AICD

AFRICA INFRASTRUCTURE COUNTRY DIAGNOSTIC

COUNTRY REPORT

# Mali's Infrastructure: A Continental Perspective

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Africa's Infrastructure | A Time for Transformation

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# About AICD and its country reports

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

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

The focus of the AICD country reports is on benchmarking sector performance and quantifying the main financing and efficiency gaps at the country level. These reports are particularly relevant to national policy makers and development partners working on specific countries.

The AICD was commissioned by the Infrastructure Consortium for Africa following the 2005 G8 (Group of Eight) summit at Gleneagles, Scotland, which flagged the importance of scaling up donor finance for infrastructure in support of Africa's development.

The AICD's first phase 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 was expanded to include as many of the remaining 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" is used throughout this report as a shorthand for "Sub-Saharan Africa."

The World Bank has implemented the 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 (AfDB), the Development Bank of Southern Africa (DBSA), and major infrastructure donors.

Financing for the AICD is provided by a multidonor trust fund to which the main contributors are the United Kingdom's Department for International Development (DFID), the Public Private Infrastructure Advisory Facility (PPIAF), Agence Française de Développement (AFD), the European Commission, and Germany's Entwicklungsbank (KfW). 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 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.

The data underlying the 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. Many AICD outputs will appear in the World Bank's Policy Research Working Papers series. Inquiries concerning the availability of data sets should be directed to the volume editors at the World Bank in Washington, DC.

# Contents



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# Synopsis

In recent years Mali's economy has grown steadily at a rate of more than 5 percent per year, driven by developments in gold mining, cereal harvests, and telecommunications. Mali's landlocked condition, together with its very uneven distribution of both population and economic activities between the arid north and the much richer south, challenge the country's ability to sustain this pace of growth. These two aspects define and challenge Mali's development and the infrastructure agendas.

Mali depends heavily on regional transport corridors and regional infrastructure. Its access to ports is granted through three international corridors (Tema–Ouagadougou–Bamako, Dakar–Bamako, and Abidjan–Ferkesessedougou–Bamako). Its use of water resources for irrigation as well as for hydropower is linked to transboundary international arrangements with neighboring countries. The provision of power at reasonable costs may be possible in the short run only through power trading within the West Africa Power Pool. Continued progress in telecommunications depends on connections to submarine cables passing though Cameroon and Senegal.

The country's strategic focus on the regional agenda has paid off to date, and critical institutional decisions are bringing many positive developments. More than 80 percent of Mali's segments of the West Africa road corridors are maintained in good or fair condition, giving the principal production areas of the south alternative access to the deep-water ports of Dakar, Adidjan, Takoradi, Tema, and Lomé. Air transport security has improved, supported by the refurbishment of local airports, including Bamako airport, and the restructuring of Mali's Civil Aviation Authority to increase its autonomy and guarantee harmonization of air transportation rules across West Africa. Mali has also successfully liberalized its mobile telephone markets, with access approaching 40 percent in 2008. Roaming agreements and cross-country competition have kept mobile prices low. Access to electricity in Mali more than doubled in the last decade, helped by the introduction of an apparently successful program for rural electrification (AMADER) that widened access to more than 36,000 rural households.

But Mali still faces critical infrastructure challenges. Perhaps the starkest lies in the power sector. The cost of producing power in Mali is among the highest in the region ($0.33–0.39 per kWh), an obstacle to expanding access to unserved households. Despite recent achievements, only about 17 percent of the population enjoys access to electricity, much lower than the rates found in other low-income countries on the continent. Furthermore, the power tariff of about $0.20 per kilowatt-hour, while relatively high, is still insufficient to cover costs. Diversification of the generation mix is necessary. This will involve tapping the country's hydropower potential and increasing reliance on imports.

Water supply and sanitation (WSS) also represent a challenge. Restructuring EDM to separate its power services from its WSS functions has become a pressing issue. The separation is needed to better attribute costs, improve efficiency, and develop effective partnerships with the private sector in the very distinct water and the power businesses.

Addressing Mali's public infrastructure needs will require sustained spending of more than $1 billion per year, depending on the technologies and standards chosen. WSS and power account for the largest portion of this total—around one-third each.

When all sources of spending are taken into account, Mali spent an annual average of about $555 million on infrastructure during the late 2000s. That is equivalent to about 10 percent of GDP, a relatively high share compared with other African countries, though still only about half of the share that China has spent on infrastructure in recent years. About 60 percent of total infrastructure spending has been investment. WSS spending represents a surprisingly small share of total public spending, with transport, power, and ICT absorbing larger shares (together about 85 percent of the total). The public sector (through taxes and user fees) and official development assistance are the largest source of investment, followed distantly by private funds. A total of $200 million is lost annually to inefficiencies, mainly because of the misalignment between tariffs and costs in the power sector. Only by changing the generation mix and significantly reducing generation costs will Mali be able to minimize this inefficiency in the long run. Raising tariffs to the level of full recovery will not affordable by a substantial share of the population, however.

Assessing spending needs against existing spending and potential efficiency gains leaves an annual funding gap of between $283 million per year, or 5.1 percent of GDP, most of it associated with water and sanitation and, to a much lesser extent, transport. Mali will likely need more than a decade to reach the illustrative infrastructure targets outlined in this report. Under business-as-usual assumptions for spending and efficiency, it would take over 50 years for Mali to reach these goals. Yet with a combination of increased finance, improved efficiency, and cost-reducing innovations, it should be possible to reduce that time to 15 years.

## The continental perspective

The Africa Infrastructure Country Diagnostic (AICD) has gathered and analyzed extensive data on infrastructure in more than 40 Sub-Saharan countries, including Mali. The results have been presented in reports covering different areas of infrastructure—ICT, irrigation, power, transport, water and sanitation—and different policy areas, including investment needs, fiscal costs, and sector performance.

This report presents the key AICD findings for Mali, allowing the country's infrastructure situation to be benchmarked against that of its African peers. Given that Mali is a poor but stable country, two sets of African benchmarks will be used to evaluate Mali's situation: nonfragile low-income countries and middle-income countries. Detailed comparisons will also be made with immediate regional neighbors in the Economic Community of West African States (ECOWAS).

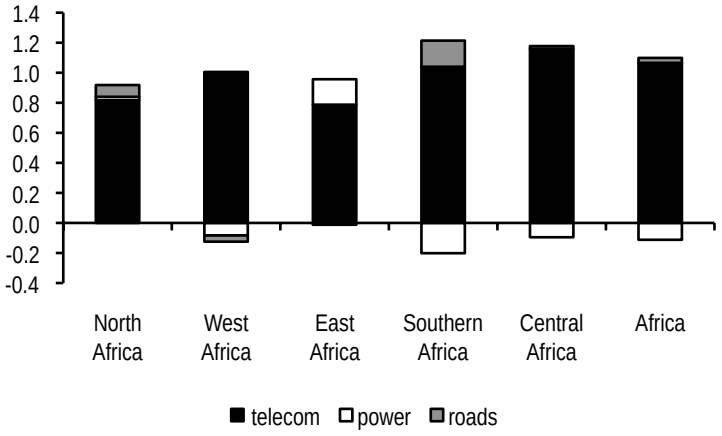
Several methodological issues should be borne in mind. First, because of the cross-country nature of data collection, a time lag is inevitable. The period covered by the AICD runs from 2003 to 2008. Most technical data presented are for 2007 (or the most recent year available), while financial data are typically averaged over the available period to smooth out the effect of short-term fluctuations. Second, in order to make comparisons across countries, we had to standardize the indicators and analysis so that everything was done on a consistent basis. This means that some of the indicators presented here may be slightly different from those that are routinely reported and discussed at the country level.

# Why infrastructure matters

In common with the rest of the continent, West Africa's growth performance improved markedly in the 2000s relative to the 1990s. The overall improvement in per capita growth rates has been estimated at 2 percentage points, of which 1.1 percentage points can be attributed to better structural policies and 0.9 percentage points to improved infrastructure**.** This contribution came mainly from the ICT revolution, while deficient power infrastructure held growth back (figure 1).

Figure 1. Infrastructure has contributed much to economic growth—but could contribute much more

Infrastructure's contribution to annual per capita economic growth in African regions, 2003–07, in percentage points



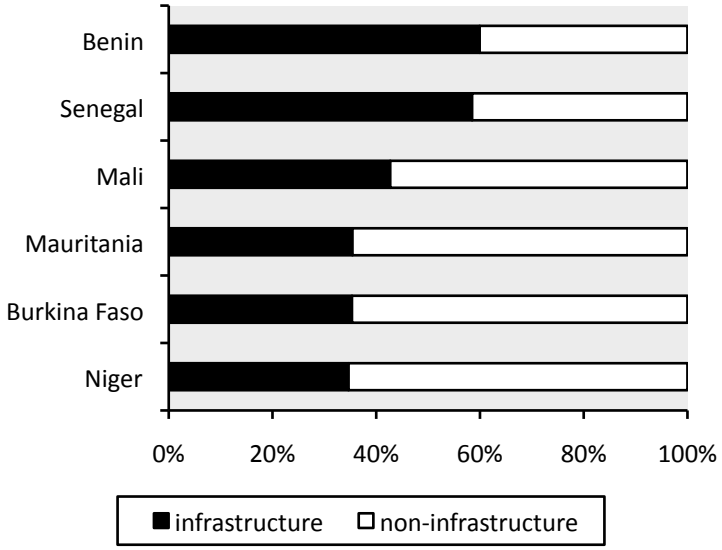

Source: Calderon 2009.

Mali's sustained growth has been driven primarily by telecommunications services, but also by transport, gold mining, and well-performing cereal harvest (World Bank 2007a). Between 2003 and 2006, Mali's economy grew at an average annual rate of 5.3 percent, despite external shocks, including a decline in cotton prices and rise in oil prices.

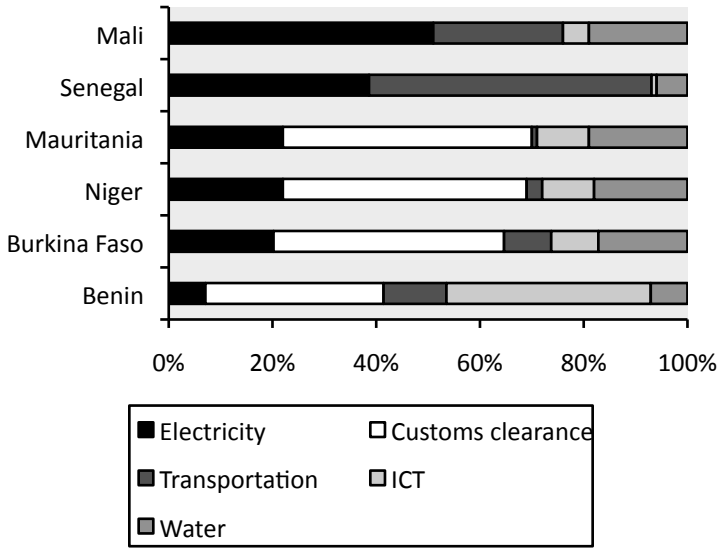
Evidence from enterprise surveys suggests that infrastructure constraints are responsible for about 40 percent of the productivity handicap faced by Malian firms (figure 2), with the remainder being due to poor governance, red tape, and financing constraints. Power is the infrastructure constraint that weighs most heavily on Malian firms, with transport a close second.

Figure 2. Infrastructure deficits hold back firms' productivity

a. Percentage of productivity handicap attributable to infrastructure




b. Percentage of productivity handicap attributable to infrastructure subsectors




Source: Escribano, Guasch, and Pena 2009.

