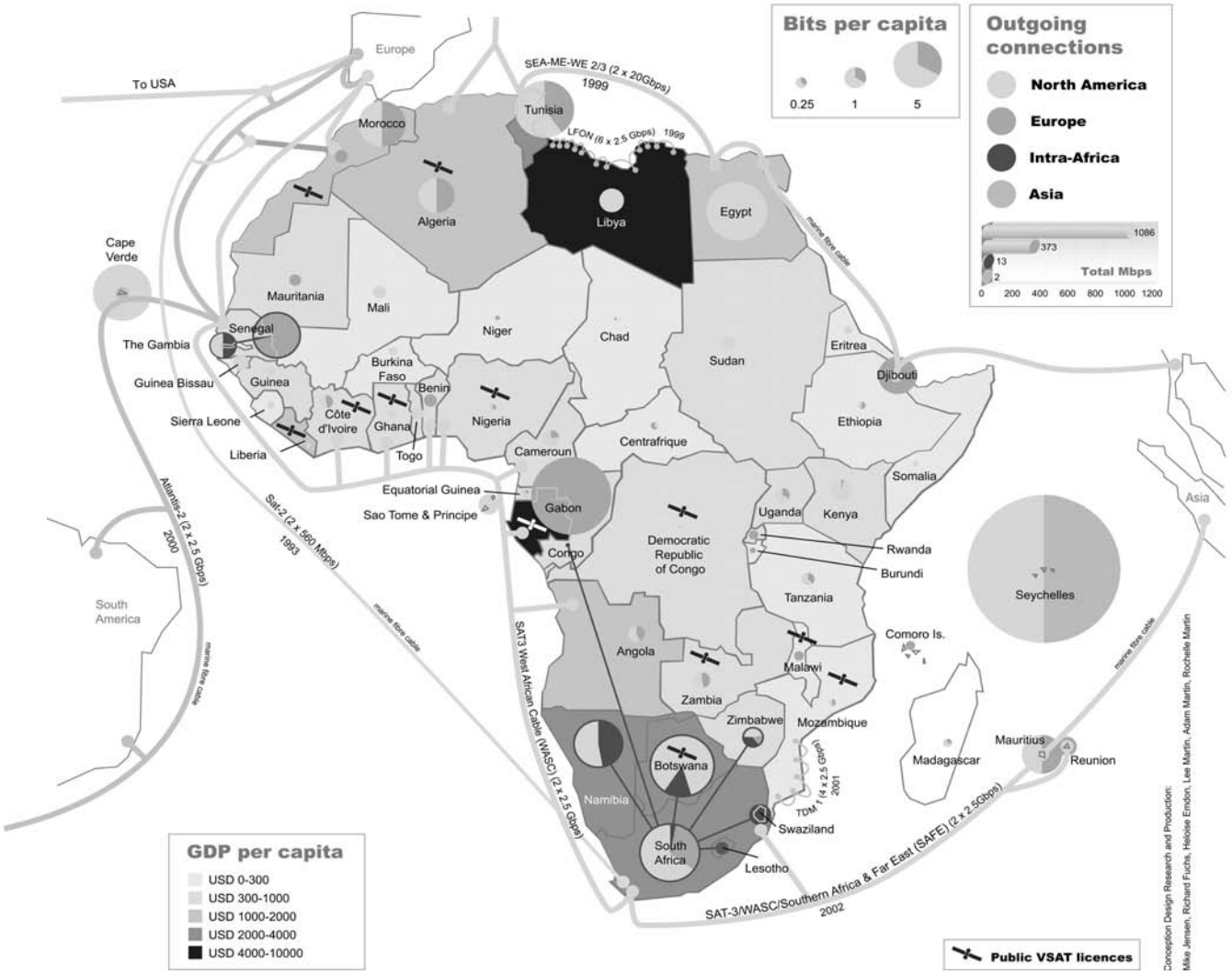
Most African capitals now have more than one ISP, and in mid-2002 there were about 560 public ISPs across the region (excluding South Africa, where the market has consolidated into three major players with 90 percent of the market and about 100 smaller players with the remainder of the market). In 2002, twenty countries had five or more ISPs, while seven countries (Egypt, Kenya, Morocco, Nigeria, South Africa, Tanzania, and Togo) had ten or more active ISPs; seven countries, however, still had only one ISP. Although Ethiopia and Mauritius are the only countries where a monopoly ISP is still national policy (i.e., private companies are barred from reselling Internet services), monopolies are present in other countries, predominantly in the francophone and the Central African/Sahel subregions, where markets are small: Burkina Faso, Central African Republic, Republic of Congo, Djibouti, Ethiopia, Mauritius, and Niger.

