



BACKGROUND PAPER 10 (PHASE I)

Information and Communications Technology in Sub-Saharan Africa: A Sector Review

SUMMARY

*Mavis Ampah, Daniel Camos, Cecilia Briceño-Garmendia,
Michael Minges, Maria Shkaratan, and Mark Williams*

JANUARY 2009

Africa's Infrastructure | A Time for Transformation

© 2009 The International Bank for Reconstruction and Development / The World Bank
1818 H Street, NW
Washington, DC 20433 USA
Telephone: 202-473-1000
Internet: www.worldbank.org
E-mail: feedback@worldbank.org

All rights reserved

A publication of the World Bank.

The World Bank
1818 H Street, NW
Washington, DC 20433 USA

The findings, interpretations, and conclusions expressed herein are those of the author(s) and do not necessarily reflect the views of the Executive Directors of the International Bank for Reconstruction and Development / The World Bank or the governments they represent.

The World Bank does not guarantee the accuracy of the data included in this work. The boundaries, colors, denominations, and other information shown on any map in this work do not imply any judgment on the part of The World Bank concerning the legal status of any territory or the endorsement or acceptance of such boundaries.

Rights and permissions

The material in this publication is copyrighted. Copying and/or transmitting portions or all of this work without permission may be a violation of applicable law. The International Bank for Reconstruction and Development / The World Bank encourages dissemination of its work and will normally grant permission to reproduce portions of the work promptly.

For permission to photocopy or reprint any part of this work, please send a request with complete information to the Copyright Clearance Center Inc., 222 Rosewood Drive, Danvers, MA 01923 USA; telephone: 978-750-8400; fax: 978-750-4470; Internet: www.copyright.com.

All other queries on rights and licenses, including subsidiary rights, should be addressed to the Office of the Publisher, The World Bank, 1818 H Street, NW, Washington, DC 20433 USA; fax: 202-522-2422; e-mail: pubrights@worldbank.org.

About AICD



This study is a product of the Africa Infrastructure Country Diagnostic (AICD), a project designed to expand the world's knowledge of physical infrastructure in Africa.

AICD will provide a baseline against which future improvements in infrastructure services can be measured, making it possible to monitor the results achieved from donor support. It should also provide a better empirical foundation for prioritizing investments and designing policy reforms in Africa's infrastructure sectors.



AICD is based on an unprecedented effort to collect detailed economic and technical data on African infrastructure. The project has produced a series of reports (such as this one) on public expenditure, spending needs, and sector performance in each of the main infrastructure sectors—energy, information and communication technologies, irrigation, transport, and water and sanitation. *Africa's Infrastructure—A Time for Transformation*, published by the World Bank in November 2009, synthesizes the most significant findings of those reports.

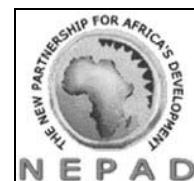
AICD was commissioned by the Infrastructure Consortium for Africa after the 2005 G-8 summit at Gleneagles, which recognized the importance of scaling up donor finance for infrastructure in support of Africa's development.



The first phase of AICD focused on 24 countries that together account for 85 percent of the gross domestic product, population, and infrastructure aid flows of Sub-Saharan Africa. The countries are: Benin, Burkina Faso, Cape Verde, Cameroon, Chad, Côte d'Ivoire, the Democratic Republic of Congo, Ethiopia, Ghana, Kenya, Lesotho, Madagascar, Malawi, Mozambique, Namibia, Niger, Nigeria, Rwanda, Senegal, South Africa, Sudan, Tanzania, Uganda, and Zambia. Under a second phase of the project, coverage is expanding to include as many other African countries as possible.



Consistent with the genesis of the project, the main focus is on the 48 countries south of the Sahara that face the most severe infrastructure challenges. Some components of the study also cover North African countries so as to provide a broader point of reference. Unless otherwise stated,



therefore, the term “Africa” will be used throughout this report as a shorthand for “Sub-Saharan Africa.”



