

Part 2

Sectoral Snapshots

Chapter 7

Information and Communication Technologies: A Boost for Growth

Information and communication technologies (ICTs) have been a remarkable success in Africa. Sector reform, particularly in the mobile segment of the market, has transformed the availability, quality, and cost of connectivity across the continent. In less than 10 years, mobile networks have covered 91 percent of the urban population, and coverage in rural areas is growing. However, these high overall levels of coverage hide significant variation between countries, and particularly in the proportion of their populations that have access to services. Some countries have been much more successful in providing basic voice services than others, and some segments of the market, such as fixed-line telephone service and broadband Internet, have been less successful than the mobile segment. Fixed-line penetration rates remain low and are falling in most countries, while broadband Internet is expensive and available to only a small proportion of the population.

Although large parts of the ICT sector have been transformed, much remains to be done. Policy makers need to take the following steps

to address the specific challenges facing the ICT sector in Africa:

- Complete the reform agenda by establishing full competition throughout the sector.
- Revise the licensing framework to accommodate rapid technological change and emerging competition.
- Reform the state-owned enterprises (SOEs) that hinder sector growth and development.
- Ensure low-cost international access infrastructure by preventing monopoly control over bottleneck facilities.
- Promote the development of high-bandwidth backbone infrastructure (the networks that carry communications traffic between fixed points in a network).
- Stimulate innovation in the use of wireless technologies by reforming the way the radio spectrum is allocated and managed.
- Promote universal access to ensure that ICT availability is as extensive as possible.

The African ICT Revolution

In Africa, the greatest expansion in ICT has been in voice services. Internet services, in contrast, have grown only slowly. Overall, the ICT sector has had a strong, positive effect on Africa's GDP.

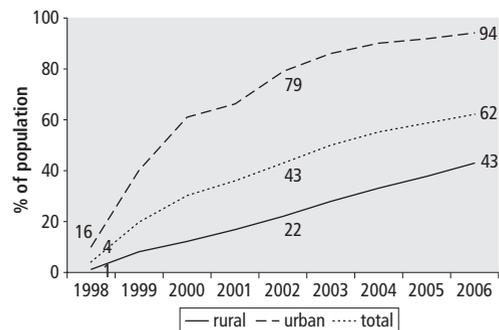
Access to Basic Voice Services

Sub-Saharan Africa has witnessed dramatic growth in the penetration of ICT services since the mid-1990s—mainly in mobile telecommunications, where the number of mobile users grew from 10 million in 2000 to more than 180 million in 2007 (ITU 2008). During the mid-2000s, more than 25 million new mobile subscribers were added each year, and annual growth rates exceeded 30 percent (figure 7.1). The fixed-line market has grown much more slowly, from 10 million fixed telephone lines in 2002 to 11.8 million in 2006.

Competition among mobile operators has created a race to increase the percentage of the population covered by their networks. By 2006, one or more of the mobile networks covered 62 percent of the Sub-Saharan population, which was hence able to access a mobile signal, whether they actually subscribed to the service or not. This coverage continues to increase each year (figure 7.2).

All countries in the region have seen growth in the use of mobile telephones, but with the exception of Nigeria (which added 750,000

Figure 7.2 Global System for Mobile Communications Coverage in Africa, 1998 to Third Quarter of 2006



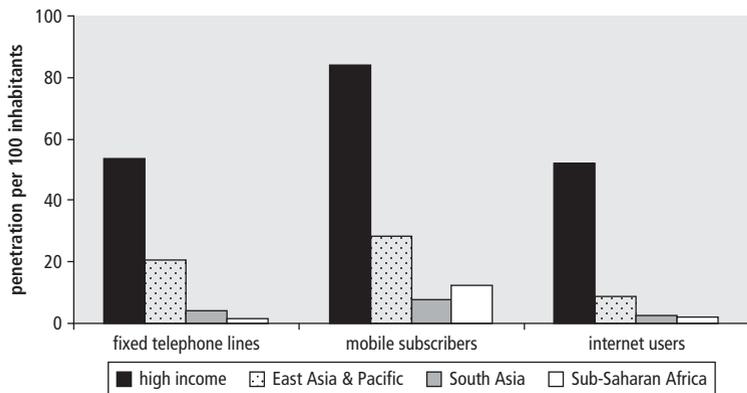
Source: Minges and others 2008.

landlines after introducing competition), growth rates for fixed lines have stagnated or turned negative. For example, the number of fixed lines in South Africa declined by 300,000 between 2000 and 2007.

Access to new ICT services has been remarkably broad. Across Africa, the rural mobile penetration rate is 3 percent, while in middle-income countries it is as high as 13 percent. In urban areas, the penetration rates range from 22 percent in low-income countries to 38 percent in middle-income countries. Even people among the lowest income groups have access to ICT through mobile networks; in the bottom three income quintiles, access ranges from 1.6 percent to 5.5 percent. In middle-income countries, the penetration rate in the lowest-income quintile is 10 percent.

The widespread use of prepaid telephone service has revolutionized access to mobile networks for low-income households. An estimated 97 percent of consumers in Sub-Saharan Africa are prepaid users. With prepaid charging systems, customers can purchase services in small increments and control their expenditures. Operators have introduced other innovative price schemes, some targeted at poor customers: low-cost on-net calling, caller ID (to facilitate callbacks within social and business networks), low and sometimes free off-peak tariffs, and systems to transfer mobile phone credit electronically between subscribers. For operators, these schemes, particularly prepayment, dramatically reduce credit risk and the cost of revenue collection.

Figure 7.1 Growth of Mobile Subscribers in Africa, 1998–2006



Source: Minges and others 2008.

This rapid growth in access to ICT in Africa has happened despite the relatively high price of services. In 2007, a representative basket of prepaid mobile services cost \$12.58 a month, six times the \$2 that it cost in Bangladesh, India, and Pakistan. Prices in Africa are declining but not as fast as in other world regions. In 2000, each mobile subscriber paid about \$39 a month in African countries and in Bangladesh, India, and Pakistan. By 2005, that figure had fallen to \$7 in Bangladesh, India, and Pakistan but only to \$20 in Africa. If prices were to fall to the levels seen in South Asia, access to ICT in Africa could be significantly higher.