Of the regional ISPs, African Lakes' AfricaOnline has been listed by the London Stock Exchange as the largest operation. The group now has services in Côte d'Ivoire, Egypt, Ghana, Kenya, Namibia, Swaziland, Tanzania, Uganda, and Zimbabwe. AfricaOnline is also engaged in a partnership with WorldCom/UUNET to provide AfricaOnline's infrastructure in Kenya and Zambia. UUNet South Africa also provides their own dial-up and leased line services in Namibia and Botswana. South Africa-based MediaPost is expanding its network, with operations currently in South Africa, Tanzania, Rwanda, Republic of Congo, Kenya, and Senegal and firm plans for Nigeria, Cameroon, Malawi, and Democratic Republic of the Congo. The next largest regional ISP is Swift Global, but after selling its Ugandan operation to AfricaOnline, it is now only present in Kenya and Tanzania, making South African ISP Mweb the other regional player, having purchased ISPs in Namibia, Uganda, and Zimbabwe.

Although many African countries now have Internet points of presence (POPs) in some of the secondary towns (totaling about 280, in different locations across the continent), most rural users still have to make a costly long distance call to connect to the Internet. However, some countries have now instituted local call charges for all calls to the Internet regardless of distance, which greatly reduces costs for those living in remote areas and increases the accessibility and viability of Internet services provided by rural public access facilities in these nations. So far, nineteen countries have adopted this strategy: Benin, Burkina Faso, Cape Verde, Chad, Ethiopia, Gabon, Malawi, Mali, Mauritius, Mauritania, Morocco, Namibia, Niger, Senegal, South Africa, Togo, Tunisia, Uganda, and Zimbabwe. Interestingly, the Seychelles has gone a step further to encourage use—tariffs for calls to the Internet are charged at a 50 percent lower rate than normal local voice calls.

Currently, the average total cost of using a local dial-up Internet account for twenty hours a month in Africa is about US$60 per month (price includes usage fees and local call telephone time included, but not telephone line rental). ISP subscription charges vary greatly (between US$10 and US$80 a month) and largely reflect the different levels of maturity of the markets, the varying tariff policies of the telecommunications operators, the different regulations on private wireless data services, and on access to international

Figure 4. **African Internet Bandwidth per Capita and Marine Fibre Cables**



Source: International Development Research Center (2002)

telecommunications bandwidth. So far the "free-ISP" model has only been adopted in Egypt, where there are no monthly charges and revenues obtained from the local call tariffs are split between the telecommunications operator and the ISP.

According to the Organisation for Economic Cooperation and Development (OECD) (2000), twenty hours of Internet access in the United States costs US$22 per month (inclusive of telephone charges) in 2000. Although European costs were higher (US$33 in Germany, US$39 across the European Union), these countries have per capita incomes that are at least ten times greater than the African average. In fact, US$60 per month is higher than the average African monthly salary. Low income has limited individual use of the Internet and has, together with elements such as the low telephone and computer penetration, created the demand for public-access facilities (the cost of a single account being effectively shared amongst the customers who would not otherwise be able to afford access).

Public access services are already very much in evidence in most countries in Africa, particularly in those such as Nigeria and Senegal where telecommunications operators have relied on the private sector to provide public telephone services. Such services are also available in most other major urban areas across Africa, however, in rapidly-growing numbers of telecenters, kiosks, cybercafes, business centers as well as in other locations (e.g., in community phone-shops, schools, police stations, and clinics).