The World Bank is implementing AICD with the guidance of a steering committee that represents the African Union, the New Partnership for Africa’s Development (NEPAD), Africa’s regional economic communities, the African Development Bank, the Development Bank of Southern Africa, and major infrastructure donors.



Financing for AICD is provided by a multidonor trust fund to which the main contributors are the U.K.’s Department for International Development, the Public Private Infrastructure Advisory Facility, Agence Française de Développement, the European Commission, and Germany’s KfW Entwicklungsbank. The Sub-Saharan Africa Transport Policy Program and the Water and Sanitation Program provided technical support on data collection and analysis pertaining to their respective sectors. A group of distinguished peer reviewers from policy-making and academic circles in Africa and beyond reviewed all of the major outputs of the study to ensure the technical quality of the work.



The data underlying AICD’s reports, as well as the reports themselves, are available to the public through an interactive Web site, www.infrastructureafrica.org, that allows users to download customized data reports and perform various simulations. Inquiries concerning the availability of data sets should be directed to the editors at the World Bank in Washington, DC.



Summary

Africa is undergoing a revolution in information and communications and technology (ICT) that is bringing telecom services within the reach of hundreds of millions of people. The revolution is based on wireless technologies, which are bypassing the fixed-line networks on which the telecom markets of developed countries were built.

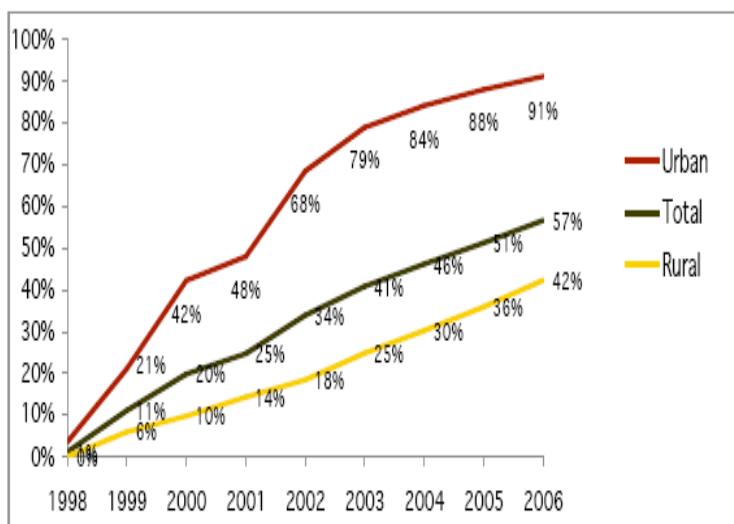
In the 53 countries surveyed, the rolls of fixed-line subscribers grew by 11 million, from 19.5 million lines in 2000 to 30.6 million in 2007. That is an improvement, but it pales against the growth in mobile networks, which added 252 million subscribers over the same time period. The number of mobile subscribers in the 53 countries jumped more than 15 times—from 15 million in 2000 to 267 million in 2007. By 2006, 57 percent of Africans were living under the footprint of the mobile networks (figure A).

These averages mask wide variations among countries. Of the 53 countries studied, the small middle-income group had seven times more fixed lines per 100 inhabitants than the low-income countries. The range in mobile penetration rates is equally great. The average rate for the region is 28.1 mobile subscriptions per 100 inhabitants, but this ranges from just over 1 in Eritrea to 98 in Seychelles.

Similarly wide variations in access can be found within countries, between rich and poor households, and between rural and urban areas. Less than 3 percent of rural African households have access to a fixed telephone lines, whereas 20 percent of urban households have them. Rural-urban differentials in access to cellular services are less marked, as networks have extended into remoter areas, with 42 percent of rural dwellers versus 91 percent of urbanites living under the mobile footprint.