## The state of Mali's infrastructure

Mali is an enormous semi-arid territory without direct access to a sea port. Mali's land area is the largest of the ECOWAS countries and one of the largest in Africa. It has a very low population density (figure 3a), a clear concentration of natural resources in the south (figure 3d), and varying levels of

poverty and wealth (figure 3b). Mali's territory is dominated by the Senegal and Niger River deltas, both of which have potential that remains largely undeveloped (figure 2b).

The spatial distribution of Mali's economy and demography shows marked differences between north and south. The south has a relatively higher population density hosting most of the country's largest cities and concentrating most of the country's natural resources (mainly precious metals) and economic activity (agricultural production) (figure 2a,d). By comparison, the north is arid and sparsely populated, primarily by nomad communities. While it has significant tracts of land with high agricultural value those are currently are not being fully exploited.

The distribution of Mali's infrastructure networks reflects the population distribution and has a strategic focus on integrating the country with regional networks and export points. As a result, the density of transport, power, and ICT infrastructure is greater in the south of the country than in the north (figure 3a, b, c). In fact, Mali has one of most spatially concentrated infrastructure networks on the continent. With the exception of some roads that connect scattered mining sites and irrigation areas, Mali's northern region is an inaccessible desert (figure 4a–d).

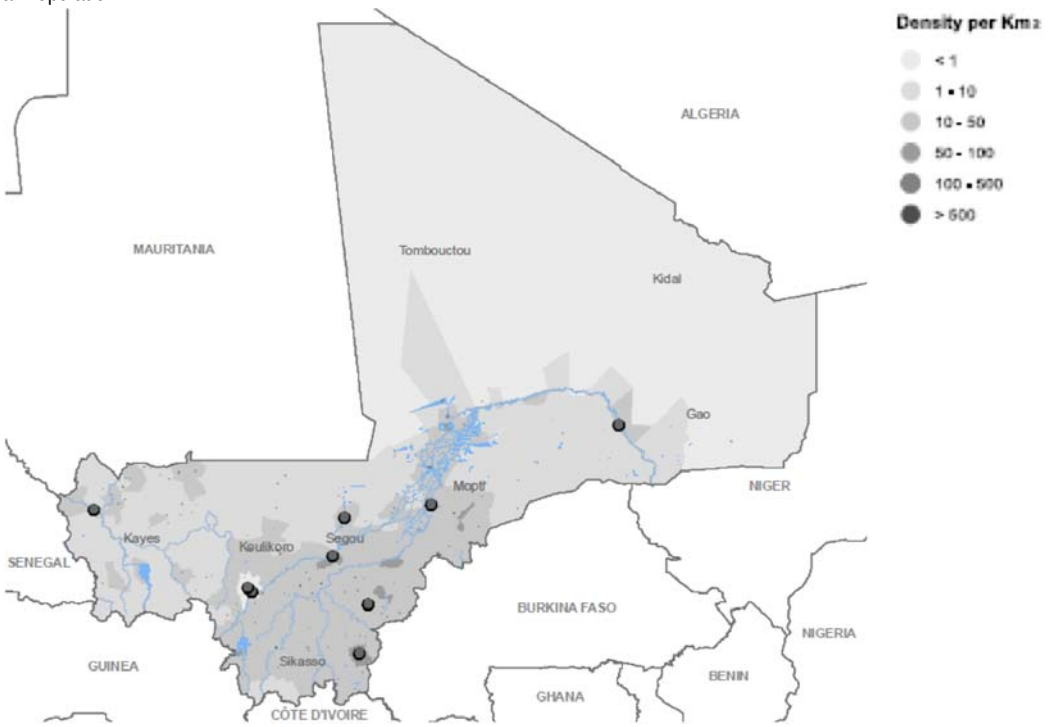
Mali depends heavily on regional corridors and regional infrastructure, particularly for transport and water resource development. Currently, three international trade corridors (Tema–Ouagadougou–Bamako, Dakar–Bamako, and Abidjan–Ferkesessedougou–Bamako) link Mali to the sea. Due to the security situation in Côte d'Ivoire, which traditionally provided Mali with access to the sea, transit patterns have shifted to other corridors and associated ports in the subregion. Mali is also part of the Transahelian road corridor (Nouakchott–Ndjamena), which is expected to gain relevance for intraregional trade in the ECOWAS region. The rail network of the region is essentially disconnected. Rail networks use three different gauges, which makes regional rail interconnection difficult and reinforces the importance of road corridors. However, there is already a proposal to connect Transrail (the Mali-Senegal rail company) with Sitarail (the Côte d'Ivoire-Burkina Faso company).

As regards regional power, Mali is a member of West Africa Power Pool (WAPP), although its transmission network is not yet interconnected with other countries (except Senegal). In the case of ICT, Mali has developed a fiber optic network that is connected to the SAT3 submarine cable at two different connection point in Senegal and Côte d'Ivoire. Mali also belongs to two river basins: the Senegal River basin and the Niger River basin. It therefore shares international riparian rights with Algeria, Benin, Burkina Faso, Cameroon, Chad, Côte d'Ivoire, Guinea, Mauritania, Nigeria, and Senegal. Unlocking the enormous irrigation potential of Mali is particularly susceptible to upstream investments in Guinea and in Senegal.

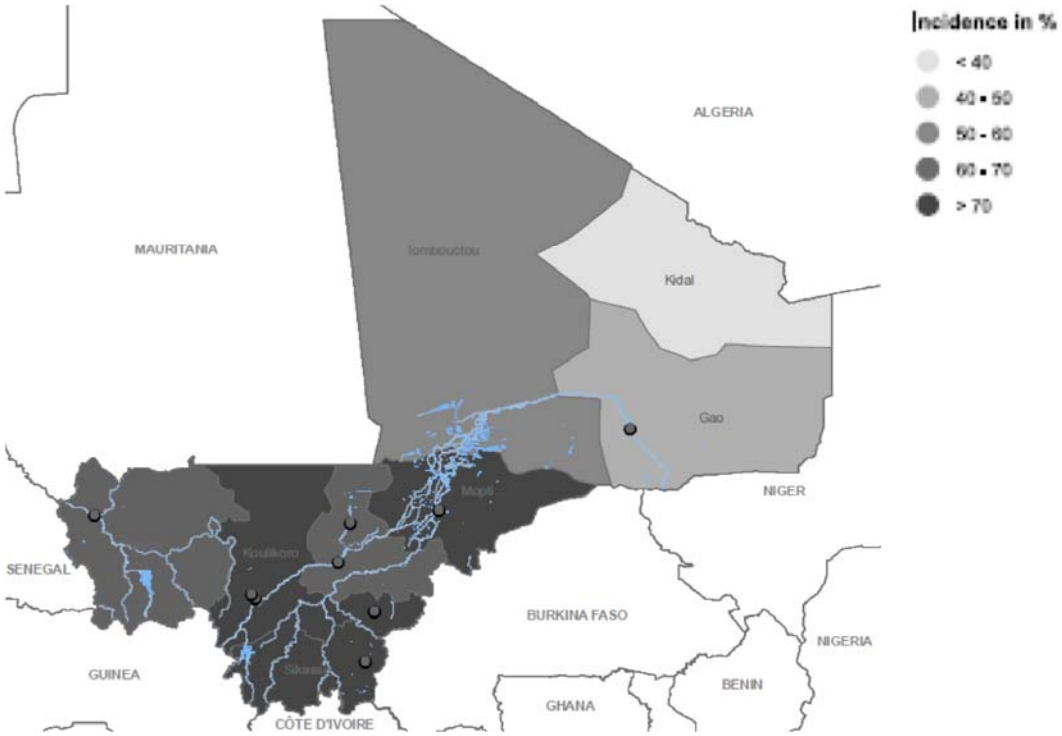
This report begins by reviewing the main achievements and challenges in each of Mali's major infrastructure sectors. The key findings are summarized below (table 1). Thereafter, attention will turn to the problem of how to finance Mali's outstanding infrastructure needs.

Figure 3. Mali's population, income, and mineral resources are concentrated in the southern half of the country