The average price of international calls in Sub-Saharan Africa has fallen significantly since 2000, but prices for calls to countries outside the region remain much lower than for calls within the region. The average peak price of a one-minute call from Africa to the United States is \$0.45, compared with \$1.23 for an international call within Africa. These averages mask significant variation among countries (figure 7.3). Price variation is much lower for calls within Africa.

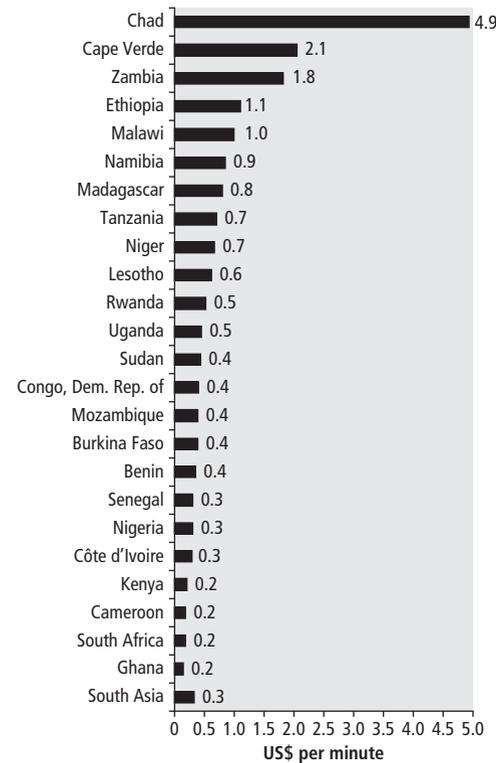
Access to the Internet

Unlike the expanded access to basic voice services, rates of access to the Internet are low and growing only slowly in Africa. High prices and limited availability are key reasons, compounded by poor fixed-line access networks, limited access to the broadband radio spectrum, poor domestic backbone networks, and limited use of computers (figure 7.4).

ICT Sector Developments

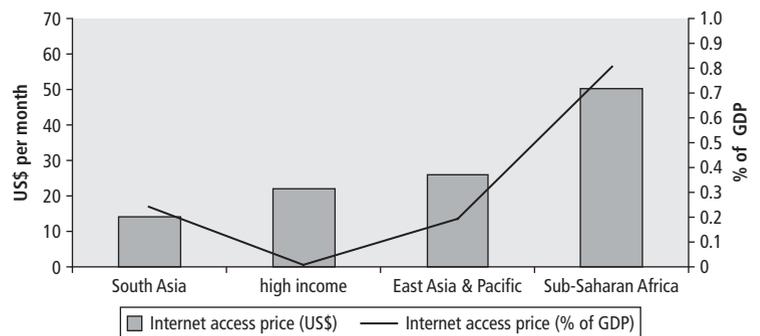
Growth in the ICT sector in Africa has taken place primarily in mobile phones through global systems mobile (GSM) networks. The economies of scale generated by the global standardization of GSM equipment have dramatically reduced prices of handsets and network equipment, and international standards allow customers to use networks in more than one country at a low cost. As a result, several pan-African operators have emerged, and they are highly innovative in their tariffs and services. For example, international roaming is a

Figure 7.3 Price of One-Minute, Peak-Rate Call to the United States, 2006



Source: Minges and others 2008.
Note: Peak rate includes taxes.

Figure 7.4 Price Basket for Internet Access, 2005



Source: Minges and others 2008.

contentious issue in many parts of the world, but multinational African operators such as Celtel, MTN, Safaricom, and Vodacom have international on-net tariffs offering savings to their customers of about 15 percent per minute in call charges. The major alternative global

standard for wireless voice services, Code-Division Multiple Access, is also making slow but steady progress in Africa. Operators in the region have also pioneered innovative services using the mobile telephone networks, such as mobile banking and remittance payments.

The fixed-line market in Sub-Saharan Africa continues to be dominated by incumbents—operators that were either formerly or are currently owned by the state—and their performance remains relatively poor (figure 7.5). The productivity of these operators is low, and most of them have higher levels of personnel than international benchmarks, as measured by the number of lines per employee. In July 2008, the Sub-Saharan operators ranged from 20 to 346 lines per employee, whereas the figure was 427 in Latin America and the Caribbean region, and 700 in Organisation for Economic Co-operation and Development member countries.

The low productivity of African incumbent telecommunication companies creates hidden costs for the economy, through suboptimal allocations of resources to the sector and low consumption of telecommunication services. The cost of this excess labor can be on the order of 0.4 percent of GDP, and even higher in some cases (figure 7.6). For Cameroon, Ghana, and Namibia, among other countries, the level of this inefficiency exceeds the cost of meeting universal access targets.

Economic Impact of the ICT Industry

The ICT sector has positively affected economic growth in Africa. Research shows that

increasing investment in ICT services results in higher long-run rates of economic growth (Roeller and Waverman 2001); according to estimates, the ICT revolution in Africa is responsible for about 1 percentage point of the improvement in Africa's per capita economic growth rate between the mid-1990s and the mid-2000s (Calderón 2008). This positive effect will continue as investment in the sector continues and as the use of ICT raises productivity in all types of businesses.

Large-scale private investment, reaching a cumulative value of about \$20 billion, has driven the expansion of access to ICT. Between 1992 and 2005, the vast majority of the 82 private sector transactions in the ICT sector were for new operations in mobile communications (World Bank 2009). SOE privatizations and license fees generated a further \$3.3 billion of revenues for the state. This investment continues today, as new deals in the region are announced regularly. The current financial crisis has adversely affected investment rates, however, limiting operators' access to finance.