Access to the Internet is much less widespread than access to basic voice services. There were less than four million subscribers in 2007. Of these, more than three-quarters were living north of the Sahara or in the Republic of South Africa. The most common form of access to the Internet is through shared facilities such as Internet cafes and telecenters so, in practice, we estimate that there were about 44 million Internet users in 2007—around 5 percent of the population, less than half the rate in Pakistan.

Figure A GSM mobile telephone coverage in AICD countries, 1998–2006



Source: AICD.

What price access?

As mobile network coverage increases across the region, the primary determinant of popular access to services is price, which is high by international standards and in relation to household incomes in the region. In 2007 the average monthly prepaid package for mobile service in the countries studied was priced at around \$12, almost the same as the average package for fixed lines. There is great variation across countries, with pre-paid mobile baskets ranging from a high of \$19 to a low of \$4. The price of a fixed-line package covers a similar range, from \$2 to \$25 per month.

Broadband Internet is not always available, but where it is, services are usually charged on a flat-rate basis. Here, too, prices tend to be very high. The average price of an entry level monthly DSL subscription in Sub-Saharan Africa was over \$100. In comparison, the average monthly price in OECD countries for a broadband connection was \$34.

But although mobile tariffs are still high given the low incomes in the region, they are falling steadily and, as the networks expand, are reaching lower-income customers. One indication of the drop in prices is the steady fall in the average revenue generated by network subscribers. The monthly average revenue per mobile user (ARPU) stood at \$16 in 2007, less than half the level of \$40 in 2000. There is plenty of room, however, for prices to come down even further. Over the same time period, ARPUs in Bangladesh, India, and Pakistan fell by almost 90 percent—to \$4 per month. In the fixed-line realm, some prices have increased and others fallen as competition has forced the fixed operators to rebalance tariffs. The average price of a call to the United States from the region, for example, was cut in half between 2000 and 2007.

Despite high service prices, the mobile networks have been able to provide access to low-income users through flexible retail packages. Over 90 percent of the region's consumers are on prepaid plans, which allow them to purchase services in tiny increments and control their spending precisely. High connection charges are rare, so the minimum cost of access to mobile services is generally lower than for fixed networks, which traditionally operate on a post-paid subscription basis. For the operators, prepayment dramatically reduces credit risk and the cost of revenue collection. Moreover, the absence of credit checks, proof-of-address requirements, and other "know your customer" measures has reduced the cost of customer acquisition in the region and increased the flexibility of markets.

Other factors—notably taxes and energy shortages—keep prices of ICT services in Africa higher than they would be if market dynamics alone were at work. These taxes include import duties on mobile handsets, taxes on services, and, in some countries, particularly in East Africa, excise charges on calls. Value-added taxes range from 5 percent to 23 percent in the countries studied. The combined effect of these taxes and duties is to add significantly to the cost of mobile ownership, putting ICTs outside the reach of many consumers who otherwise might be able to afford them. Uganda ranks second in the world in taxes as a percentage of total mobile revenues, while Kenya and Tanzania are above the world average. Shortages of electricity contribute to higher costs, as service providers must rely on their own generators to power mobile base stations and other telecommunications equipment. Scarce and unreliable electricity also affects operators' earnings because mobile subscribers, particularly in rural areas, have difficulty recharging the batteries in their mobile phones.