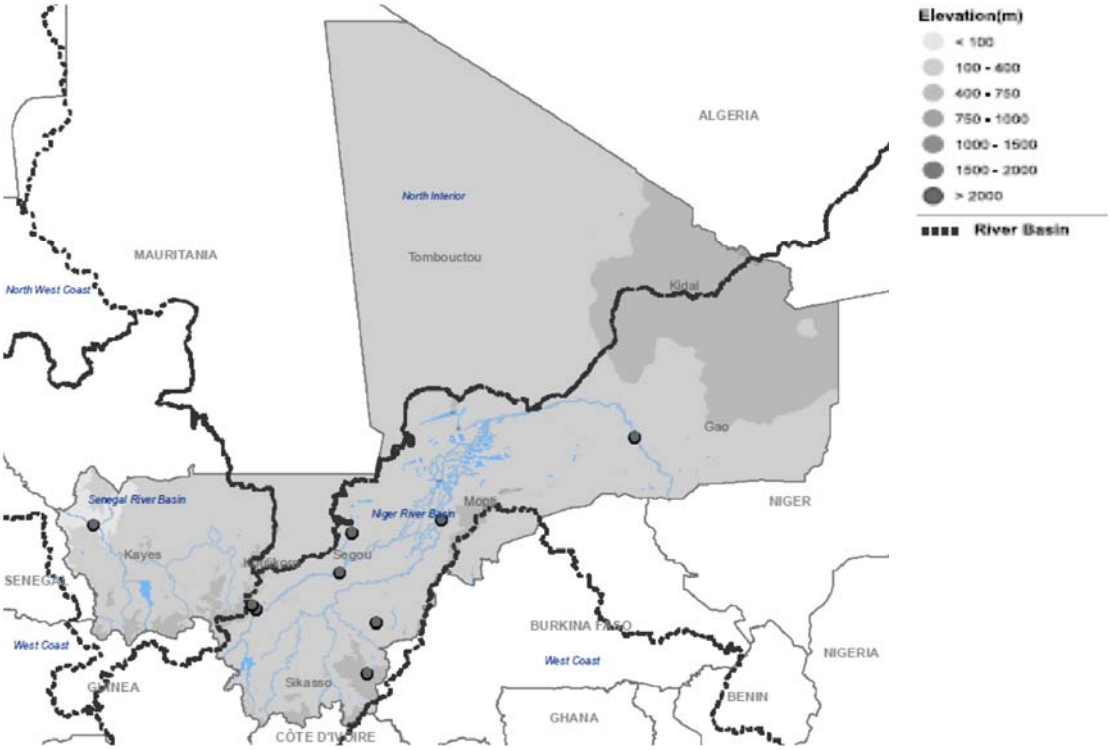
a. Population



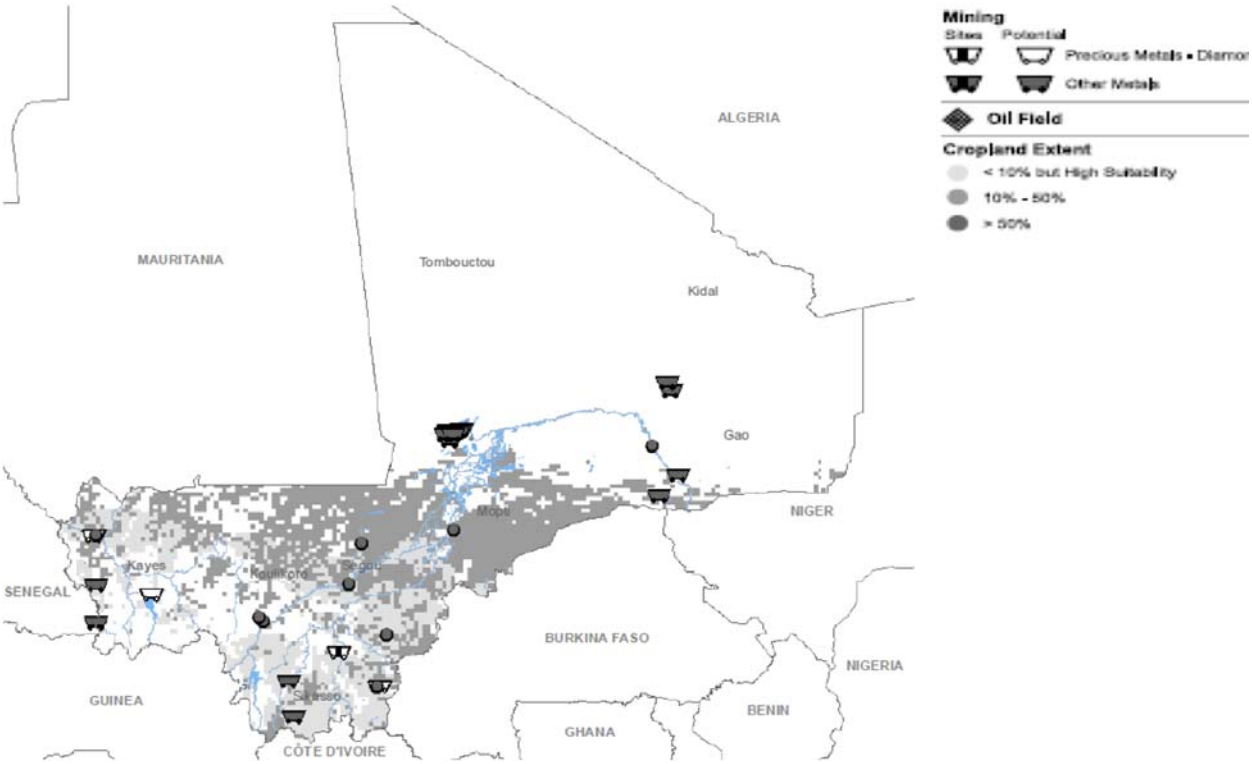

b. Poverty



c. Topography



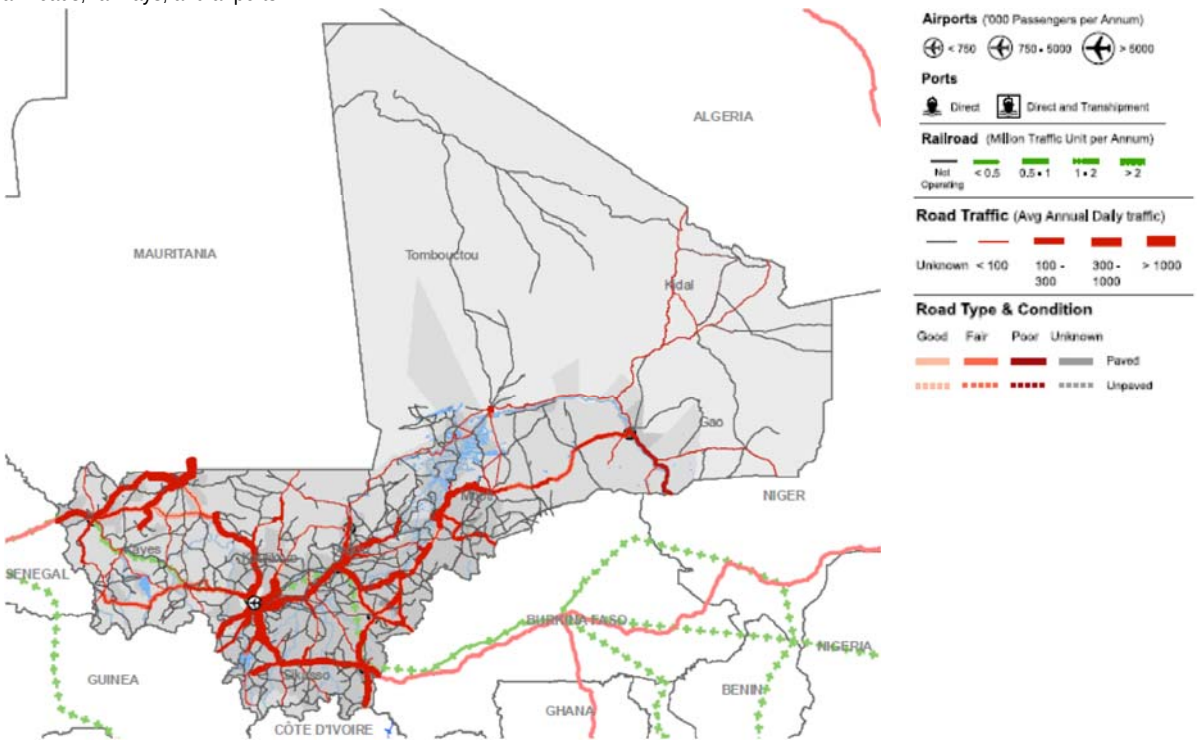

d. Natural resources



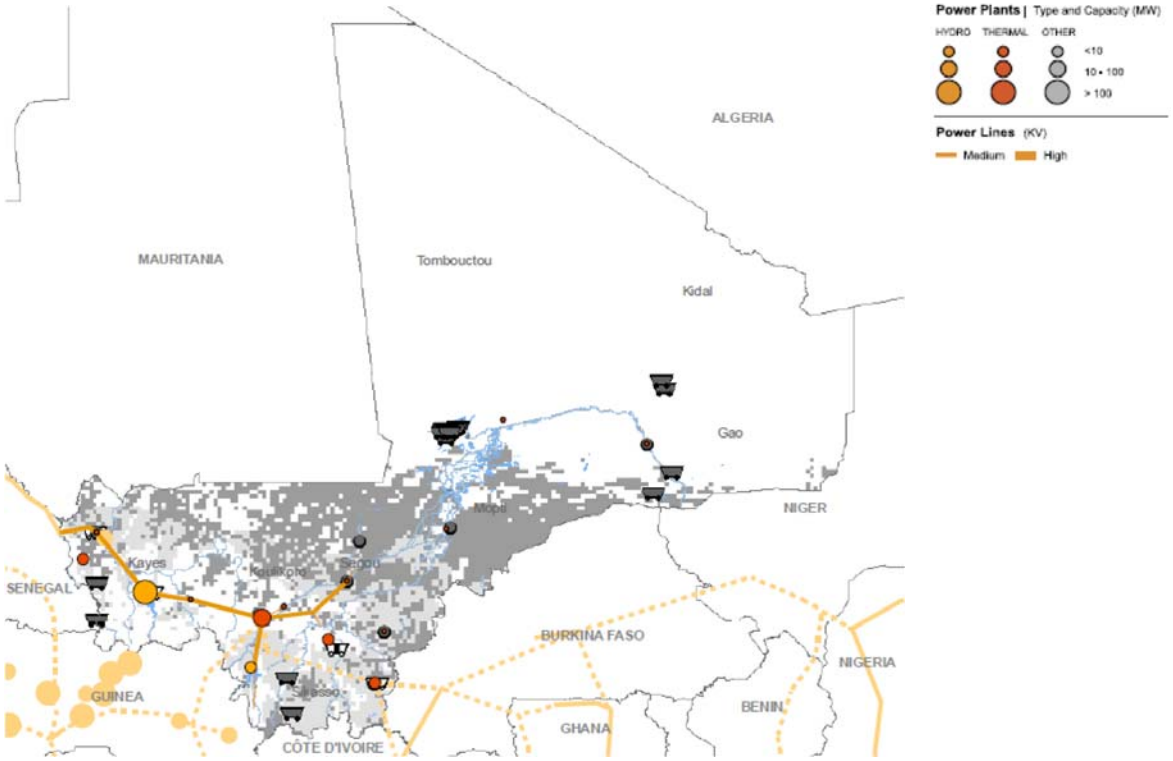

Source: AICD Interactive Infrastructure Atlas for Ghana downloadable from http://www.infrastructureafrica.org/aicd/system/files/gha_new_ALL.pdf

Figure 4. Mali's infrastructure networks reflect population density and natural resources