The concept has also received considerable support from members of the international community, as well as a number of national governments and public telecommunication operators as a means to establish access in rural areas. Public access to the Internet is being seen as one of the most important ways of realizing Universal Service Objectives in rural and remote locations. To achieve the objectives, many national government programs and more than twenty international pilot projects have been initiated

Table 3. **African Internet Statistics 2002**

Country	Dial-up Subscribers	International Bandwidth	Population (in Millions)	GDP/ Capita US$	Cities with POPs
		Outgoing Kbps	2000	1999	
Algeria	45,000	12,000	30.08	1,442	1
Angola	16,000	5,126	12.09	1,684	3
Benin	4,500	2,100	5.78	374	1
Botswana	20,000	14,000	1.57	3,252	11
Burkina Faso	4,700	256	11.31	199	1
Burundi	300	512	6.46	159	4
Cameroon	7,000	9,000	14.31	617	2
Cape Verde	2,456	1,024	0.41	876	1
Central Africa	700	64	3.48	276	1
Chad	900	64	7.27	149	2
Comoros	491	64	0.66	382	7
Republic of Congo	200	128	2.79	833	5
Côte d'Ivoire	13,000	6,000	16.20	767	13
D.R. C.	4,500	1,024	49.30	400	1
Djibouti	850	2,048	0.62	846	6
Egypt	100,000	535,000	65.98	1,195	1
Equatorial Guinea	200	64	0.43	668	1
Eritrea	2,500	512	3.58	161	1
Ethiopia	6,500	8,200	59.65	103	5
Gabon	5,000	16,384	1.17	5,121	7
Gambia	3,000	1,024	1.23	284	14
Ghana	15,000	4,096	19.16	372	3
Guinea	4,000	128	7.71	677	10
Guinea-Bissau	250	640	1.13	245	4
Kenya	35,000	28,000	29.01	347	2
Lesotho	750	784	2.06	547	2
Liberia	250	128	2.67	1,000	1
Libya	4,000	2,048	5.98	6,579	1
Madagascar	10,000	2,750	16.36	224	1
Malawi	3,500	2,300	10.75	242	2
Mali	6,000	4,096	10.69	230	1
Mauritania	960	384	2.53	455	1
Mauritius	35,000	4,096	1.15	3,661	1
Morocco	80,000	200,000	27.87	1,218	1
Mozambique	6,000	2,048	18.88	86	11
Namibia	15,000	6,144	1.66	2,051	100
Niger	2,000	384	10.08	161	1
Nigeria	60,000	15,000	113.50	551	2
Reunion	47,000	576	0.68	9,270	4
Rwanda	2,700	1,300	6.60	317	1
São Tomé	378	64	0.14	358	1
Senegal	15,000	48,000	10.00	518	4
Seychelles	3,000	4,098	0.08	6,995	3
Sierra Leone	1,000	512	4.57	209	1
Somalia	250	768	10.63	169	2
South Africa	750,000	342,000	44.31	2,979	2
Sudan	9,000	10,000	28.29	364	7
Swaziland	5,000	256	0.95	1,388	1
Tanzania	30,000	12,000	32.10	244	4
Togo	1,700	1,536	4.40	324	9
Tunisia	70,000	75,000	9.34	2,144	1
Uganda	10,000	9,250	20.55	317	5
Zambia	7,000	5,120	8.78	463	1
Zimbabwe	25,000	11,000	12.68	712	4
Africa	**1,492,535**	**1,409,100**	**769.66**	**1,207.5**	**283**

Source: Sangonet http://www3.sn.apc.org/africa

throughout Africa (mostly in Ghana, Mozambique, and Uganda, as well as in Benin, South Africa, Tanzania, Zambia, and Zimbabwe) to test different models, means of implementation, and mechanisms for sustainability. The demand for public phone shops and telecenters is also having spinoffs in the IT sector for small businesses, equipment providers, and franchisers.

However, the case for large, multibranch cybercafe chains is not yet proven, as regional ISP AfricaOnline learned when it rolled out hundreds of public access kiosks as part of its E-Touch franchise program in which local stores were provided with a PC to enable e-mail and Internet access. AfricaOnline had approximately 100,000 users spread across 740 outlets in Côte d'Ivoire, Kenya, Uganda, Tanzania, and Zimbabwe before it discovered these outlets were generating insufficient income to maintain them. The company has subsequently closed most of them, and is testing a new franchise strategy with fewer, better known, "I-cafes."

In the area of Internet-based content and applications, the African Web presence continues to increase, but there are generally few relevant applications for the general population. Almost all African countries now have some form of local or internationally-hosted Web server, unofficially or officially representing the country with varying degrees of comprehensiveness. French-speaking countries generally have a higher profile on the Web and greater institutional connectivity than the non-French speaking countries. This is largely due to the strong assistance provided by various francophone support agencies, as well as the Canadian and French governments, which are concerned about the dominance of English on the Internet. The two dominant francophone content developers are the Agence de Cooperation Culturelle et Technique (ACCT) (with the BIEF center), and AUPELF-UREF/REFER's Syfed Center; both centers are building websites of local information as well as providing access.