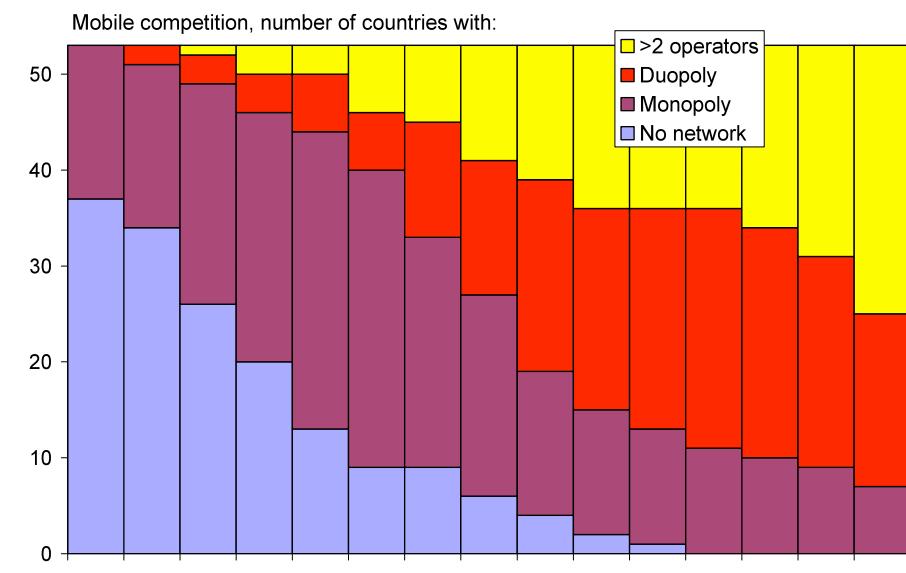
From monopoly to competition

Competition is the quickest route to lower prices and wider access to services. Perspectives on telecom governance have changed radically over the past few decades. The most important implication has been the shift from monopoly to competition. Greater competition has brought expanded networks, lower prices, and new efforts to reach previously underserved groups of customers.

Since 1993, most of the countries studied have introduced some degree of competition in their telecommunications markets (figure B). Less than ten countries have a monopoly mobile market and the majority of African countries have more than two mobile operators.

More than two dozen of the countries allow some degree of competition in fixed-line and international markets, but only a few

Figure B Status of mobile competition



Source: AICD.

have more than two operators in these segments. Few outright bans on competition remain in national legislation.

The popularity of the Internet has resulted in growing demand, and most countries have issued licenses to several Internet service providers (ISPs). Some countries have relaxed their authorization regimes, requiring low or no license fees, so there are a number of licensed or registered ISPs; in some countries, only a fraction of these are operational.

Despite the large number of ISPs licenses that have been issued, many of the countries have imposed restrictions on what ISPs can do. For example, ISPs are often not allowed to provide their own infrastructure unless they obtain other licenses. Restrictions on entry into the fixed-line and international gateway markets have meant that ISPs have often had to lease infrastructure from incumbent operators sometimes at prices that are not cost-based. ISPs are sometimes not allowed to directly obtain international bandwidth, which is particularly onerous for landlocked countries that rely on satellite. Even in countries with other options for international connectivity (such as undersea fiber optic networks), incumbent operators often have a stranglehold on landing stations and belong to consortiums that own the networks. This means that ISPs have no choice but to go through the incumbent operator for fiber-based international connections.

Of the 14 AICD countries for which the International Telecommunications Union has data, most do not allow full competition in international gateways. Six reported that international gateways were a monopoly of the incumbent, four reported partial competition; only four responded that full competition existed in this market segment.

Despite widespread *de jure* liberalization, the process of *de facto* liberalization has been moving more slowly. Barely half of the countries studied have more than three active operators. Constraints on competition often appear in the licensing process. In some countries there is no clear procedure for obtaining a license, perpetuating the *de facto* monopoly. In other countries, the complexity of the licensing process can discourage new entrants. For example, some countries divide the market into many segments and require a license for each. Sometimes it is not clear which licenses are needed to provide which service, or whether the scope of a license allows the licensee to offer the services it wants to offer.