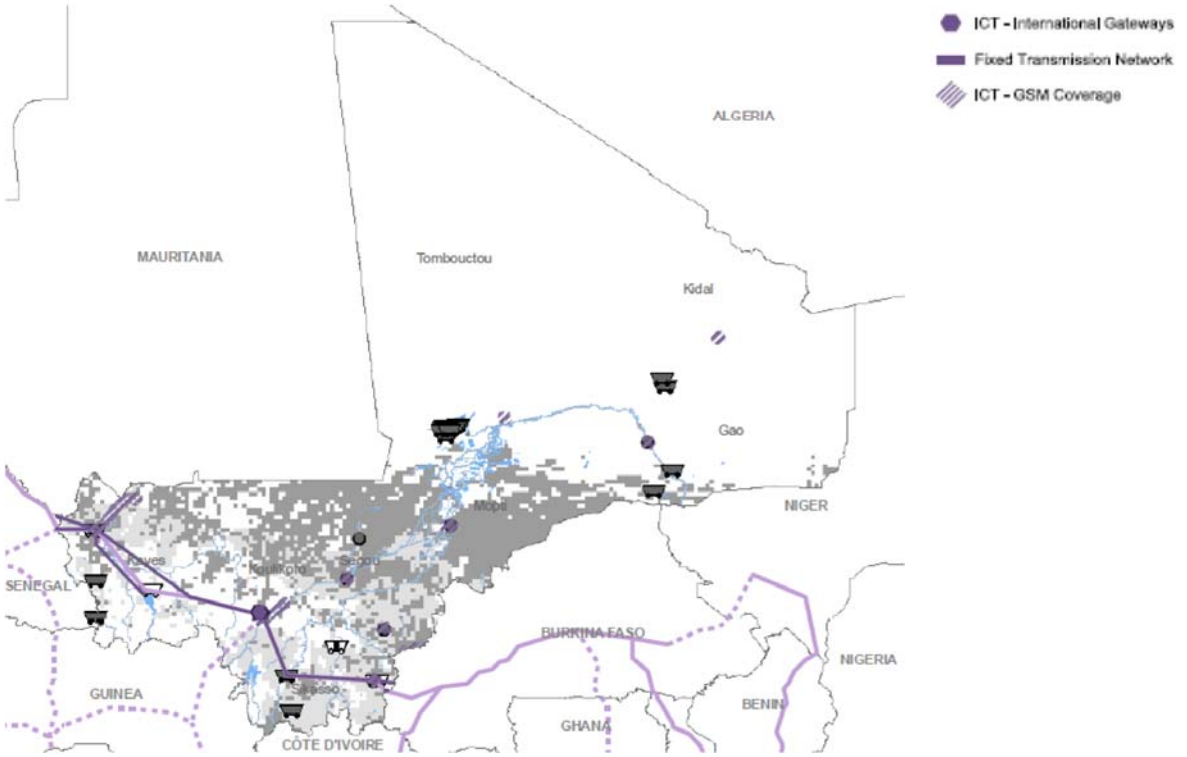
a. Roads, railways, and airports



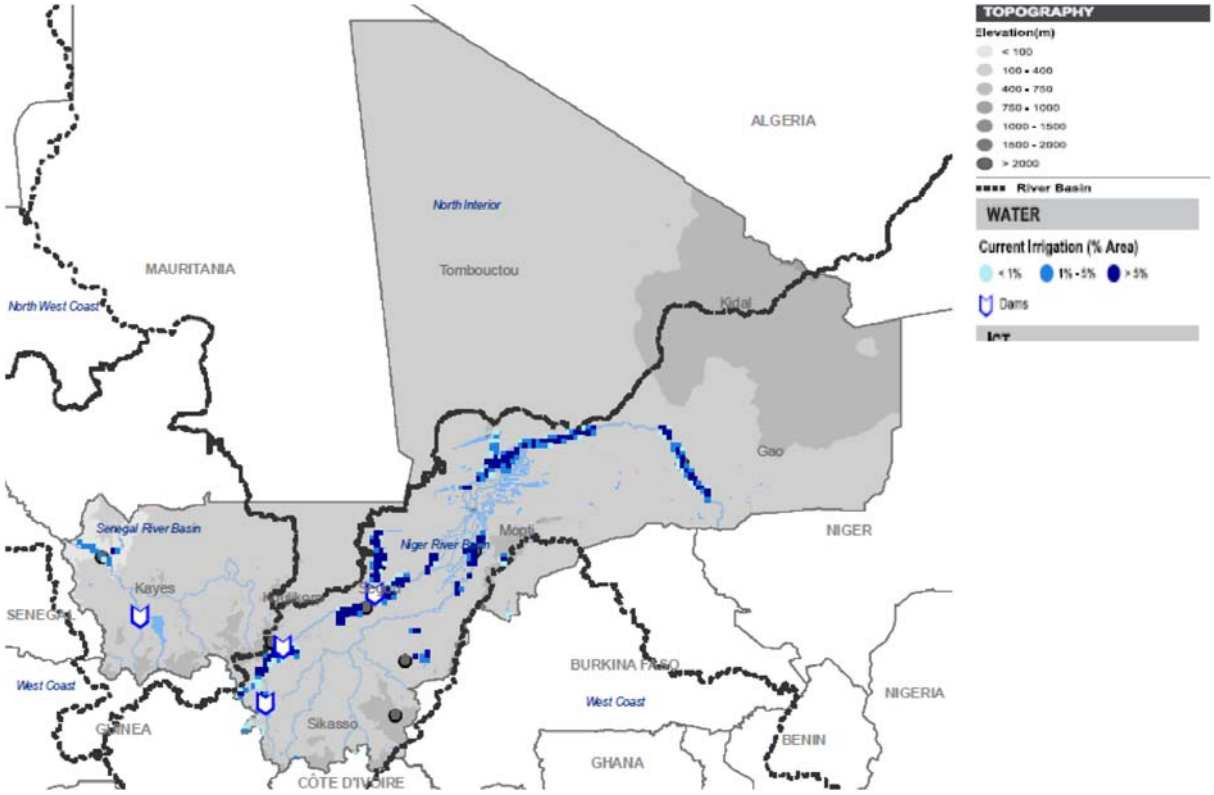

b. Power



c. ICT




d. Water resources




Source: AICD Interactive Infrastructure Atlas for Ghana downloadable from http://www.infrastructureafrica.org/aicd/system/files/gha_new_ALL.pdf

Table 1. Achievements and challenges in Mali's infrastructure sectors

| Sector | Achievements | Challenges |
|---|---|---|
| Air transport | Refurbishment of Bamako airport and adoption of important institutional commitments:<br>Creation of Civil Aviation Authority and regional project for adoption of international safety and security IATA/IOSA standards | Increasing connectivity.<br>Improving air safety and security |
| ICT | Impressive increase in mobile penetration<br>Remarkable integration with regional infrastructure to overcome Mali's landlocked condition | Moving from duopoly regime to full competition<br>Engaging the second phase of SOTELMA privatization<br>Ensuring wider and more affordable access to broadband services |
| Power | Impressive progress on electrification<br>Implementation of a rural electrification program | Addressing increasing power demand while containing power costs by changing generation mix and increasing cheaper imports<br>Reducing operational inefficiencies of EDM<br>Adjusting tariffs |
| Railways | Increased traffic density.<br>Intense usage of assets.<br>Improved safety, efficiency, and timeliness. | Undertaking needed investments to restore full capacity and reliability of rail system<br>Overcoming the problem of aging equipment<br>Restaffing the operator to overcome an aging labor force<br>Financially reforming the operator |
| Roads | Strategic focus on regional corridors has materialized in alternative routes to sea gates in the sub region.<br>Recently created Road Authority provides conditions for multiyear maintenance<br>National and regional connectivity is acceptable | Ensuring the success of the recently introduced performance-based maintenance contracts<br>Obtaining resources needed for maintenance from the government<br>Extending the road network using adequate engineering standards that take traffic patterns into account<br>Improving rural access, especially for agricultural production/surplus areas. |
| Water and sanitation | Moderate increase in population having access to improved sources of water and sanitation | Defining a clear institutional framework to match EDM restructuring<br>Reducing the urban-rural access gap to improved water and sanitation sources<br>Improving the efficiency of EDM<br>Achieving a sustainable level of cost recovery of water delivery by reducing production costs and adjusting tariffs. |

Source: Findings of this report.

## Roads

### Achievements

Mali's road transport indicators are strongly driven by its geography and demography. They should be interpreted with care. Mali's road density is among the lowest on the continent. This is partially explained by geography: half of the territory is arid or desert and therefore is not easily accessible by road. Even in parts of the country that are not arid or desert, however, road density lags behind the continent's averages. Rural accessibility is also poor when compared with peer countries with similar income levels (table 2).

Table 2. Mali's road indicators benchmarked against Africa's low- and middle-income countries

| | Unit | Low-income countries | Mali | Middle-income countries |
|---|---|---|---|---|
| Classified road density | km/1000 km$^2$ of arable land | 132.1 | **38.3** | 318.4 |
| Classified road density | km/1000 km$^2$ of land | 88.2 | **27.9** | 278.4 |
| Rural accessibility Index-HH Survey | % of rural population within 2km of all-season road | 34.1 | **14.0** | 62.7 |
| GIS rural accessibility | % of rural population within 2km of all-season road | 23.1 | **16.7** | 31.5 |
| Paved road traffic | Average annual daily traffic | 1341.1 | **547.5** | 3797.7 |
| Unpaved road traffic | Average annual daily traffic | 38.5 | **21.5** | 74.7 |
| Paved network condition | % in good or fair condition | 86.2 | 64.8 | 82.0 |
| Unpaved network condition | % in good or fair condition | 55.8 | — | 57.6 |
| Perceived transport quality | % firms identifying roads as major business constraint | 27.6 | **20.1** | 18.2 |
| Overengineering | % of main road network paved relatively to low traffic | 29.6 | 47.7 | 18.4 |

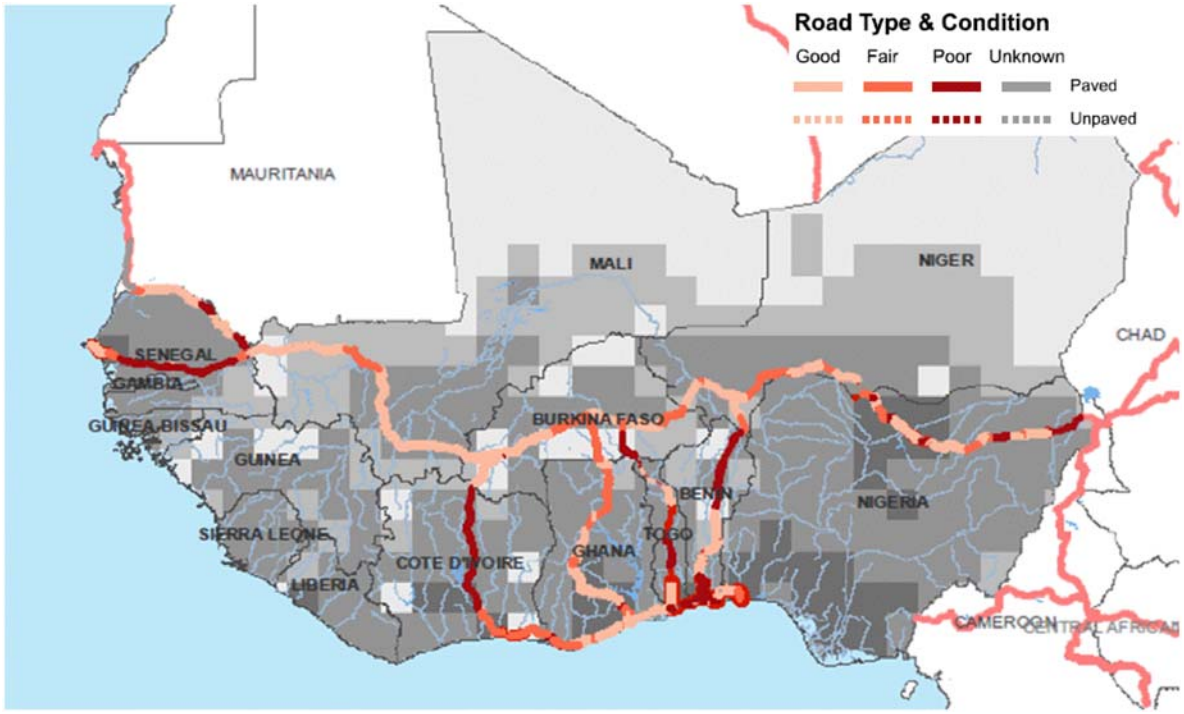
Source: Gwillliam and others 2009.

Derived from AICD national database downloadable from http://www.infrastructureafrica.org/aicd/tools/data

Mali's main (primary and secondary) road network is adequate to achieve regional and national connectivity.[1] The share of business identifying road transportation as a constraint for doing business is 20 percent, which is much lower than in other low-income countries in Africa and comparable to middle-income countries. Strategically, Mali has primarily focused on maintaining and rehabilitating its portions of the regional road corridors. This has allowed the country to ensure that its major urban areas and areas of production are connected by road to the major deep water ports of Dakar, Abidjan, Takoradi, Tema, and Lomé (figure 5).

[1] Regional connectivity refers to the road networks needed to connect the national capitals and cities with populations of 50,000 or more to the major ports. National connectivity refers to the road networks needed to connect provincial capitals and cities with populations of 25,000. This includes the network identified by the Trans African Highways.

Figure 5. Mali: at the center of regional corridors




Source: World Bank 2010.

Like its neighbors, Mali has made the investments necessary to pave almost 100 percent of the regional road network falling within its national boundaries. Furthermore, in contrast to some of its coastal neighbors, Mali has a good track record in maintaining its portion of the regional corridors. About 90 percent of it is in good or fair condition (table 3). Despite continued constraints in adequately funding the development and maintenance of the overall road network, Mali has clearly prioritized maintainance of key regional routes.