In response to the high cost of Internet services and the slow speed of Web access, and also because of the overriding importance of electronic mail, lower-cost e–mail-only services are continuing to attract subscribers. However, the relatively high cost of local e-mail services from African ISPs means that a large proportion of African e-mail users use the international, free Web-based services such as Hotmail, Yahoo, or Excite. These services are more costly and slower than using standard e-mail software because extra online time is needed to maintain the connection to the website. Unfortunately for the ISPs, these services can also use up scarce international bandwidth. In response to these issues and the growing use of shared accounts, some African ISPs, such as AfricaOnline and MailAfrica, have set up their own low-cost Web-based e-mail services.

Outside North and South Africa, there are generally few organizations using the Web to deliver significant quantities of information or to carry out transactions with their user base. Although large numbers of organizations now have a "brochure" website with basic descriptive and contact information, very few actually use the Internet for real business activities. This is mainly explained by the limited number of local people that have access to the Internet (and thus the limited importance of a Web presence to the institution), the lack of credit cards, the limited skills available for digitizing and coding pages, and the high costs of local Web-hosting services.

Similarly, although there are some notable official general government websites, such as those of Angola, Egypt, Gabon, Lesotho, Mauritius, Morocco, Mozambique, Senegal, South Africa, Togo, Tunisia, and Zambia, there is as yet little government use of the Internet for administrative purposes or for interacting with the public. Lack of timely information is known to be the largest constraint on the small-scale agricultural production and natural resource exploitation sector, which provide a livelihood for 70 to 80 percent of Africa's population. However, the potential for ICT to impact this sector has not yet received much attention, although some commodity markets in east Africa, such as coffee and tea, are now beginning to trade online.

Web presence is higher in sectors involved in tourism and foreign investment, because these sectors aim to develop an international market presence. Some administrations are also beginning to streamline their operations and improve internal efficiency by switching to a network environment within the organization. For example, the government of Lesotho recently declared that announcements for cabinet and committee meetings would be made only by e-mail. South Africa, Algeria, and Tunisia now provide immediate global access to tenders via the Web. Health and education departments in many countries are beginning to electronically transmit operational management information system statistics (e.g., disease occurrences and pupil registrations). The results of blood tests done in remote areas of South Africa are being transmitted to remote clinics that are off the telecommunications grid via mobile telephone text messages. As greater numbers of public officials gain low-cost access to the Web, the vast information resources available via Internet are becoming increasingly important tools in ensuring informed decision-making.

The "death of distance" introduced by the Internet has meant that the opportunities to be found in the much larger economies of the more developed countries can be exploited by some African companies. Examples of such initiatives include the following:

1. A local ISP in Morocco is digitizing the National Library of France's paper archives. They are scanned in France, sent to Morocco by satellite link, and are edited by keyboard operators in Rabat.
2. In Togo and Mauritius, call centers now provide telephone support services for international companies with customers in Europe and North America.
3. In Cape Verde "virtual security guards" have found jobs using the Internet to monitor webcams in office parks on the east coast of the United States. They notify local rapid response teams there if they see anything amiss.
4. Many African artists and craft makers are selling their wares on the World Wide Web.

In most major cities in Africa, various private companies provide Internet applications training. However, apart from a few universities, there are virtually no network engineering-level facilities. The United Nations Development Program (UNDP) and Cisco recently created a joint venture to assist in the establishment of nonprofit Cisco network training academies in all the less-developed countries. Many of these academies have opened in Africa, including in Democratic Republic of the Congo. The UNDP's Sustainable Development Networking Programme (SDNP) and the United States Agency for International Development's Leland initiative have also trained significant numbers of network technicians. Other initiatives include the following:

1. In Cameroon, United Nations Institute for Training and Research (UNITAR) and ORSTOM have collaborated in a joint project focusing on technical capacity-building in sub-Saharan francophone Africa. The first training center and courses have been established in Cameroon (CITI-CM) with support from the World Bank's infoDev fund and additional funds from from Orstom, ACCT, and others. A network engineering course is now being run regularly at CITI-CM. Funds are being sought for CITI-CI (Côte d'Ivoire), CITI-SN (Sénégal), CITI-BF (Burkina Faso), CITI-BE (Bénin), and CITI-ML (Mali).
2. An Internet training program for institutes, schools, and other agencies of higher learning in francophone and lusophone sub-Saharan African countries, called Internet pour les Ecoles Inter-Etat d'Afrique de l'Ouest et du Centre, has been established in a related effort to the UNITAR/ORSTOM project, under the Diderot Initiative.
3. COMNET-IT, established by the Commonwealth Secretariat (ComSec) in Malta to support ICT in Commonwealth developing countries, has initiated a number of ICT-support activities, such as the provision of scholarships for Commonwealth country students to obtain postgraduate degrees in computer science.
4. The African Virtual University (see website) is providing training in computer and Internet applications and programming languages to its twenty-nine university campuses in eighteen countries in Africa.

5. International volunteers are being seen as an increasingly important vehicle for training and technology transfer. This has been been boosted by the recently announced UNITeS program of the UN's UN Volunteers and other similar nongovernmental organization initiatives, such as the Global Netcorps (previously NetCorps Canada) and GeekCorps.
6. More general ICT applications and indeed "technology enhanced" teaching in other subjects is also now being tackled by the growing number of national school-based networking projects and foundations active on the continent, such as SchoolNet Africa (see SchoolNet website).

Hardware and Software

Most recent estimates (i.e., 2001 data) for the number of personal computers in Africa put the total at about 7.5 million—an average of about one per 100 people. These figures, however, are notoriously unreliable because of limited capacities for monitoring industry and the large numbers of machines brought in independently to avoid duties. Some studies, such as the 1995 ACCT survey, indicate that official figures are three to six times higher than actual figures, making the average closer to one PC per 500 people. Account should also be taken of the number of users sharing a single computer, which is much greater than in the more developed regions.

Underutilization of existing computer resources is also common. Often an office may have many machines but only one connected to the Internet, and there is a preponderance of stand-alone computers, indicating limited use of Local Area Networks. This usually means that there is competition for the Internet-connected machine and a shared e-mail account, which is not effective use of the Internet.

Few international companies operate offices in Africa, but some of the major companies such as Bull, HP, IBM, NCR, Oracle, and Microsoft have some form of local representation in most countries. Microsoft now has its own offices in Côte d'Ivoire, Kenya, Morocco, and South Africa. PC equipment is often clone equipment imported from Asia; but Dell, HP, IBM, and ICL also have significant shares of the market, and Dell South Africa is now selling via the Web.

Although there have been notable efforts in some countries to reduce import duties on computers, communications equipment and peripherals are still often charged at higher rates. The high cost of computer hardware in Africa has a major impact on the continent's ability to improve networked readiness, as this cost is often the largest component of network startup budgets. This situation is likely to become an even more critical bottleneck because low-cost bandwidth, such as through Ku-Band VSAT and spread spectrum wireless (WiFi) links, is increasingly becoming available. As a result, the use of recycled PCs, thin clients, set-top boxes, or other low-cost Internet "appliances," as well as Open Source (free) software, is becoming more common.

Electronic Mass Media

Radio is still by far the most dominant electronic mass medium in Africa, with ownership of radio sets being far higher than for any other electronic device. The United Nations Educational, Scientific and Cultural Organization estimates that in 1997, radio ownership in Africa was close to 170 million with a 4 percent per annum growth rate. This puts current estimates for 2002 at more than 200 million radio sets, compared with only 62 million televisions. It is estimated that more than 60 percent of the population of the sub-continent are reached by existing radio transmitter networks, while national television coverage is largely confined to major towns. Some countries, even relatively well developed ones, still do not have their own national television broadcaster. For example, Botswana has only this year launched a national television broadcaster.

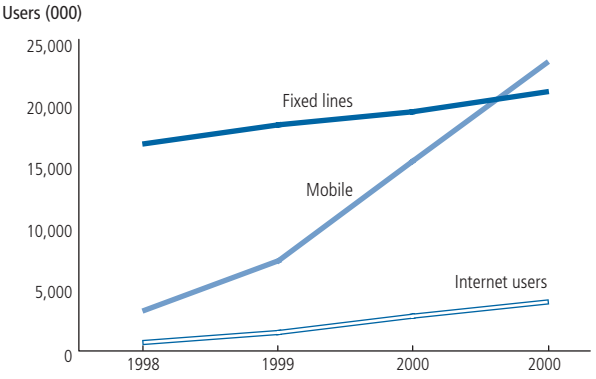
An increasing number of commercial stations are being established following liberalization of the sector in many countries. However, most of these stations concentrate on entertainment (music), and the news and information output is often limited to a re-broadcast either of news produced by the national (state-controlled) broadcaster, or of news produced by an international broadcaster or news agency. Local news and current affairs (especially that focusing on events outside of the capital) or educational programming is rarely broadcast, and local community stations have also been slow to take off.