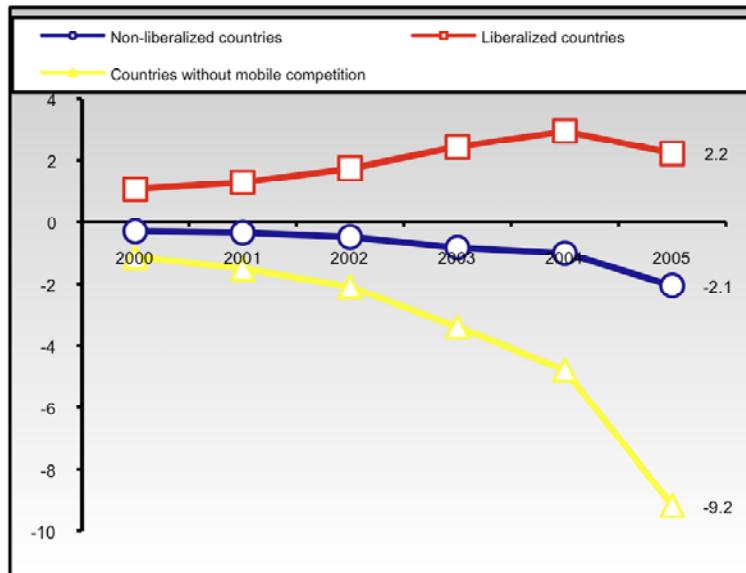
Competition and performance

Countries that pursued early market liberalization for mobile telephony had an average penetration level that was 2.2 points higher in 2005 than would be expected from their average income (figure C). Liberalized countries are those that have established an independent regulatory agency, partly privatized government-owned operators, and maintained competition for at least five years. Those that did not had average mobile penetration rates 2.1 points below the level suggested by their income. As competitive markets develop, the gap between countries that are reforming and those that are not is getting wider. The performance gap in the fixed-line sector followed the same pattern but was less pronounced.

The effects of competition deepen as reform proceeds. Mobile penetration speeds up, for example, as the number of operators in the market increases. For the sample countries, mobile subscriptions increased by more than 3 percentage points annually after the entry of the fourth operator. The growth occurs earlier in higher-income countries (those where annual per capita income is greater than \$1,000), where subscriptions jumped 11 percentage points after the entry of the second operator.

Competition in mobile services also forces fixed operators to rebalance their tariff structure (figure D). This has resulted in higher average fixed tariffs, but much lower prices for international calls.

Figure C Difference between expected and actual mobile penetration, 2000–05



Source: AICD.

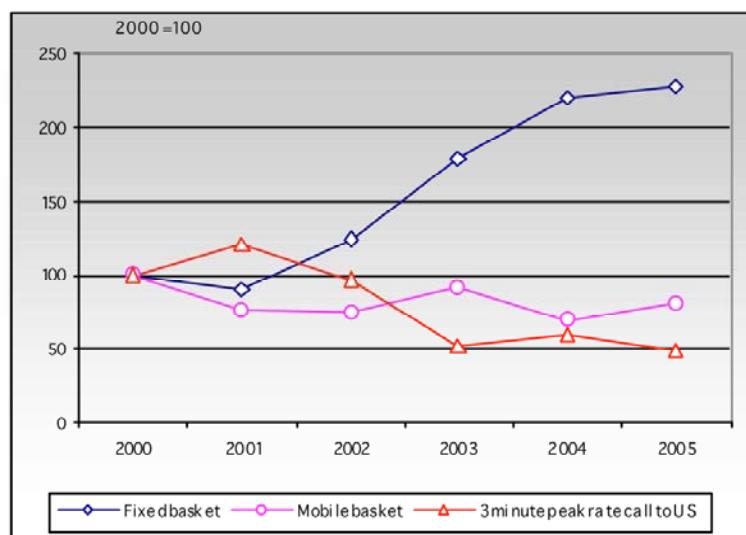
Competition is the primary driver of reductions in the price of long-distance and international services. However, access to submarine fiber-optic connectivity also plays an important role in determining the price of international services, particularly Internet access. When access to the submarine cables remains in the hands of the incumbent operator, the incumbent is likely—in the absence of adequate regulatory controls—to prevent the full cost advantage of this technology from being passed on to consumers. In countries with multiple international gateways, some competitive pressure is exerted, and service prices are significantly lower than in countries where the submarine cable provides the only international gateway. In the case of broadband and Internet access in general, access to fiber has undoubtedly had a significant impact on prices.