Table 3. Condition of ECOWAS regional road network in member countries

Percent of the network

| | Condition | | | | Type | | |
|---|---|---|---|---|---|---|---|
| | Good | Fair | Poor | Unknown | Paved | Unpaved | Unknown |
| Burkina Faso | 58.2 | 33.6 | 8.2 | 0 | 100.0 | 0.0 | 0.0 |
| Côte d'Ivoire | 16.1 | 47.1 | 35.4 | 1 | 90.3 | 9.7 | 0.0 |
| Ghana | 70.3 | 23.6 | 6.1 | 0 | 100.0 | 0.0 | 0.0 |
| Mali | 66.6 | 21.7 | 0.0 | 11.7 | 99.6 | 0.4 | 0.0 |
| Senegal | 39.8 | 15.1 | 45.1 | 0.0 | 99.8 | 0.2 | 0.0 |
| ECOWAS | 45.1 | 28.4 | 22.5 | 4.0 | 92.5 | 7.4 | 0.1 |

Source: AICD various sources

Landlocked, Mali has sought to diversify access to the sea and regional markets. Although these alternative routes increase transport costs since they reach more distant ports, they are important sources of insurance against unexpected events and conditions in neighboring countries. For example, the crisis in

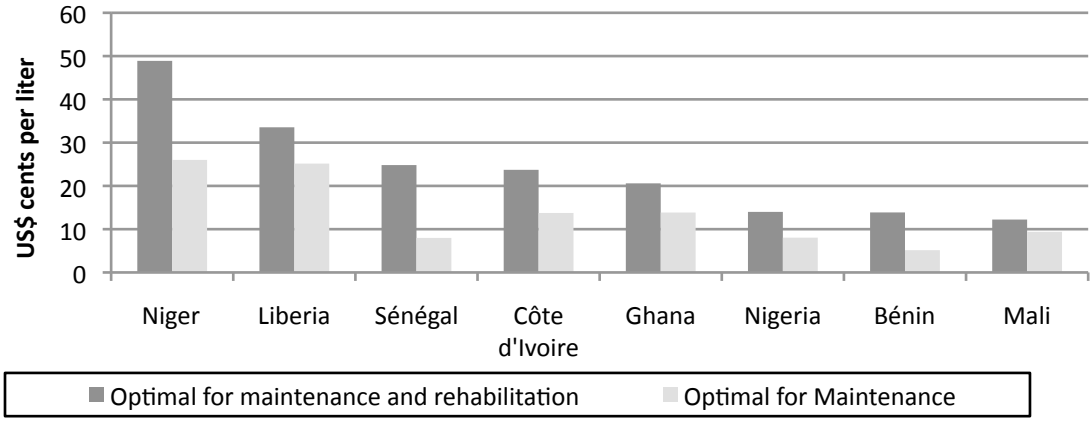
Côte d'Ivoire has forced Mali to shift trade traffic to other regional ports of the region and to develop alternative corridors. Until 2000, Abidjan captured about 80 percent of all transit traffic to and from Mali. By 2003, that figure had dropped to only 14 percent, as traffic was diverted to Dakar in Senegal, Lomé in Togo, and Tema in Ghana. Dakar became the most important port for Mali, capturing one-third of traffic. The shift from the traditional Abidjan corridor to other corridors has cost Mali an estimated $12 million per year. Mali's transport costs are now the highest in the region. Furthermore, at 30 percent of import values, Mali's transport costs surpass those of all other comparator countries or country groups, including its landlocked neighbors Niger (14.5 percent) and Burkina Faso (21.5 percent) and the landlocked country group (18 percent) (World Bank 2006).

Underpinning road performance in Mali is the reform of road sector institutions, in which included the creation of a second-generation road fund in 2000 followed by the inception of a Road Maintenance Executing Agency (AGEROUTE). With these institutional reforms, Mali is setting the grounds for the enforcement and proper implementation of towards multiyear, performance-based maintenance contracts.

## Challenges

Road maintenance in Mali remains inadequately funded. Furthermore, adjustments to the fuel levy have not kept pace with changes in inflation, maintenance requirements, and axel loads (figure 6). The government has been systematically covering the funding gap with transfers from the treasury. In 2009, the government sharply increased the per liter fuel levy from $0.6 cents (3 CFA) to $5.5 cents (25 CFA). This increase has yet to result in an increase in maintenance spending. Even if the fuel levy were fully collected, a shortfall of between 42 percent (if only maintenance is considered) and 56 percent (if rehabilitation needs are also considered) would remain. To bridge the maintenance funding gap through the road fund, the fuel levy would need to almost double to $10 cents per liter, which would still be within the average range for Africa (figure 6).

Figure 6. Mali's fuel levy is low relative to neighboring countries




Source: Gwillliam and others 2009.

Mobilizing adequate financial resources from the government to maintain the existing road network is an important challenge for Mali in the road sector. Based on the experience of other countries in Africa,

however, establishing the necessary institutional framework and institutions such as a Road Fund, Road Maintenance Executing Agency, and Road Agency usually increases the likelihood of better mobilizing and protecting maintenance funding and therefore delivering better maintenance. Countries that have adopted a road fund and a road agency in Africa have the best track record of roads in good and fair condition—82 percent—in contrast to those countries that have created only a road fund (70 percent) or a road agency (62 percent ) (table 4).

Table 4. Mali is on track to secure road maintenance resources

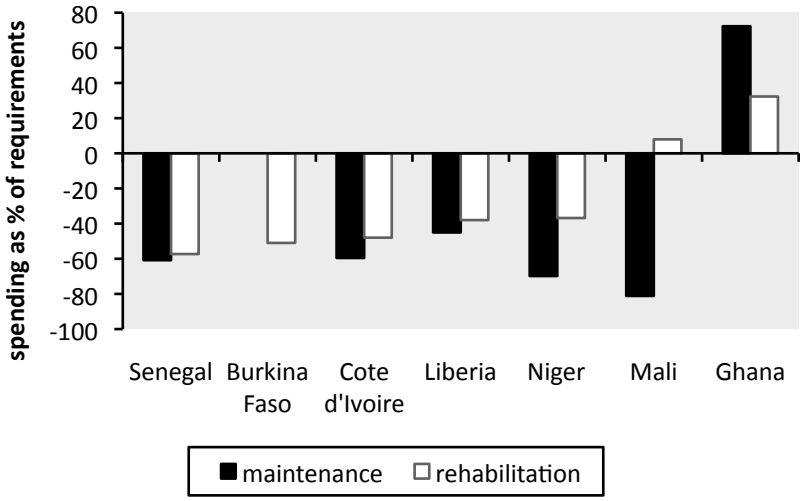
Percentage of main road network in good or fair condition by country groupings

| Country category | | Institutions | | Geography | | Financing | |
|---|---|---|---|---|---|---|---|
| Middle-income | 81 | Road fund and agency | 82 | Flat and arid | 77 | High fuel levy | 79 |
| Low-income, aid | 75 | Road fund only | 70 | Rolling and humid | 70 | Low fuel levy | 70 |
| Low-income, oil producer | 70 | Road agency only | 62 | | | No fuel levy | 75 |

Source: Gwillliam and others 2009.

Despite its inability to maintain the existing network, Mali continues to expand the road network. There is that pressure to connect the north to the rest of the country for national unity and security reasons with standards that sometimes defy economic justification, for instance paved roads in tranches that don't carry enough traffic to justify it, and provide connectivity thought corridors that might not be the ones providing market access to the most productive areas. This leads to an over spend on capital investments in general at the expense of maintenance, and within capital spending, a bias to allocate resources for expansions rather than rehabilitations. Network expansion has clearly come at the expense of maintaining the existing network (figure 7).

Figure 7. Mali is underspending on maintenance and overspending on expansion




Source: Gwillliam and others 2009.

Traffic over most of the paved road network in Mali averages 550 vehicles per day, which is well below the average of 1,000 vehicles per day in Africa's low-income countries. Close to 50 percent of the

main road network in Mali appears to be overengineered, which means that roads are paved although traffic levels are below 300 vehicles per day—the threshold level of traffic to justify paving.

At the same time, spatial analysis of the network suggests the physical extension of the rural network is inadequate. According to GIS analysis**,** only 17 percent of Mali's rural population lives within two kilometers of an all-season road. This is below the 22 percent average for Africa's low-income countries and the 60 percent average for Africa's middle-income countries (table 2). These figures should be interpreted with care. Due to the challenge imposed by geography and demography, grating reasonable road access to 100 percent of the rural population is neither affordable nor economically logical. Expanding the road network so that 50 percent of the rural population live within two kilometers of an all-season road could require 40,298 kilometers of roads. By comparison, providing good road accessibility to the land that currently produces 80 percent of the Malian agricultural production value would require a rural road network of only 16,497 kilometers.

## Rail

### Achievements

Mali's binational railway line—jointly owned with Senegal—has the potential to be a key conduit for international trade. The line between Dakar and Bamako is part of one of the main transport corridors in West Africa but currently captures only 12 percent of Mali's international trade traffic.

Efforts have been made to improve Mali's rail system and to bring fresh capital to an investment-starved system. In October 2003, through a competitive international process, a 25-year concession was granted to the privately owned company Transrail SA. Prior to the concessioning, the 1,228 km Dakar–Bamako railway was operated by two parastatal companies: the Société Nationale des Chemins de Fer du Senegal (SNCS) operated the Senegalese part (644 km), and the Régie Nationale du Chemin de Fer du Mali (RCFM) operated the Malian part (584 km) (World Bank 2007b).

Transrail's productivity is on par with or better than some concessioned railways on the continent. However, it has still room for improvement as its performance is still significantly worse than other African railway concessions, such as Sitarail and Camrail (table 4). Transrail's freight tariffs average $7 cents/ton-km, which is regionally competitive. Transrail has improved both the operational and financial performance of the railway, although it is not yet financially sustainable. Since its concessioning in 2003, Transrail's annual turnover has increased 27 percent from $29.7 million to $37.8 million in 2009. Despite this improvement, however, the company accumulated net losses of $25 million between 2003 and 2009, leaving it without any margin for major investments in rolling stock or infrastructure rehabilitation.

### Challenges

Transrail has four main challenges going forward: (i) increase production beyond the breakeven point (or about 600 millions ton-km/year), which will require securing more than $200 million in new investment for track and rolling stock, (ii) reduce its existing and aging workforce while training hundreds of new employees to counteract the depletion of the personnel skills, (iii) secure a more balance intermodal competition (road/rail) environment from its host countries**,** and (iv) fund its short- and

medium-term cash deficit through an increase in its working capital by restructuring its concession agreement and current shareholder structure.

Between 2005 and 2009, Transrail's traffic volume was only half that of Sitarail, the other West African railway concession with a very similar type of a binational network (table 5). This is despite the fact that Transrail had access to greater hinterland demand. The main reasons for Transrail's underperformance was a lack of financing, dilapidation of tracks, and outdated rolling stock. The relatively high rate of derailments (0.45 derailments per million TU) and the low locomotive reliability (15 mainline locomotive breakdowns per 100,000 km) are indicators of these problems. These numbers should not come as a surprise, however, as Transrail's assets are aging. Some portions of the track are over 70 years old, and the average locomotive age is 30 years. The segment between Tambacounda and Dioubeba in Senegal close to the border with Mali (approximately 464 km) is in poor condition, which hampers access to the port of Dakar.

Table 5. Railway indicators for Mali and selected other countries, 2005–09

| | TRANSRAIL (Senegal - Mali) | SITARAIL (Côte d'Ivoire – Burkina Faso) | Camrail (Cameroon) | Madarail (Madagascar) |
|---|---|---|---|---|
| Concessioned (1)/ state-run (0) | 1 | 1 | 1 | 1 |
| Freight traffic volume (million ton-km) | 393 | 794 | 1,061 | 113 |
| Passenger traffic volume (million passenger-km) | 91 | 210 | 377 | 3 |
| Total traffic volume (million TU)* | 429 | 878 | 1,212 | 114 |
| EFFICIENCY: | | | | |
| Staff: thousand TU per staff | 247 | 558 | 547 | 118 |
| Derailments per million TU | 0.45 | 0.01 | 0.15 | 2.31 |
| Mainline locomotive breakdowns per 100,000km | 15 | 6 | 9 | 6 |
| TARIFFS: | | | | |
| Average unit tariff, freight, US cents/ton-km | 7.0 | 6.3 | 8.1 | 6.0 |

Source: Bullock 2009.
Derived from AICD rail operator database downloadable from http://www.infrastructureafrica.org/aicd/tools/data
— = data not available.
Note: * With 2.5 passenger-km equivalent to 1 TU, 1 ton-km equivalent to 1 TU

Transrail's short-term prospects are grim unless tracks and rolling stock are rehabilitated and its concession contract is restructured. Trasnrail recently proposed an emergency investment plan that is deemed to be insufficient given Transrail's operational needs. Transrail faces critical cash flow and insolvency issues. The company is almost bankrupt with significant public service obligations and build up in arrears. The precarious operational situation leads to unpredictability of performance.