In the last few years, there has been substantial growth of satellite-based broadcasting on the continent. In 1995, South African company M-Net launched the world's first digital direct-to-home subscriber satellite service (DSTV). Subscribers have access to more than thirty video channels and forty audio programs, and these are available to most of Africa through low-cost KU-band terminals. The US-based company, WorldSpace, launched a digital radio broadcasting satellite called AfriStar in late 1998. Radio broadcasters from many African countries, as well as from Europe and the United States, are using the service to broadcast their channels all over Africa and to most of Europe. WorldSpace ultimately aims to make a suite of more than eighty audio channels available to anyone who can afford the special digital radio (priced at US$50); the radio is also able to receive data services, including the transmission of Web pages and other information such as weather maps and crop disease images.

Outlook

As Figure 5 below shows, of all the major network components in Africa, the most impressive growth has been in the uptake of mobile telephones. This, combined with the not insignificant use of the Internet, has undoubtedly had a substantial impact on the ability of entrepreneurs to do business in urban areas, as well as for more wealthy individuals to stay in contact with friends and family.

Figure 5. **Growth in the Number of ICT Users in Africa**



Source: ITU, Sangonet

Nevertheless, the vast majority of Africans remain unconnected. Efforts to promote broader use in Africa have been discussed among high-level policymakers since the early 1990s. Official recognition was given to the issue in 1996, when the Conference of African Ministers of Social and Economic Planning requested that the United Nations Economic Commission for Africa set up a "high-level working group" to help define a strategy for greater networked readiness in Africa. Subsequently, an expert group developed a framework document entitled the African Information Society Initiative (AISI). Since then, communications ministers from more than forty African countries have provided high-level endorsement for AISI, along with specific telecommunications development policies which they encapsulated in their common vision document, *African Connection*, published in 2001 (see African Connection website).

Among the proposals in AISI was a call for the formulation and development of a national information and communication infrastructure (NICI) plan that would be driven by national development priorities in every African country. AISI also proposed cooperation among African countries in order to share experiences. Most countries have begun the process of developing NICI plans, and seventeen countries have finalized their strategies—Benin, Burkina Faso, Cape Verde, Côte d'Ivoire, Egypt, Gambia, Mauritania, Mauritius, Morocco, Mozambique, Rwanda, Senegal, Seychelles, South Africa, Sudan, and Tunisia (see UNECA website). A high priority in many of these plans is improvement of public Internet access in rural areas through the use of telecenters that exploit the convergence of technologies to provide cost-effective services in underserviced and remote locations.

As addressing the digital divide has become an even higher priority in the international community, the outlook for international support has also improved. This has culminated in the activities of the G8 Digital Opportunity Task Force (Dot Force), the United Nations ICT Task Force, and related efforts in 2002 that have resulted in developed countries creating a variety of new projects (such as Canada's Institute for Connectivity in Africa and Italy's e-Government Support Program in Mozambique, Nigeria, and Tunisia) to help developing countries achieve networked readiness.

Much of the impact of these efforts will depend on the extent of improvements to the telecommunication infrastructure on which the networks depend. The high costs of connectivity in remote areas will hopefully be addressed by the large number of low-cost, two-way Ku-band VSAT satellite-based data services that have been launched this year by companies such as Afsat and Web-Sat. These services will be a major boon to rural users, making use of the new high-powered satellite footprints now covering Africa, similar to services currently available in the United States and Europe. Costs are about US$1,500 to US$3,000 for the equipment and US$200 to US$400 per month for "better than dial-up" speeds (i.e., about 56 Kbps outgoing and 200 to 400 Kbps incoming). These are expected to see rapid uptake wherever regulations allow; unfortunately, most countries in Africa either charge excessively high license fees or do not allow these services at all, as they compete with the state-run telecommunications operator.