The SAT-3 undersea fiber-optic cable has helped to alleviate the shortage of bandwidth for a number of countries on Africa's west coast. In addition, Cape Verde and Sudan have been able to connect to other fiber-optic submarine cable systems. Although landlocked, Ethiopia is sending an overland fiber-optic cable to Sudan to tap into that country's fiber link to Saudi Arabia. Some nations on the west coast, which lack their own international fiber outlet, are also using terrestrial links to connect to neighbors with a SAT-3 landing station. For example, Namibia has a fiber link to South Africa. East Africa has been

particularly affected by a shortage of fiber-based international Internet connectivity and as a result faces high retail prices. Most East African countries are collaborating to create the East African Submarine Cable System (EASSy), which would provide high-speed fiber optic connectivity at lower costs. Progress toward EASSy, however, has been hampered by governments keen to ensure that the system will provide access to those outside the consortium.

Figure D Tariff rebalancing following reform of the telecommunications sector, 2000–05

Index: 2000 = 100



Source: AICD.

Reform and regulation

How telecommunications markets are structured and regulated affects competition—for example, by limiting entry to the market—and therefore affects access, by keeping prices higher than they otherwise would be.

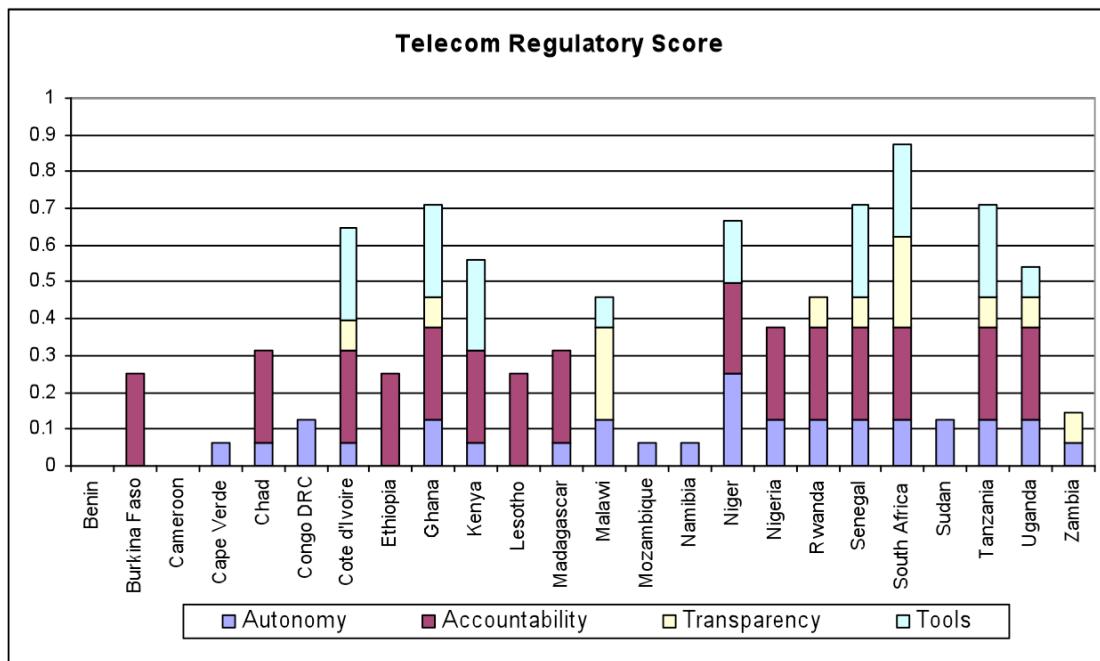
All the countries studied have laws and regulations covering the telecommunications sector; over 20 adopted their present legislation after 2000. A typical bill establishes a national regulatory agency (NRA) to supervise the telecommunications sector and contains general provisions governing competition,

licensing, interconnection, allocation of scarce resources (such as numbering and spectrum), pricing, and market entry. Wide variations are found between countries in the extent of reform.