Mali's railways, if successfully rehabilitated, could offer the best long haul transport to and from Dakar. The Dakar–Bamako railway, which was the primary mode of transport during colonial times, should be revitalized to provide a more economical mode of transport than roads. The concession for the management by a private operating company has shown that the downfall due to mismanagement and years of neglect can be partially offset, but it is not substitute of a needed investment in rehabilitation.

## Air transport

### Achievements

Mali's air transport market is small, with a capacity of 6 seats per 100 inhabitants, which is low compared to West African neighbors (table 6). Local demand is minimal, even by regional standards, and limited by the availability of functional airports (7 airports). Furthermore, fares are out of reach for most of the population.

More than 90 percent of all passengers are regionally or internationally bound. The market is highly concentrated in two places: the long haul destination to Europe (Paris), which had 110,000 passengers and 4000 tons of freight in 2004; and the Bamako airport, which had approximately 200,000 passengers and 5,700 tons of freight in 2009. The country's other airports have less than 30,000 passengers per year combined, and only Kayes exceeds 10,000 passengers.

Table 6. Benchmarking air transport indicators for Mali and selected other countries

| Country | Mali | Côte d'Ivoire | Ghana | Senegal | Burkina Faso | Nigeria |
|---|---|---|---|---|---|---|
| *Traffic (2007)* | | | | | | |
| Domestic seats (seats per year) | — | — | 144,183 | 130,000 | 20,245 | 1,199,572 |
| Seats for international travel within Africa (seats per year) | 564,455 | 851,003 | 909,819 | 1,260,000 | 244.721 | 1,373,745 |
| Seats for intercontinental travel (seats per year) | 165,776 | 297,891 | 832,895 | 1,230,000 | 147,095 | 2,437,702 |
| Seats available per capita | 0.06 | 0.06 | 0.08 | 0.23 | 0.03 | 0.09 |
| Herfindahl index – air transport market (%) | 11.75 | 9.75 | 6.28 | 11.64 | 22.89 | 11.28 |
| *Quality* | | | | | | |
| Percent of seat-km in newer aircraft | 95.6 | 90.9 | 96.8 | | 93.4 | 71.42 |
| Percent of seat-km in medium or smaller aircraft | 54 | 52.3 | 15.7 | 39.3 | | 29.6 |
| Percent of carriers passing IATA/IOSA audit | 0 | 0 | 0 | 50.0 | 0 | 28.6 |
| FAA/IASA audit status | No audit | Fail | Fail | No audit | No audit | No audit |

Source: Bofinger 2009.

Derived from AICD national database downloadable from http://www.infrastructureafrica.org/aicd/tools/data

Note: All data as of 2007 based on estimations and computations of scheduled advertised seats, as published by the Seabury Aviation Data Group. This captures 98 percent of worldwide traffic, but a higher percentage of African traffic is not captured by the data. The Herfindahl-Hirschmann Index is a commonly accepted measure of market concentration. It is calculated by squaring the market share of each firm competing in the market and then summing the resulting numbers. A HHI of 100 indicates the market is a monopoly. The lower the HHI, the more competitive the market is.

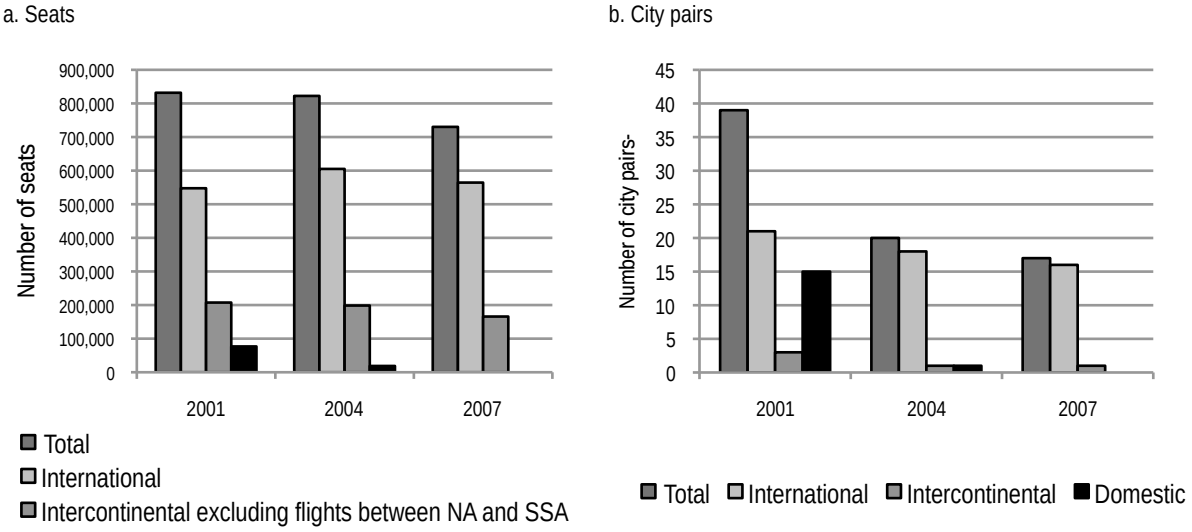
Recent investments on several local airports—including refurbishment of Bamako Airport—total over 30 billion FCFA (US$60 million). This investment has been complemented by institutional reforms intended to improve airport security. Mali's Civil Aviation Authority was recently restructured to have more autonomy to deliver licenses and enforce rules and regulations in compliance with the ICAO's guidelines on safety and security. Many of these reforms have been implemented as part of regional projects and alliances to guarantee harmonization of air transportation rules across West Africa.

Across the region, there has been a tendency for aircraft fleets to be renewed and scaled down in size to facilitate consolidation of routes towards a hub and spoke system. The aircraft fleet serving Mali has renewed rapidly in recent years, with the share of the fleet comprising aircraft of recent manufacture rising from 87 percent in 2001 to 96 percent in 2007, putting Mali ahead of many of its neighbors. Moreover, the share of medium or smaller aircraft serving Mali increased from 27 percent in 2001 to about 54 percent in 2007, in support of the emerging hub and spoke system.

### Challenges

Mali has a declining air market and has been progressively losing international connectivity (figure 8). This is partially a result of the collapse of Air Afrique (2004) and Air Senegal (2009), which left the regional market very fragmented. Moreover, between 2004 and 2008, the number of flights per week in Mali fell from 77 to 41. This represents a contraction of the market of 47 percent, the worst market contraction in West Africa during the period if Mauritania is excluded. Nevertheless the airline market is fairly competitive (Herfindhal of 12 percent) perhaps as a direct consequence of the implementation of the Yamoussoukro Decision of opening Africa airs and reflecting the high traffic and competition developed along the route Bamako–Dakar, operated by more than six carriers. This is an important achievement as until 2007, three airlines—Air France, Royal Air Maroc, and Air Senegal—controlled more than half of the market.

Figure 8. Mali's air transport market is thin and declining




Source: Bofinger 2009.
Derived from AICD national database downloadable from http://www.infrastructureafrica.org/aicd/tools/data
Note: As reported to international reservation systems

Like many other African countries, Mali continues to face significant safety and security issues in air transport. Mali failed the FAA/IASA Audit, and none of its carriers have passed the IATA/IOSA audit.

## Water supply and sanitation

### Achievements

The share of the population in Mali that continues to practice open defecation or use surface water is among the lowest in the continent. In 2006, about 4 percent of the population relied on surface water, which is eight times lower than the average for low-income countries in Sub-Saharan Africa. Similarly, around 20 percent of the population practices open defecation, which is roughly half the level in other low-income countries (table 7).

Table 7. Benchmarking water and sanitation indicators

| | Unit | Low-income countries, mid-2000s | Mali | | Middle-income countries, mid-2000s |
|---|---|---|---|---|---|
| | | | Early 2000s | Late 2000s | |
| Access to piped water | % pop | 10.5 | 8.9 | 10.8 | 52.1 |
| Access to standposts | % pop | 16.2 | 20.2 | 15.5 | 18.9 |
| Access to wells/boreholes | % pop | 38.3 | 65.1 | 69.5 | 6.0 |
| of which, protected wells/boreholes | % pop | | 14.2 | 29.8 | |
| of which, unprotected wells/boreholes | % pop | | 50.9 | 39.7 | |
| Access to surface water | % pop | 37.4 | 5.8 | 4.2 | 13.0 |
| Access to septic tanks | % pop | 4.9 | 6.0 | 2.4 | 40.8 |
| Access to improved latrines | % pop | 9.9 | 40.8 | 47.6 | 1.4 |
| Access to traditional latrines | % pop | 50.1 | 30.8 | 28.6 | 30.4 |
| Open defecation | % pop | 40.3 | 22.2 | 21.3 | 14.3 |
| Domestic water consumption | liter/capita/day | 72.4 | 39 | 44 | 165.9 |
| Revenue collection | % sales | 92.7 | 96.0 | 96.0 | 100.0 |
| Distribution losses | % production | 34.3 | 37.0 | 25.5 | 26.8 |
| Cost recovery | % total costs | 56.0 | — | 70 | 80.6 |
| Operating cost recovery | % operating costs | 65 | — | 98 | 145 |
| Labor costs | connections per employee | 158.6 | 170.4 | 210.8 | 368.7 |
| Total hidden costs as % of revenue | % | 162.7 | 184 | 124 | 140.4 |

| | Mali | Countries with scarce water resources |
|---|---|---|
| Residential tariff (US cents per $m^3$) | 25.2 | 60.26 |

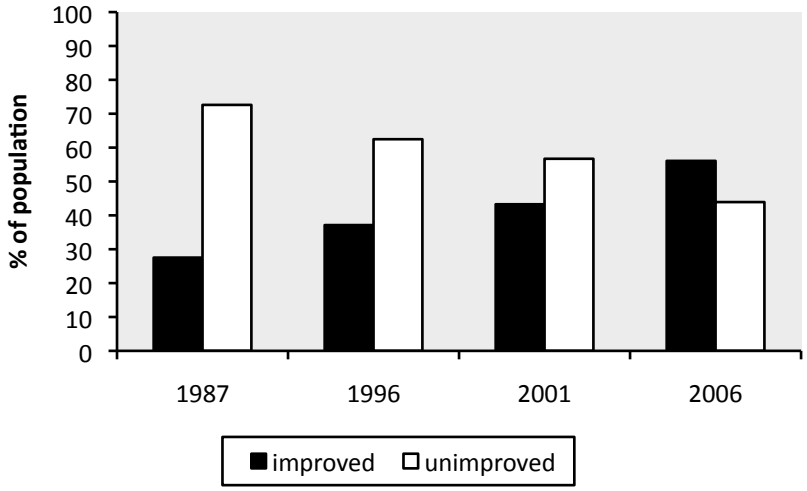
Source: Demographic and Health Survey and AICD water and sanitation utilities database downloadable from http://www.infrastructureafrica.org/aicd/tools/data. DHS figures are as of 2006. Utility numbers are as of 2001 and 2007.
Note: Tariff data as of mid 2000s

In less than two decades, Mali has managed to provide access to improved water and sanitation to more than half of its population, or in the worst case (figure 10). The share of the population with access to improved water doubled from less than 30 percent in 1987 to 60 percent in 2007 (figure 9a). Over the same period, access to improved sanitation rose from a 40 percent share to over 50 percent. The migration of people from no services to improved services has been achieved by providing shared low-cost alternatives. For instance, 40 percent of the 60 percent of the population with improved water access, has

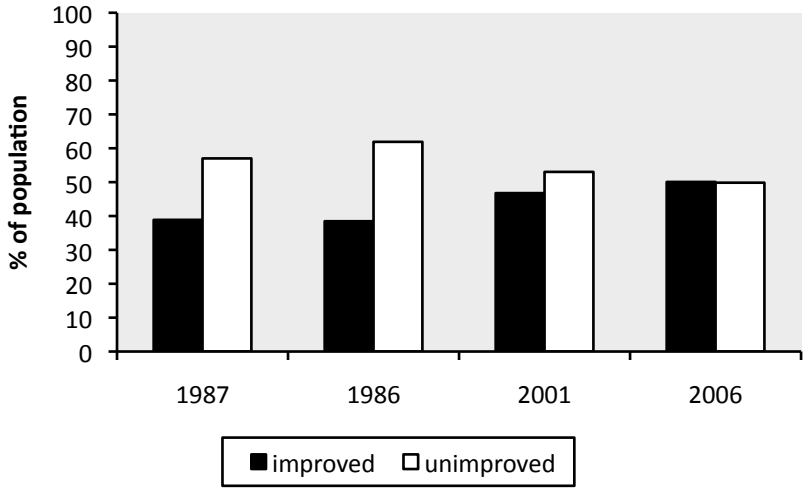
it via protected wells and boreholes to access water. For sanitation, the statistics close to half of the population relies on improved latrines.