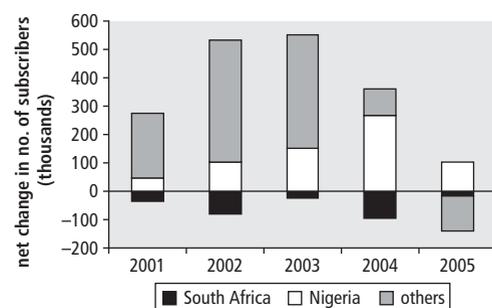
Overall ICT employment has grown as the mobile sector directly and indirectly added jobs in African countries. Multiplier effects and new lines of business (mobile airtime agents and m-transactions) also add to employment growth and income generation. In East Africa, the mobile industry directly and indirectly provides employment for close to 500,000 people (GSMA 2007).

The new ICT infrastructure and related reforms have increased government revenues through one-time fees for licenses and ongoing payments through licenses and taxes. The revenue generated by the ICT industry in African countries ranges from 1.7 percent to 8.2 percent of GDP, with an average of 4.0 percent. The tax and license revenues generated by the industry have also had a significant positive fiscal effect (figure 7.7).

Institutional Reforms in the ICT Sector

Market liberalization has been the most important cause of the ICT sector's growth in Africa. Regulatory reforms and the

Figure 7.5 Net Change in Fixed-Line Market, 2001–05



Source: Minges and others 2008.

privatization of SOEs have complemented these market reforms.

Market Reforms

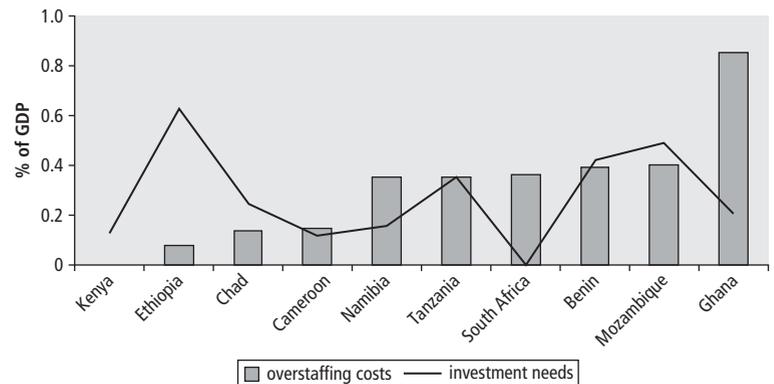
The widespread liberalization of markets in Africa and the emergence of competition, particularly among mobile operators, have been the main drivers of the ICT sector’s performance (figure 7.8).

Countries with more competitive markets cover, on average, 64 percent of their population with mobile networks, compared with 57 percent for the less competitive markets. Among the low-income African countries, those with more competitive markets have 31 percent higher mobile penetration rates, 6 percent lower mobile prices, and 39 percent lower international call prices (as measured by the price of a call to the United States).

The benefits of market liberalization increase as competition intensifies. In general, the annual increase in penetration rises as more firms enter the market. Relatively little growth occurs in market penetration in the initial change from monopoly to duopoly, but when a country issues its fourth mobile license, penetration rates increase, on average, by almost 3 percentage points every year. A country’s average income also affects the performance of the telecommunication sector. In poorer countries, increased competition is felt most strongly when a market reaches four operators, whereas for middle-income countries, the effect is strongest when a third operator is introduced.

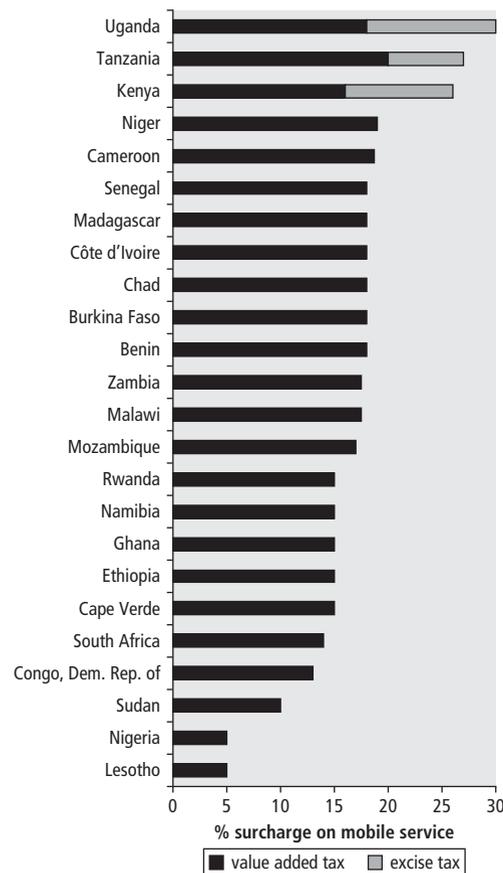
Some countries that have established a legal framework for a liberalized market have nonetheless failed to establish effective competition. Few countries have legislation with outright prohibitions on competition in telecommunications, but many have restrictions on competition arising from exclusivity clauses granted in licenses to existing operators. In 12 countries where data were available, a gap of at least two years elapsed between ending the legal restrictions on competition and granting new licenses. Twelve Sub-Saharan countries have competition in the fixed-line and international markets, but only a few of them have more than two operators in these segments. Even in the mobile segment, barely half of the

Figure 7.6 Costs of Overstaffing for Fixed-Line Incumbents in Selected Countries



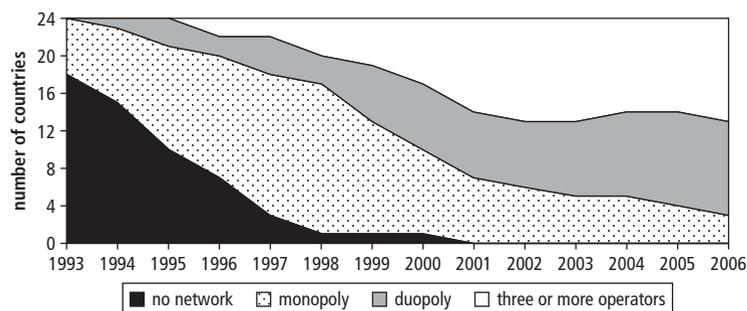
Source: Minges and others 2008.