Liberalization of the telecommunication sector and the introduction of competition are increasingly seen as key factors needed to drive down prices and improve the quality of service, and although some countries have begun to open up their markets, there is a general sense that too little is being done. While a variety of efforts are underway to restructure national telecom operations and build better national and international infrastructures, many of these efforts lack a cohesive approach built on a clear understanding of the dynamics and impact of the blindingly fast-changing communications technologies. As a result, the pace of regulatory change is still generally seen by the Internet industry as too slow, conducted with insufficient transparency, and with not enough participation by the sector in developing policy. In general, strategies continue to favor an extension of the monopoly for the incumbent (usually for five to seven years) in return for a high share price sold to a foreign strategic investor, which is normally a multinational operator keen to shore up profits under threat from liberalization in their home markets.

The justification for continuing the exclusivity period of the national operator is usually to ensure that sufficient income is generated to roll out infrastructure without it being siphoned by competitors. Although this strategy may be logical, experience since the Federal Communications Commission (FCC) breakup of AT&T has shown that the only way of ensuring the efficiency of service delivery is to bring self-interest into play by opening the markets and using competition to do much of the regulating. This strategy also helps address the problem of limited resources that faces government policymakers and regulators worldwide (even the FCC); regulators do not have the capacity to keep up with the rapid technological change in order to fully enforce regulations.

Furthermore, the old model of an extensive regulatory apparatus supporting the slow entry of only one or two new operators is not as relevant in Africa as it is in developed countries, because developed countries are not burdened with huge state-owned operators holding 99.9 percent of the market, or encumbered with old technologies (used by the majority of the population) that need to be carefully moved into a competitive environment. In contrast to the massive incumbents in developed nations, emerging operators in Africa make use of much cheaper next-generation technologies that allow many smaller companies to enter the marketplace, and they are more self-regulated than operators in developed countries. African operators' self-regulation is even more evident when one takes into account their partial self-provisioning (as demonstrated by the rapid growth of the Internet, WiFi, and mobile telephony).

In practical terms, while competition in the ICT sector results in some overlap and duplication of resources by the different competitors, the overall operation of the sector is more efficient than that of a monopoly. Thus, the initial process of privatization and liberalization of the telecommunications sector in Africa should bypass the common first step of transforming a public monopoly into a private one; a private monopoly can be even more difficult to control, especially if it has a large foreign partner experienced in the use of litigation. Generally, the record of foreign participation in Africa indicates that even the strategy of a limited exclusivity period for basic services in urban areas is questionable, and it may ultimately be more efficient to transition directly from a public monopoly to a multiplayer-competitive environment, perhaps with small areas of exclusivity for rural locations.

Technology and design options for rural populations are becoming more readily apparent as technologies mature. Perhaps more important than decisions about technology, however, is a reassessment of the traditional view that rural communications services are unprofitable. The need for subsidized rural communications emerged decades ago in developed countries when telecommunication infrastructure costs were high, and where most of the population resided in densely populated urban areas that could be serviced at relatively low cost in conjunction with high-volume business users. In this environment, cross-subsidization and Universal Service Obligations were needed to cover the relatively greater costs of serving the small minority of mainly residential users living in sparsely populated rural areas.

These factors are not generally applicable in Africa and other developing countries today—most of the population is in rural areas, and network infrastructure roll-out and usage costs have already plummeted and will continue to do so for the foreseeable future. The growing availability of fibre, wireless, and satellite bandwidth services have the potential to make rural areas almost as easy to reach as urban ones, and technology convergence means that the same infrastructure can be used to provide many services, not just voice calls. Further, the use of the Internet for transaction purposes vastly increases the added value potential of the infrastructure, and thus the incentives to build it.

In addition to lowering usage and infrastructure costs, the overhead costs associated with centralized national network planning are no longer required. This is so because of the emergence of the Internet model of network development, which allows anyone to build a part of the network and be able to sell excess bandwidth to third parties in order to help cover their own costs or generate a profit. Examples of this model are already evident in the Universities of Zambia and Mozambique, which have become leading ISPs following the establishment of their own facilities for internal use. It is no coincidence that these service providers rely extensively on VSAT and wireless systems to access and deliver their services independent of the monopoly telecommunications operators in their countries.

In identifying appropriate strategies for broader network use, another important point to be made is that African models of infrastructure provision are likely to be quite different to those employed in developed countries, not only because of the generally low income levels in Africa, but also because, in Africa, informal business activity and rural populations are much more important.