Figure 9. Half of Mali's population has access to improved water and sanitation

a. Water




b. Sanitation




Source: WHO – Joint Monitoring Program 2010, from Demographic and Health Surveys for 1987,1996, 2001 and 2006

Mali's achievements in water and sanitation are even more remarkable given the country's demography and geography. Mali's population has been growing at an annual rate of 2.5 percent, and people continue to move to the most urbanized areas of the country, creating enormous pressure on existing infrastructure. In the late 1990s, Mali's expansion strategy focused on water provision through standposts. During the 2000s, however, the emphasis has been on increasing the use of wells, boreholes, and, to some extent, piped water for improved water provision (table 8a). An average of 0.8 percent of the population gained access to piped water annually between 1996 and 2001, and 0.6 percent gained access between 2001 and 2006. Use of standposts increased by 2 percent of population per year between 1996

and 2001 but fell by 0.5 percent of population per year between 2001 and 2006, during which the use of wells and boreholes increased by 2.4 percent of population per year.

Table 8. Expansion of safest water and sanitation technologies

a. Water

| | Population gaining access (per year, %) | |
|---|---|---|
| | 1996–2001 | 2001–2006 |
| Piped water | 0.79 | 0.55 |
| Standposts | 2.05 | –0.51 |
| Wells/boreholes | –1.20 | 2.34 |
| Surface water | 0.24 | –0.05 |

b. Sanitation

| | Population gaining access (per year, %) | |
|---|---|---|
| | 1996–2001 | 2001–2006 |
| Flush toilets | 1.04 | –0.57 |
| Improved latrines | 1.36 | 2.28 |
| Traditional latrines | 0.50 | 0.25 |
| Open defecation | –1.18 | 0.32 |

Source: WHO–Joint Monitoring Programme 2010, from Demographic and Health Surveys for 1987,1996, 2001 and 2006

Between late 1900s and early 2000s, the patterns from providing access to sanitation modalities have shifted from flush toilets to improved latrines. Population gaining access to flush toilets increased by 1 percent per year between 1996–2001 while during 2001–06 fell by –0.6 percent. During the same periods, the percentage of the population gaining access to improved latrines each year increased by 60 percent from 1.4 to 2.2 percent (table 8b). Although population using open defecation decreased at a 1.2 percent per year during 1996–01, for 2001–06 every year 0.3 percent of the population regained use of open defecation.

Urban water is provided by EDM (Energie du Mali) a multiservice utility that provides access to both water and to electricity. EDM has been instrumental in Mali's achievements in provision of improved water and sanitation services in urban areas, managing to keep up with population growth and urbanization rates. The share of the population that EDM serves through private residential connections in EDM service areas went from 18.6 percent in 2000 to 29.0 percent in 2007. Over that same period, the number of household connections rose from 54,688 to 103,286—an increase of about 90 percent. Similarly, the number of community standpipes almost doubled from around 1,000 in 2001 to 2,400 in 2005, corresponding to an increase in access via standpost from 20 percent to 34 percent.

EDM's improvements in providing access can be traced to its 2000 award of a concession to a private consortium composed of SAUR International, a member of the French group Bouygues (table 9). The concession was later cancelled owing to financial strain but left a track record of improved standard operational efficiency indicators: nonrevenue water fell from 36 percent in the early 2000s to 26 percent in 2008; connections per employee rose from 189 in 2005 to 210 in 2007; and revenue per cubic meter of water consumed increased from $0.57 in 2000 to $0.66 in 2007.

Table 9. Evolution of operational indicators associated with EDM (water)

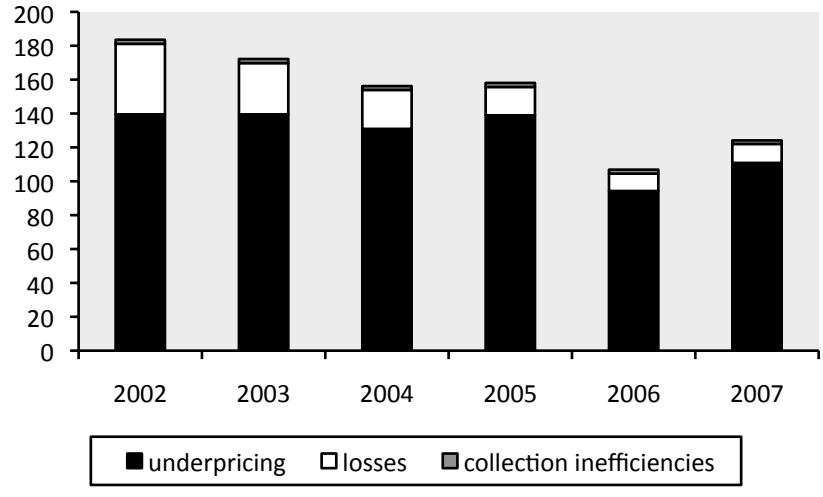
| Year | Water delivered (millions $m^3$/year) | System losses (%) | Collection ratio (%) | Average cost (US$/$m^3$) | Average effective tariff (US$/$m^3$) | Total hidden costs (US$ millions/year) | Total hidden costs (% revenues ) |
|---|---|---|---|---|---|---|---|
| 2002 | 34 | 36.7 | 96 | 1.14 | 0.34 | 36 | 184 |
| 2003 | 39 | 32.1 | 96 | 1.14 | 0.34 | 38 | 172 |
| 2004 | 43 | 29.8 | 96 | 1.14 | 0.34 | 41 | 156 |
| 2005 | 47 | 26.7 | 96 | 1.14 | 0.34 | 43 | 158 |
| 2006 | 50 | 25.4 | 96 | 0.90 | 0.34 | 32 | 107 |
| 2007 | 53 | 25.5 | 96 | 1.07 | 0.34 | 43 | 124 |

Source: Derived from Briceño-Garmendia, Smits, and Foster 2009.
Note: Due to lack of data average tariff assumed fixed at 0.34/ US$/$m^3$ as observed in 2006

### Challenges

Despite its operational achievements, EDM has not been able to neutralize the financial drain associated with a lack of fundamental mechanisms of tariff determination and indexation the operational inefficiencies in practice (figure 10). EDM's hidden costs (box 1) escalated from $36 million annually in 2002 to around $43 million annually in 2007—close to 0.6 percent of Mali's GDP, primarily driven by underpricing (table 8). As of 2006/7, EDM's hidden costs were over 100 percent of revenues and were the worst among all other water utilities the region (figure 11). The concession contract provided for quinquennial tariff revisions, but systematic adjustments were never carried out. Mali's residential water tariffs are substantially lower than those found in other African countries with scarce water resources (table 6) and certainly are not enough to allow for cost recovery. The hidden costs associated with other operational inefficiencies have fallen and remained at relatively low levels.

Figure 10. Evolution of hidden costs in Mali's water sector



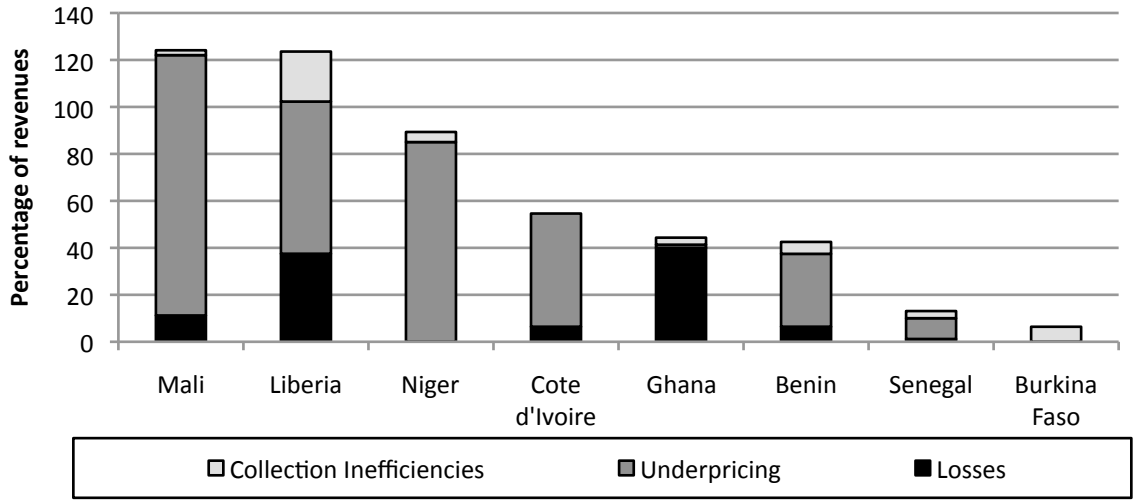

Source: Derived from Banerjee, Skilling, and others 2008.

Secondly, institutional arrangement for EDM continues to be a challenge. EDM manages both urban water and electricity services and despite enormous efforts attribution of costs has not been achieved. The strategy of the Government points toward a separation of water and electricity using a stepped approach and an asset holder/ affermage model. However, many aspects of the restructuring have not been clarified. For instance, mechanisms for private sector involvement have not been established (including the position of the current private shareholder in EDM) and the government has not been explicit on whether operations and commercial services will fall under one or more companies.

Box 1. Hidden costs in utilities

A monetary value can be attributed to observable operational inefficiencies: mispricing, unaccounted-for losses, and undercollection of bills, to mention three of the most conspicuous operational inefficiencies, by using the opportunity costs of operational inefficiencies: tariffs for uncollected bills and production costs for mispricing and unaccounted for losses. These costs are considered hidden as they are not explicitly captured by the financial flows of the operator. Hidden costs are calculated by comparing a specific inefficiency against the value of that operational parameter in a well-functioning utility (or the respective engineering norm) and multiplying the difference by the opportunity costs of the operational inefficiency.

Figure 11. Hidden costs for Mali's water utility are among the highest in the region




Source: Derived from Briceño-Garmendia, Smits, and Foster 2009.

Another challenge in the sector is linked to demography. Rapid urbanization has put pressure on water supply infrastructure. Water production capacity is deficient in Bamako, Kayes, Gao, Koutiala, and Kidal. This situation is due to growth in the number of consumers: more than 110 percent between 2000 and 2004. In the five cities mentioned, the number of urban connections grew from 55,665 in 2000 to 115,799 in 2009. Keeping pace with urbanization would require 10,120 new connections per year. Yet between 2000 and 2009 only 6,790 new connections were installed. To take just one example, it is urgent to mobilize the financing needed to complete the Kabala Water project to ensure adequate water supply for Bamako and cure the recurrent water shortages in many neighborhoods of the capital city. During a meeting organized for that purpose on April 30, 2010, donors confirmed their willingness to support the government's efforts with a likely funding envelope of $220 million.