Figure 7.7 Value Added and Excise Taxes on Mobile Telephone Services, 2006



Source: Minges and others 2008.

Note: In Kenya, Tanzania, and Uganda, the excise taxes shown are applicable to mobile calls. Rwanda is planning to implement an excise tax on mobile airtime.

Figure 7.8 Status of Mobile Competition, 1993–2006

Source: Minges and others 2008.

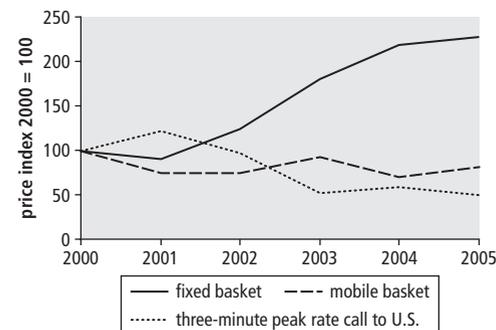
countries have more than three active operators despite evidence that most markets in the region can support more. Across the region, market reform is far from being complete.

Regulatory Reform

Changes in the legal framework that governs the sector have matched the reforms in market structure. All African countries have laws and regulations covering telecommunications. Typically, a new law (supplemented by decrees and regulations) establishes a national regulatory agency with general provisions for competition, licensing, interconnection, allocation of scarce resources (for example, numbering and spectrum), and pricing. Of the 24 countries sampled, 23 have such a broad institutional framework and independent regulatory authorities, up from 5 in 1996.

Regulators still exert considerable control over incumbent fixed-line operators' tariffs. They have allowed these operators to respond to competition by rebalancing their tariffs, allowing monthly fixed charges to increase and national and international call prices to fall. Regulators have less control over mobile operators' tariffs, which are forced down through competition (figure 7.9).

Some regulators have been successful in setting wholesale tariffs (the charges that operators pay each other for handling calls when they pass from one network to another), which feed directly into the retail price that customers pay for their calls. As competition develops, particularly among mobile operators, regulating these interconnection charges becomes more

Figure 7.9 Tariff Rebalancing in African Countries with a Liberalized Telecommunication Sector, 1993–2006

Source: Minges and others 2008.

Note: Price index represents prices as a percentage of their level in the base year 2000 so that only relative changes over time are highlighted.

important. It can be challenging for regulators with limited technical capacity and legal powers to impose decisions on operators, but some regulators have recently been successful. In Tanzania, the national regulatory authority introduced a phased reduction in mobile termination rates, based on a calculation of operators' costs. Nigeria's regulatory authority has established a target for mobile termination rates, and in Kenya, the regulatory authority recently established a ceiling on mobile termination rates, as well as a cap on the retail price of calls between networks.

Reform of State-Owned Enterprises

As governments have liberalized their markets and reformed the institutions for regulating them, many have also reformed the operators they formerly owned. By the end of 2006, 15 African countries had sold shares in their state-owned telecommunication operator to the private sector. These transactions largely involved equity and management partnerships with strategic investors; only Nigeria and Sudan privatized by issuing shares on local or regional stock exchanges.¹ From 1993 to 2006, the total value of such privatizations was \$3.5 billion, half of which was accounted for by South Africa's Telkom.

The nature of strategic partnerships and their success have varied over time. Direct investment by developed-country investors in

the fixed-line business has been complemented by sales to developing-country investors, particularly from the Middle East and South Asia. The performance of these privatizations and partnerships has been mixed. In some cases, such as Uganda, the privatization of the state-owned fixed-line incumbent was part of a successful overall reform of the sector. In others, private investors have withdrawn, resulting in the renationalization of ICT assets. Ghana and Rwanda resold the businesses after the first privatization failed, indicating a sustained commitment to reform.

Despite the notable successes, the governments of many African countries retain ownership of at least one telecommunication operator, which distorts the market and creates inefficiencies. Thus, the region has some distance to go before it has a fully privately owned and competitive telecommunication market.

Access to International Connectivity

One of the main drivers of the high cost of Internet and of international voice calls is the price of international connectivity, determined by physical access to submarine fiber-optic cables and the level of competition in the international market. Countries with access to submarine cables have lower international call prices than those without access. Nevertheless, countries that have competitive access have significantly lower prices than those retaining a gateway monopoly (table 7.1).

Access to high-capacity submarine fiber-optic infrastructure is therefore a necessary but insufficient condition for low-price international voice services. Countries also need to ensure that the international facilities segment of the market is competitive if customers are

to benefit from lower prices and better quality of service.

Domestic Backbone Infrastructure

Backbone network infrastructure to carry communications traffic between fixed points in the networks is limited, thus constraining the development of broadband Internet. Mobile operators do not require high-capacity backbone networks to carry voice traffic and have typically developed their own using wireless technologies. Broadband Internet backbone networks need much greater capacity, however, typically using fiber-optic cables. The limited extent of these networks is a constraint on the development of the broadband market in Africa.

Considerable variation exists across the region in how markets for domestic backbone infrastructure operate. In many countries, both implicit and explicit constraints limit development of this type of infrastructure. For example, mobile operators may be required to use the incumbent's backbone network, or they might be allowed to build their own but not to sell backbone network services to other operators on a wholesale basis. These types of regulations limit the development of backbone networks and hinder the development of broadband.