Innovative models are necessary to address the low-income factor, and these models must focus on shared infrastructure, public access facilities, and the use of intermediaries to interact with the public (who may not be functionally literate, let alone computer literate). In other respects, strategies to improve network services are unlikely to be uniform across the continent because of the very large variations between countries. Aside from variations in annual per capita GDP levels, which range from US$200 to US$7,000, and market sizes that vary from 1 million to 100

million people, many other factors vary substantially, and may affect strategy. Some of the important issues that need to be taken into account include:

1. *The communications regulatory environment*. The national regulatory environment in Africa varies greatly, from relatively open competition in Internet service provision or even in mobile services and the local loop, to long-term monopolies in all of these areas. In particular, very few countries allow the use of VSAT or other wireless technologies that may bypass state-run operators, and if they do, they levy high bypass or license fees.
2. *The extent of existing fixed infrastructure and the cost of access*, for example fixed line penetration can vary from 20 percent to less than 1 percent, depending on the country.
3. *The existing usage of the radio spectrum*. Many countries do not have adequate resources to efficiently manage their radio spectrum allocation for use by either national or regional telecommunications and Internet operators. This has resulted in congestion in some wavebands, lack of a transparent licensing process, and difficulties in obtaining spectrum from the regulators.
4. *The resources that national governments and their international cooperating partners are allocating to national information and communication infrastructure building projects*. In some countries there is strong, if somewhat uncoordinated, support from both multilateral and bilateral development agencies in this area; other countries have yet to begin this process.
5. *The focus of national universal service goals*. Currently, the aim of most of these efforts is simply to improve the provision of public telephones within walking distance; however, some countries, such as South Africa and Uganda, have gone further, and have included the provision of more advanced network services and established universal service funds to redirect some of the profits made by telecommunications operators into the provision of network access in rural areas. Uganda has also developed an incoming termination fee, which is to be paid to telecenters for incoming calls.

Consolidating markets and building economies of scale will clearly require greater regional collaboration, both for deploying infrastructure and for creating content and applications. Encouraging efforts that warrant further support and adoption in other regions have been made at the regional level by South African Development Community (SADC) and Common Market for Eastern and Southern Africa (COMESA), which have both adopted a variety of measures to improve network use, most notably:

1. SADC's model telecommunication legislation, which has been adopted by most member states, and is therefore a legally-binding protocol
2. The formation of the Telecommunication Regulators Association of Southern Africa (TRASA); TRASA acts as a forum for regulators in the region to exchange information and experience
3. The ComTel project to develop the terrestrial telecommunication links between neighboring states in COMESA, and to harmonize and upgrade the cross-border information systems in transport, customs, import/export, and trade.

Obtaining startup financing for small businesses to establish public access services is an acute problem, because the level of investment usually required falls in the gap between traditional microcredit loans (US$50 to US$1,000); and financiers of venture capital or loan funds that are not generally interested in anything smaller than US$250,000 (mainly because of the overheads required to carry out due diligence). As a result, a public access startup project, which might only require between US$25,000 and US$100,000, has considerable difficulty in sourcing the necessary funds. Hopefully, this problem will in part be addressed through the newly created DOT Force Entrepreneurial Network (DFEN), which aims to provide financing and support to small- and medium-sized enterprises (SMEs) and entrepreneurs planning to use ICT in innovative and creative ways in the developing world. The initial focus of DFEN's activities will be Africa.

The African Union and their program, the New Partnership for African Development (NEPAD), which is supported by the international community, are addressing many of the more systemic issues. This many-faceted effort is aimed at accelerating Africa's development, and it should help to create an environment more conducive to networked readiness.

Endnotes

1. ITU; United Nations Educational, Scientific and Cultural Organization (UNESCO) statistics.
2. It should be noted, for example, that there is a large variation between countries in the charges for installation, line rental, and call tariffs. The average business connection in Africa costs more than US$100 to install, US$6 a month to rent, and US$0.11 per three minute local call. But installation charges are higher than US$200 in some countries (Egypt, Benin, Mauritania, Niger, and Togo), line rentals range from US$0.8 to US$20 a month, and call charges vary by a factor of 10—from US$0.60 an hour to more than US$5 an hour.
3. Network Wizards conducts a quarterly survey in which the number of hosts on the Internet is counted.

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