Compared with other infrastructure sectors, there has been intensive institutional reform. These changes have been predominantly driven by market reforms that fostered competition and facilitated various forms of private participation. Policy oversight evolved accordingly.

Progress is also evident on the regulatory front, although the picture is more mixed. By 2007, 45 AICD countries had NRAs in operation, but governments continue to interfere with their decisions. Effective NRAs depend on legal frameworks that make them accountable to the public, encourage them to operate transparently, give them the enforcement powers and other tools they need to do their job, and grant them autonomy and freedom from political interference. Regulatory quality differs from country to country (figure E), but autonomy is a particularly scarce commodity.

Figure E Telecom regulatory score



Source: AICD

On the other hand, progress on accountability has been encouraging, particularly if compared with other variables of regulation and other infrastructure sectors. Achievements in transparency have been mixed and generally incomplete, with much ground yet to be covered. Almost all the NRAs have Web sites. Yet availability and quality of online information remain uneven.

Failure to reform has a direct fiscal cost because competitive markets generate higher taxable revenues. Telecom revenue as a percentage of GDP in the liberalized countries is 5.6 percent, compared with 3.5 percent in the nonliberalized countries (figure F). In the liberalized countries telecom revenues increased by 2.5 percent of GDP between 2000 and 2005, compared with the 1.2 percent rise observed in the nonliberalized countries.

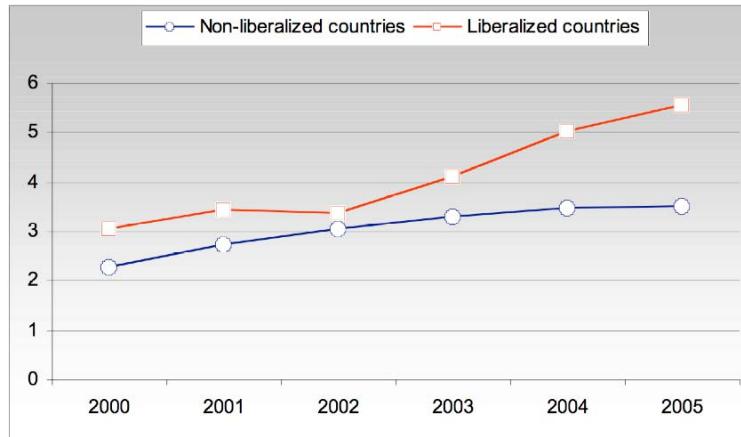
The persistence of state-owned enterprises

Given the private sector's success in delivering ICT services, it is striking that half of the fixed-line operators in Africa remain in public hands, despite low productivity and poor quality of service. Only those in South Africa and Sudan put into effect even half of international best practices for governance (figure G).

In countries with state-owned fixed-line incumbents, public spending on telephone service averaged 2 percent of GDP, an extraordinarily large amount to be spent by the public sector in a market that is increasingly competitive. The reason for the high spending is clear enough. It is not uncommon for public utilities to be used as social buffers,