Countries that have fully liberalized the market for backbone networks have seen rapid growth in infrastructure competition. In Nigeria, at least four of the major operators are developing high-capacity fiber-optic cable networks capable of supporting high-bandwidth services, and a similar pattern is emerging in Kenya. These networks are concentrating on major urban areas and on interurban links

Table 7.1 Prices for Access to International Voice and Internet Connectivity

Access level	Share of countries (%)	Price for a call within Sub-Saharan Africa (\$ per minute)	Price for a call to the United States (\$ per minute)	Price for 20 hours of dial-up Internet access (\$ per month)	Price for ADSL broadband Internet access (\$ per month)
No access to submarine cable	67	1.34	0.86	67.95	282.97
Access to submarine cable	32	0.57	0.48	47.28	110.71
Monopoly on international gateway	16	0.70	0.72	37.36	119.88
Competitive international gateways	16	0.48	0.23	36.62	98.49

Source: Minges and others 2008.

Note: ADSL = asymmetric digital subscriber line.

where the majority of customers are. If high-capacity backbone networks are to extend beyond these areas, some form of public support will likely be needed, preferably in partnership with the private sector.

Completing the Remaining Investment Agenda

Voice Services

The cost of completing mobile network coverage for voice in Africa is relatively modest. By adopting a spatial approach to modeling the cost of providing access to mobile phone networks, reliable estimates have been developed of the capital and operating expenditures required for completing the rollout of GSM voice signal throughout Africa. Potential revenues are estimated based on population density and income distribution. Potential costs are estimated based on terrain characteristics and cell size and the resulting number of additional base stations needed to complete national GSM coverage. These raw base station numbers drive estimates of capital and operating expenditures.

Reaching all the unserved population would require investments of \$0.8 billion a year over 10 years. Currently, 43.7 percent of the population lives in areas not covered by wireless voice networks. If the right competitive environment is established, the private sector could fill most of this gap, reaching 39 percent of the population—the vast majority of the unserved—with a voice signal. Only \$0.3 billion per year of public investment would be needed to reach the remaining 4.7 percent of the population in the coverage gap (table 7.2).

Nevertheless, the size of the coverage gap varies immensely across countries (figure 7.10), and in a handful of cases (the Democratic Republic of Congo, Madagascar, and Zambia) can exceed 15 percent of the population.

These analytical results are robust; the size of the coverage gap increases only from 4.4 percent to 5.9 percent of the population if the amount spent on telecommunication services drops from 4 percent of GDP per capita (the baseline assumption) to 3 percent. Similarly, even if costs were three times greater than in the base case, the coverage gap would increase from 4.4 percent of the population to 12.6 percent.

Internet Services

Despite the anticipated positive economic effect that widespread use of broadband would have on African economies, mass-market broadband Internet at speeds seen in other parts of the world is unlikely to be commercially viable in Africa for the near future. The broadband Internet available in most African countries is typically limited to major urban areas and to Internet cafés, businesses, and high-income residential customers. Network coverage is limited, prices are high, and speeds are lower than in other regions of the world. This limited current level of service could be expanded to national coverage using wireless network infrastructure with the same technical and economic advantages as GSM voice networks (lower operating and security costs than wired networks and the potential to use prepaid billing systems). The investment to cover the entire population using limited-performance wireless broadband technology has been estimated at approximately \$0.9 billion.

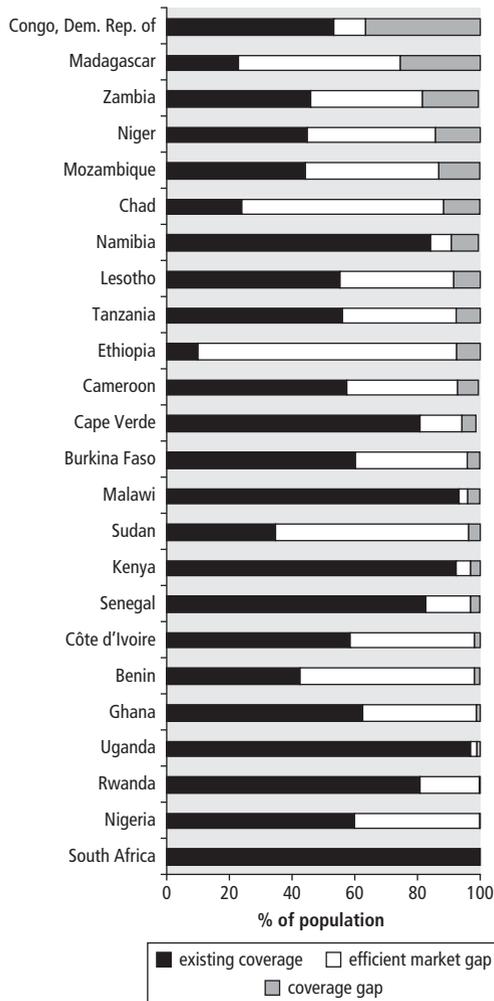
Table 7.2 Investments Needed to Close Gaps in Voice and Broadband Coverage in Sub-Saharan Africa

Indicator	Voice coverage			Broadband coverage		
	Total investment	Efficient market gap	Coverage gap	Total investment	Efficient market gap	Coverage gap
Average annual investment (\$ billions)	0.8	0.5	0.3	0.9	0.7	0.2
Percentage of population affected	43.7	39.0	4.7	100.0	89.0	11.0

Source: Mayer and others 2008.

Note: *Efficient market gap* is the portion of total investment need that the private sector could meet under commercial terms if all regulatory barriers to entry were dismantled to allow the market to function efficiently. *Coverage gap* is the portion of the total investment need that the private sector could *not* meet even under efficient market conditions. This gap would require public subsidy because the service lacks commercial viability.

Figure 7.10 Voice Coverage Gaps in 24 Sub-Saharan Countries

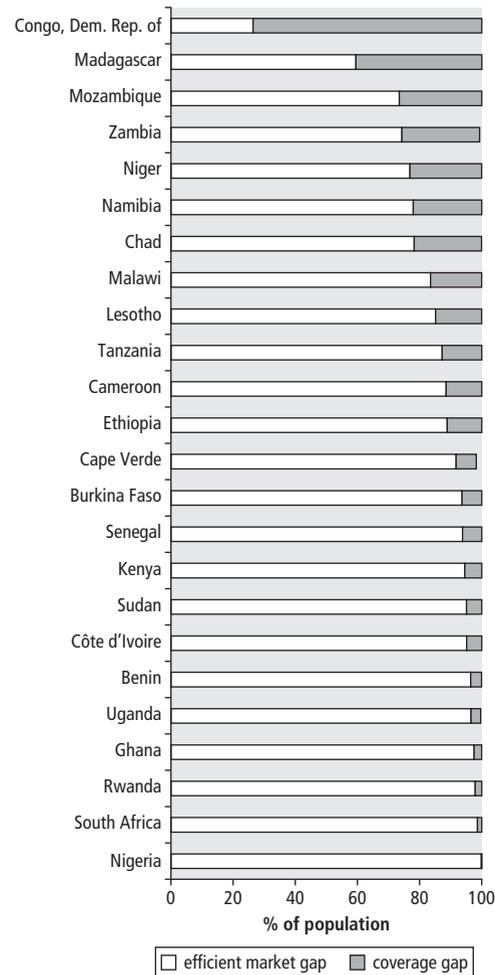


Source: Mayer and others 2008.

Note: *Efficient market gap* is the portion of the unserved market that the private sector could serve under commercial terms if all regulatory barriers to entry were dismantled to allow the market to function efficiently. *Coverage gap* is the portion of the unserved market that the private sector could not serve even under efficient market conditions. This gap would require public subsidy because the service lacks commercial viability.

As long as the right competitive environment is established, the private sector would cover most of that amount, which could reach 89 percent of the population with this limited-reach broadband access. Only \$0.2 billion of public investment would be needed to reach the remaining 11 percent of the population in the coverage gap (table 7.2). However, the coverage gap varies hugely across countries, and in a handful of cases (Chad, the Democratic

Figure 7.11 Broadband Coverage Gaps in 24 African Countries



Source: Mayer and others 2008.

Note: *Efficient market gap* is the portion of the unserved market that the private sector could serve under commercial terms if all regulatory barriers to entry were dismantled to allow the market to function efficiently. *Coverage gap* is the portion of the unserved market that the private sector could not serve even under efficient market conditions. This gap would require public subsidy because the service lacks commercial viability.

Republic of Congo, Madagascar, Mozambique, Namibia, Niger, and Zambia) can exceed 20 percent of the population (figure 7.11).

Backbone Networks

Although the existing limited level of broadband service could be expanded at relatively low cost, the shift toward higher-speed mass-market broadband Internet access in Africa at prices that would be affordable for a significant proportion

of the population would involve major investments in backbone infrastructure. The revenue generated from customers would be insufficient to make this investment commercially attractive. If governments wished to achieve this level of broadband Internet access, significant levels of public subsidy would likely be required.

High-bandwidth backbone networks are a key part of the investment needed for broadband in Africa. These networks connect towns and cities within countries and across borders. They also link to the international submarine fiber-optic cable networks that carry communications traffic between continents.

Cross-border and interregional connectivity in Africa is currently underdeveloped. One-time investment needs range from \$229 million for a minimum set of links to \$515 million for an extensive interregional network connecting all African capitals to one another with fiber-optic cables. The private sector will provide much of that investment as regional operators connect their networks across borders. Private investment is also driving international submarine cable infrastructure in Africa. Of the five major submarine fiber-optic cables either already operating or under construction in the region, only one has direct government involvement; four are owned and financed by private operators on commercial terms. These two types of backbone infrastructure are linked. As submarine fiber-optic cables are developed, cross-border links to channel traffic to landing points become more commercially viable.

Aside from routes connecting major urban centers, high-bandwidth backbone networks are unlikely to be commercially viable. Backbone network development in these areas may require some form of public support, either through financial support or through the provision of easier access to existing infrastructure (for example, transport and energy networks).

Policy Challenges

The liberalization of telecommunication markets since the mid-1990s has provided affordable ICT services to the public. It has also radically reshaped the roles of the public and private sectors. The traditional role of the public sector

as provider of communication infrastructure has been superseded in most countries by a new role as establisher and regulator of market structure. Few countries in the region, if any, have completed the reform agenda, however. Regulatory frameworks still contain restrictions on investment and competition, and the poor quality of regulation in many countries creates costly inefficiencies. Many incumbent operators remain under state ownership, creating a burden on the public sector, inefficiencies in the market, and conflicts of interest for regulators. Major challenges therefore remain if widespread ICT services at affordable prices are to be available.

Completing the Reform Agenda

Establishing full and effective competition in the ICT sector can deliver rapid and sustained improvements in the availability of communication services. The majority of countries have implemented some reforms, but they still have a long way to go. Completing the reform agenda is therefore the primary challenge facing the ICT sector in Africa.

The most important remaining reform is to increase competition through further market liberalization. In practice, that means issuing more licenses and reforming the licensing structure to allow operators more freedom to innovate and compete across a range of services.

As mobile networks expand into marginal areas, reducing the cost of network rollout and operation will become a more important aspect of the reform agenda. Some form of collaboration among competitors (for example, in the civil engineering aspects of networks, such as masts and towers) could reduce costs enough to allow companies to operate profitably in areas where they would not otherwise be able to do so. Regrettably, this type of collaboration can also enable collusion among operators, so it must be carefully regulated.

The reform agenda will evolve as the market changes. Competition regulation is increasingly becoming part of modern sector legislation in Africa, particularly regarding the behavior of dominant operators and controlling access to essential facilities. Even where a country may not have competition legislation, ICT regulators are applying the tools of competition

analysis in telecommunication regulation. They are also adapting their regulatory approach to reflect the evolving marketplace: for example, by relaxing controls on tariffs as competition becomes more effective at controlling them.