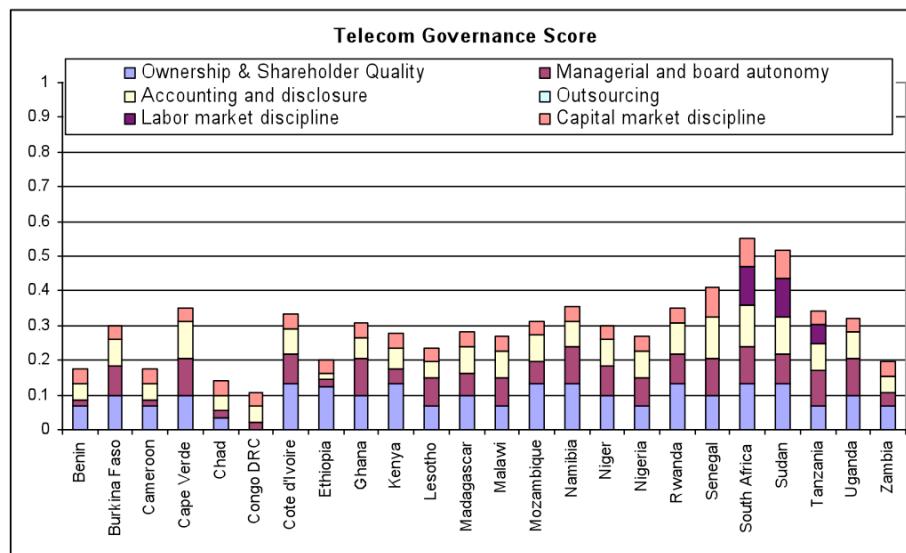
redistributing wealth via excessive employment. However, this practice carries with it substantial hidden costs of redundancy and inefficiency that are as much as 0.3 percent of GDP in Tanzania or \$200 per subscriber in Chad.

Figure F Telecom revenue as share of GDP, selected African countries, 2000–05



Note: Liberalized countries are those that have established an independent regulatory agency, partly privatized government-owned operators, and maintained competition for at least five years.

Figure G Telecom governance score



Source: AICD

The path to wider access to telecommunications services

Telecommunications reforms have led to more competitive markets in many of the countries studied. The result has been impressive growth during the first half of the 2000s, particularly in mobile telephony. The challenge will be to sustain this growth in the face of significant barriers.

The key to extending communications access in Africa is to leverage the unprecedented success of mobile technology on the continent. Given that mobile operators tend to have the largest telecommunications networks in most countries, the incremental costs of extending mobile coverage into underserved areas is probably less than that of other solutions, such as extending fixed-line networks or promoting the voice-over-Internet protocol. A companion project to this study has estimated the cost of extending mobile coverage to areas that currently do not have a mobile signal.

A number of key policy recommendations, if followed, would sustain growth and deepen access to telecommunications in the region.

- There is ample scope for further sector reform in most countries. According to a 2006 report from the GSM Association, poor regulation has reduced telecommunications investment in Africa by \$4.6 billion. Countries that have not yet privatized incumbent operators should do so in order to reduce direct state intervention in operations, encourage a more level playing field, and attract investment and innovation. Additional competition should be introduced by not limiting the number of operating licenses available. Regulatory agencies should be strengthened and allowed to operate independently.
- Countries should pursue liberalization by simplifying licensing regimes, lifting remaining bars to market entry, and examining the feasibility of introducing mobile number portability and mobile virtual network operators.
- Efforts should be increased to lower prices for telecommunications services. Average per capita income in Sub-Saharan Africa was just \$970 in 2007—less than \$3 a day. Any incremental efforts to lower prices would have a tremendous impact on affordability and hence access. A few ways to push prices down are to lower taxes and termination fees, and, where competition is limited, through regulatory action.
- Mobile telephone access should be incorporated into established goals for universal access so as to leverage the successful spread of mobile communications. Mobile telephony has probably done more to increase access through a competitive environment than any other policy, yet, for the most part mobile operators have not been involved in formal universal access programs. Adapted universal access policies might require mobile operators to expand coverage as a condition of licensing or allow mobile operators that expanded coverage to receive money from universal service funds.
- High-speed connectivity over fiber optic cable is a prerequisite for e-government and other socioeconomically beneficial applications. Private-public partnerships can play a useful role in developing and expanding national, regional, and international fiber optic links throughout the region, allowing Sub-Saharan Africa to join fully in the global information society. Although

governments should play an active role in encouraging the deployment of fiber networks, their participation should not delay the badly needed implementation of fiber backbones.