African countries will continue to see benefits as competition intensifies and access to ICT increases. As prices fall, even as far as the \$0.01–\$0.03 per minute range currently seen in South Asia, mobile phone services will become affordable to much of the African population, bringing with it positive economic and social benefits. Governments will also benefit from the expansion of telephone services. First, lower prices will fuel uptake and access to services, directly reducing the costs involved in delivering universal service. Second, greater competition will expose the hidden costs of the incumbent state-owned operators, which represent a burden on government finances and a more general effect on the economy. The expansion of the ICT sector resulting from market liberalization will increase the tax and license-fee revenues earned by governments, and ICT services themselves will become a more effective platform for delivering public services.

Revising the Licensing Framework

The traditional model of licensing is becoming obsolete. In the first wave of market liberalization, licenses were linked to market segments and technologies. GSM licenses granted the right to provide mobile communications in specific spectrum bands using a specific technology, and data licenses were granted to operate in specific value added markets. Two factors are making this traditional approach to licensing obsolete. First, the growth of competitive ICT markets in Africa has demonstrated that multiple players can compete successfully, even in small markets. Managing liberalization through technology and service-specific licenses has therefore proved to be ineffective as a policy tool. Second, technological convergence allows networks to deliver multiple ICT services, thereby reducing costs and promoting service innovation. The traditional approach to licensing often prevents operators from taking advantage of this convergence.

The negative effect of current licensing frameworks is especially evident in Voice over

Internet Protocol (VoIP), limited mobility, and Internet protocol television. Many licensing regimes restrict either the VoIP technology or its derived services. Direct consumer access to VoIP allows voice calls over Internet connections instead of the public switched telephone networks. Such services offer much lower prices for long-distance and international calls; however, restrictions are common because the widespread use of VoIP could undermine the main sources of voice revenues for incumbent operators.

Licensing constraints on the mobility of specific wireless telecommunication operators are common in Africa. Operators with limited-mobility licenses can provide wireless telecommunication services while allowing customers to move around within a limited area. No technological reason exists why these networks cannot offer full mobility; the restrictions are often imposed to protect existing mobile licensees. As competition in the full-mobility market increases, these restrictions will seem increasingly anachronistic.

Finally, the use of Internet networks to provide television services is increasing in Africa as the number of broadband subscribers increases. This raises many challenges for regulatory systems that have traditionally dealt with communication and broadcasting media through separate institutions and through separate legal and regulatory frameworks. These separations are creating obstacles to investment and competition as convergence blurs the boundaries between the technologies.

The initial response of policy makers to these trends has been to move toward unified licenses that remove technological distinctions and allow operators to provide a full range of services to customers. The design and implementation of a unified licensing system can be complex, however, magnified by the need to adjust a wide range of existing rights and obligations, annual fees, and acquisition costs. This adjustment can be done in a transparent way through public consultation, but the migration process has to be managed carefully to avoid undue destabilization of the market.

In the medium term, licenses will have to become simpler and less restrictive to facilitate the development of new services at lower prices. Ultimately, the challenge for African

countries will be to migrate from the current licensing regime to one in which controls on market entry and the services delivered by market parties would be largely abandoned. The countries of the European Union have taken this approach, moving from a system of individual licenses to a general authorization regime.

Reforming State-Owned Enterprises

Reform of state-owned, fixed-line incumbents remains a major policy challenge for governments in the region. The last decade has seen the fixed-line incumbent operators eclipsed. Compared with the mobile operators, they now play a minor role in telecommunication service in most African countries. Incumbent operators can be a disruptive force in the economy through misallocation of public resources, use of incumbents as social buffers, and the regulatory uncertainty created by their presence in the market. In some cases, preferential treatment of these operators—exclusivity agreements (for example, in control of international gateways and backbone capacity), banning of innovative services such as VoIP, and distortion of prices—inhibits innovation and investment and amplifies the economic burden of SOEs on national economies. This issue has emerged again as some Sub-Saharan governments finance the development of fiber-optic backbone networks through their SOEs.

At a minimum, SOEs should be brought fully within the regulatory and licensing framework so that they are treated in the same way as private operators. This move will stimulate competition and efficiency in resource allocation. Encouraging greater private participation in SOEs to transform and grow the businesses may also be appropriate. Given the state of many incumbent operators' networks, that may require some form of financial and management incentives to attract partners and investors. The challenge for governments will be to ensure that this transition is achieved without distorting the market. It can be done by allocating mobile and other wireless spectrum to these operators, offering management control, and minimizing network coverage commitments.

Providing SOEs with monopoly control over specific segments of the market to make them more attractive to potential buyers will ultimately be unsuccessful, for it will distort the market and constrain its development.

Ensuring Low-Cost Access to International Infrastructure

Creating the conditions for widespread broadband access is a complex policy issue facing the ICT sector in Africa. The markets in the region are so different from those in other parts of the world that governments have no obvious models to draw on. Some lessons are beginning to emerge, however. One, in particular, is the importance of access to high-capacity, low-cost bandwidth via submarine fiber-optic cable infrastructure.

The private sector has demonstrated its capacity to develop, finance, and operate such cables in Africa. The challenge for governments is to minimize the obstacles to this type of investment by readily issuing cable operators permits and licenses. The development of infrastructure, on its own, will not guarantee better services for customers. The experience of the South Atlantic 3/West Africa Submarine Cable (SAT-3) cable on the west coast of Africa shows that physical access to a cable is necessary but not sufficient for low-cost connectivity. A consortium of private operators with little direct regulation controls access to the SAT-3 cable. Because these operators are protected from competition on the cable, customers have not received the full potential benefit of the facility. The challenge for governments seeking to improve access to international infrastructure is to avoid creating infrastructure bottlenecks and to encourage competition between submarine cables and landing stations. Where they cannot do this, regulators should ensure access to the facilities on equitable terms.

Landlocked countries face a special challenge in ensuring that their operators have access to submarine fiber-optic infrastructure. If the private sector does not provide competitive infrastructure in the intervening countries, the government may have a role to play through public-private partnerships.

Promoting the Development of High-Bandwidth Backbone Networks

Domestic backbone networks will become more important as governments focus their attention on delivering affordable broadband Internet. Without these networks, countries will have difficulty making broadband services widely available at prices that significant numbers of people are willing to pay.

Private operators are investing considerable resources in this infrastructure, and the pace is increasing as operators look at broadband as a source of future market growth. Such network development is typically limited to urban areas and interurban routes where the private sector is willing to invest in network development.

No single policy approach exists to backbone network development. Some governments promote a competition-only policy, whereas others invest public resources in publicly owned networks. Regulatory frameworks often constrain investment through restrictions on fixed-network investment and on the services that can be sold. Wholesale markets in backbone services are thus underdeveloped, contributing to the high price and limited availability of broadband Internet in the region.

Successful policy for domestic backbone network development must encourage private investment in commercially viable areas and provide public support for investment in areas that are not commercially viable. Such a policy should encourage infrastructure competition by removing regulatory restrictions and should reduce the cost of investment in fiber-optic infrastructure by providing access to alternative transport and energy infrastructure. Public resources should focus on areas of the country that are not commercially viable. To the extent that public investment is needed, it should be made in partnership with the private sector to ensure that the design of the infrastructure meets the needs of market participants.

Reforming Management of the Radio Spectrum

The rapid evolution of ICT markets in Africa has increased the number of potential users of

the radio spectrum and is challenging governments' traditional systems of spectrum allocation and management. When one or two operators and the government dominated the mobile market, management of the radio spectrum did not present major challenges to governments. Market liberalization and technological innovation have increased the number of players wishing to use the radio spectrum, particularly for new broadband wireless Internet services. The way in which access to the radio spectrum is organized is therefore an increasingly important issue for the development of the ICT sector.

The traditional approach to organizing the spectrum's use is to constrain development of the ICT sector. Governments have traditionally accomplished this by deciding how each frequency band is used and who is entitled to use it. This approach is unsuitable for markets with multiple players and spectrum uses that are continually changing. Governments are ill suited to decide the best uses for the radio spectrum and are typically unable to move fast enough in the allocation process. The effect is to constrain market development, particularly in new segments of the market, such as broadband Internet.

The introduction of market forces will improve management of the radio spectrum. Where demand for the right to use certain areas of the radio spectrum exceeds supply, usage rights can be auctioned. Such spectrum auctions are widely used in developed countries, and similar systems are used in Africa to allocate mobile network licenses (which usually include the right to use specified sections of the radio spectrum). Market forces can also be introduced in spectrum management after initial allocations have been made by establishing formal property rights over the spectrum and allowing owners to trade them. Establishing such primary and secondary markets in spectrum usage would free up the spectrum and would help ensure its most efficient use.

Further evolution in how the radio spectrum is managed is possible by establishing a shared-use system for certain bands of spectrum, known as a commons approach.

Recent developments in wireless technology have allowed multiple users of the same radio spectrum bands to operate without undue interference. Allowing anyone to share the radio spectrum, with little or no registration and usually without a fee, reduces the cost of entry into the market and therefore encourages innovation in technology and service delivery.

Changing how the radio spectrum is managed requires political will. The establishment of a property rights scheme can arbitrarily create windfall gains and losses for current and future users. Some users of the radio spectrum may be difficult to incorporate into a pure market-based system. For example, requiring users in the military or emergency services to participate in spectrum markets may be particularly challenging (although not impossible) and would certainly have budgetary implications for those agencies.

Reforming the allocation and management of the radio spectrum would change the role of government. Its primary role in spectrum management would no longer be to make technical and licensing decisions. Rather, the government's role would be to design, operate, and regulate the market in the radio spectrum. Such a change would require changes in the legal framework governing the radio spectrum and the capacity of the regulatory institutions involved.

Promoting Universal Access

As more people in Africa gain access to ICT services, those who remain outside the range of networks are at a disadvantage. Several governments in Africa have attempted to extend access to ICT beyond the perceived limits of the market. The quickest and most effective way of getting infrastructure to poor rural users is through competition. Malawi and Uganda have set up effectively competitive mobile markets that already cover over 80 percent of the population and are continuing to expand.

For the majority of countries in Africa, only competition will result in mobile networks that cover the whole population. With a few exceptions, such as the Democratic Republic of Congo, the additional cost to make voice network coverage universal is modest. In

these countries, a service target of 100 percent coverage may be economically feasible. In countries where the gap left by the market is larger, a more modest target will likely be necessary.

When a universal service target is set, the major challenge is to establish a mechanism to achieve it. The majority of countries across the region currently apply a universal service levy on private operators, using the funds for specific ICT projects. This approach has had very limited success, particularly when contrasted with the commercially driven network expansion into rural areas. Universal service funds often suffer from bureaucratic obstacles and political interference in expenditure, and frequently they are not spent on the sector at all. Universal service policy in Africa therefore requires new thinking. The challenge is to meet the government's policy objectives of universal service at minimum cost to taxpayers while harnessing the beneficial effects of competition. An alternative to the traditional fund-based approach is to provide direct incentives for operators to deliver services in rural areas. For example, governments could offer operators a reduction in license-fee payments in exchange for providing services in specified areas, or they could establish pay-or-play schemes in which operators can choose between building networks in specified areas and contributing to a universal service fund, which is then used to subsidize operators that do provide services in unprofitable areas. The major advantage of these approaches is the reduction in transfers between operators and the government, thereby lessening bureaucratic delays or the diversion of funds.

Once a coverage target is defined, governments may also wish to address the issue of access for low-income groups. Call-by-call resale of services has significantly reduced the costs of accessing the network, and these systems are widespread in Africa (for example, the VillagePhone program of cell phone company MTN). Universal service targets could potentially include subsidies for prepayment directed at specific target groups of the population. However, they would have to be carefully designed to avoid mistargeting and leakage.

Notes

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1. Initial public offerings of government stakes in state-owned enterprises in the telecommunication sector have more recently been carried out in Kenya (2008) and Burkina Faso (2009).

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