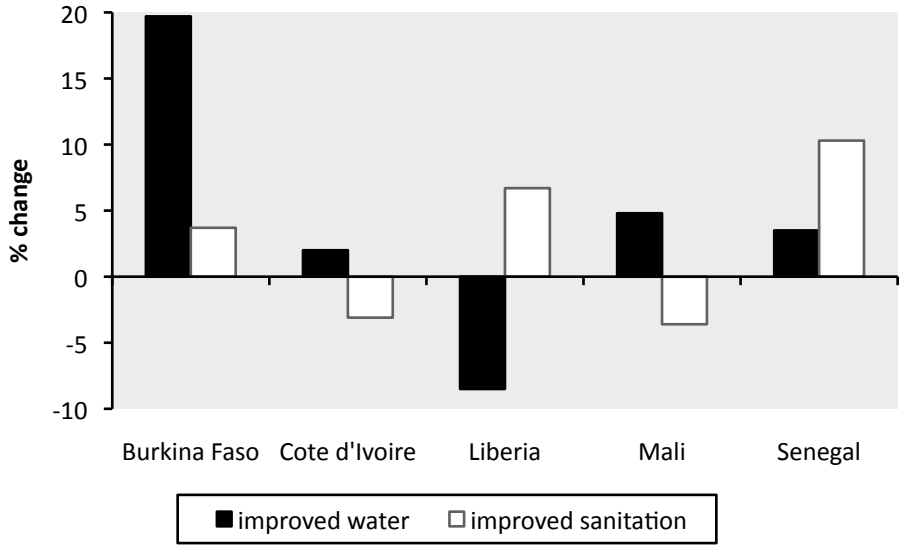
Finally, despite these undeniable achievements in absolute terms, the widening urban-rural gaps in access to improved water and sanitation remain, at 33 and 30 percent respectively (figure 12), remains an enormous challenge. These gaps underscore the ongoing challenge of extending services to rural areas—where 70 percent of the population lives—while still keeping up with urbanization. Furthermore, investments in sanitation, particularly in rural sanitation, have been insignificant, as highlighted by the March 2008 Public Expenditures Review in the rural water and sanitation sector. The majority of rural and semi-urban water projects under implementation (or recently implemented) are accompanied by hygiene and family latrines promotion campaigns, but the share of resources allocated to sanitation remains negligible.

Figure 12. Access to improved water and sanitation has increased in Mali

a. Rural and urban access to improved water and improved sanitation

| | | 1987 | 1996 | 2001 | 2006 |
|---|---|---|---|---|---|
| Improved water | Rural | 20.6 | 27.1 | 32.5 | 45.8 |
| | Urban | 52.2 | 65.7 | 70.4 | 78.9 |
| Improved sanitation | Rural | 33.5 | 32.2 | 39.4 | 40.9 |
| | Urban | 58.0 | 56.3 | 65.3 | 70.4 |

b. Change in rural-urban gap between early 2000s and late 2000s




Source: WHO–Joint Monitoring Programme 2010, from Demographic and Health Surveys.

## Power

### Achievements

Mali's installed generation capacity is almost evenly split between hydropower and oil. It was dominated by oil generation (60 percent) until the start of operation of the dam in Manantali in 2002, after which hydropower accounted for the majority of generation. As demand has increased since 2004,

however, so has the share of thermal generation and hydropower now accounts for 55–60 percent of the generation mix. This level of oil-based generation is a significant cost burden for the Malian economy. Mali does not produce oil, and oil imports are subject to enormous markup caused by Mali's flawed land transportation and condition as a landlocked state.

Despite its handicaps, Mali has recently made important strides in the power sector. Since 2000, when the concession on EDM was granted, the power utility's sales have grown at a rate of over 10 percent (and up to 17 percent) per year. New connections grew by over 70 percent between 2000 and 2004 and 30 percent between 2004 and 2007. This strong performance is partly attributable to an accelerated expansion of electricity access in Bamako. Between 2000 and 2005, 7.7 percent of Mali's population gained access to power compared with the benchmark of 4.4 percent for African peer low-income countries (the figure was 12.1 percent for middle-income countries) (table 10). The number of low voltage customers increased 110 percent between 2000 and 2009, with an average 15,107 new connections per year.

Table 10. Benchmarking Mali's power indicators

| | | | Mali | | | Middle-income countries |
|---|---|---|---|---|---|---|
| | Unit | Low-income, nonfragile countries | Late 1990s | Mid-2000s | Late 2000s | |
| National access to electricity | % population | 32.8 | 7.6 | 12.8 | 17 | 49.5 |
| Urban access to electricity | % population | 72.8 | 26.0 | 41.3 | | 74.4 |
| Rural access to electricity | % population | 12.7 | 0.4 | 2.7 | | 26.3 |
| Population gaining access | % population/year | 4.4 | | 7.7 | | 12.1 |
| | | | | Mid-2000s | Late 2000s | |
| Installed power generation capacity | MW/mil. people | 20 | | 21 | 23 | 799 |
| Power consumption (residential) | kWH/capita | 107 | | 69.2 | 76.4 | 4479 |
| Power outages | Day/year | 124.5 | | — | 52.2 | 70.6 |
| Firms' reliance on own generator | % consumption | 21 | | 30 | 16 | 11 |
| Firms' value lost due to power outages | % sales | 6 | | 2.7 | 2 | 2 |
| Delay in obtaining an electrical connection | Days | 41 | | | 36 | 12 |
| Collection ratio | % billings | 93 | | 95 | 96 | 100 |
| System losses | % production | 24 | | 23 | 22 | 20 |
| Cost recovery ratio | % total cost | 89 | | 57 | 50 | 85 |
| Total hidden costs as % of revenue | % | 88.4 | | 131 | 113 | 140.6 |

| Effective power tariffs (US cents/kWh) | Mali | Countries with predominantly hydro generation | Countries with predominantly thermal generation | Other developing regions |
|---|---|---|---|---|
| Residential at 100kWh/month | 21.0 | 10.7 | 15.7 | |
| Commercial at 900kWh/month | 18.6 | 12.9 | 19.0 | 5.0 – 10.0 |
| Industrial at 100 kVA | — | 9.3 | 13.0 | |

Source: Eberhard and others 2009.

Derived from AICD electricity database downloadable from http://www.infrastructureafrica.org/aicd/tools/data Other source include: Access data coming from Demographic and Health Surveys 1996 and 2001. Utility data from AICD electricity database downloadable from http://www.infrastructureafrica.org/aicd/tools/data. Data referring to outages is coming from the 2003 and 2007 Enterprise Surveys.

Mali has also made significant improvements in the nonresidential market. According to enterprise surveys in 2003 and 2007, the share of firms relying on their own generator fell from 45 percent in 2003 to just over 23 percent in 2007, and the share of power consumption supplied by own generation fell by half to 16 percent over the same period. This was a result of Mali improving not only electricity coverage but also the quality and reliability of the service. In fact, for those Malian firms with access to power, the quality of service is relatively good compared with neighboring countries. Losses due to power outages are less than 2 percent of sales, which is among the lowest on the continent. The duration of power outages is also below that of most of neighboring countries (table 11).

Table 11. Performance of the electricity sector in West African countries

| | Burkina Faso (2009) | Cape Verde (2006) | Côte d'Ivoire (2009) | Ghana (2007) | Mali (2007) | Mauritania (2006) | Niger (2006) | Nigeria (2007) | Senegal (2007) | Simple average |
|---|---|---|---|---|---|---|---|---|---|---|
| Number of power outages in a typical month | 10.8 | 12.5 | 4.5 | 9.7 | 4.4 | 3.7 | 20.7 | 26.8 | 11.8 | 14.4 |
| Average duration outages (hours) | 3.3 | 5.3 | 4.6 | 12.6 | 3.9 | 2.9 | 0.5 | 8.2 | 6.2 | 6.6 |
| Losses due to outages (% of sales) | 5.8 | 8.9 | 5 | 6 | 1.8 | 1.6 | 2.5 | 8.9 | 5 | 6.4 |
| % of firms owning/sharing generator | 11.6 | 39.8 | 6.5 | 26.6 | 23.8 | 28.6 | 24.8 | 85.7 | 55.4 | 43.1 |
| Electricity from generator (%) | 10.9 | 4.6 | 15.1 | 29.5 | 16 | 9.2 | 10.5 | 60.9 | 24.7 | 30.6 |

Source: Enterprise Survey database available online at http://www.enterprisesurveys.org, year of the survey in brackets.

Mali successfully introduced a rural electrification program in 2003 with the creation of AMADER[2]. At the time, rural electrification was only about 3 percent of the population, and average household monthly spending on energy was as high as $4 to $10. As of 2008, the program had granted access to 36,277 households (box 2). However, AMADER has been hindered by insufficient and uncertain funding for providing capital cost grants, which are essential for the success of the program given the high cost of connections ($776).

[2] Agence Malienne pour le Développement de l'Énergie Domestique et l'Électrification Rurale, or Malian Agency for the Development of Domestic Energy and Rural Electrification

Box 2 Rural electrification in Mali

Among new African rural electrification agencies, AMADER (Agence Malienne pour le Développement de l'Energie Domestique et l'Electrification Rurale, or Malian Agency for the Development of Domestic Energy and Rural Electrification) has had considerable success. The starting point for AMADER is a country in which only about 3 percent of the rural population has access to electricity. Until they are connected, most rural households meet their lighting and small power needs with kerosene, dry cells, and car batteries, averaging monthly household expenditure of $4 to $10.

Created by law in 2003, AMADER uses two major approaches to rural electrification: (a) spontaneous, "bottom-up" electrification of specific communities and (b) planned, "top-down" electrification of large geographic areas. The bottom-up approach, which typically consists of minigrids managed by small local private operators, has been more successful. By late 2008, about 41 bottom-up projects had been financed, comprising 36,277 household connections at an average cost per connection of $776. Typically, AMADER provides grants for about 75 percent of the connection capital costs.

Because Mali has limited renewable resources, most of the minigrid systems are diesel fired. Customers on these isolated minigrids typically receive electricity for six to eight hours a day. In promoting these new projects, AMADER performs three main functions: (a) provider of grants, (b) supplier of engineering and commercial technical assistance, and (c) de facto regulator through its grant agreements with operators. The grant agreement can be viewed as a form of "regulation by contract" that establishes minimum technical and commercial quality of service standards and maximum allowed tariffs for both metered and unmetered customers.

To ensure that the projects are financially sustainable, AMADER permits operators to charge residential and commercial tariffs that are higher than the comparable tariffs charged to similar customers who are connected to the national grid. For example, the energy charge for metered residential customers on isolated minigrids is about 50 percent higher than the comparable energy charge for grid-connected residential customers served by Energie du Mali (the national electric utility). Many of the minigrid operators also provide service to unmetered customers, who are usually billed a flat monthly charge per lightbulb and outlet, combined with load-limiting devices to ensure that a customer does not connect lightbulbs and appliances beyond what he or she has paid for.

Financing has been a problem for both AMADER and potential operators. AMADER has been hindered by insufficient and uncertain funding for providing capital cost grants. Potential operators have had difficulty raising equity or obtaining loans for the 20–25 percent share of capital costs not funded by AMADER. Promoting leasing arrangements and instituting a loan guarantee program for Malian banks that would be willing to lend to potential operators have been discussed as methods of reducing financial barriers for operators.

*Sources*: Rysankova; World Bank 2009

### Challenges

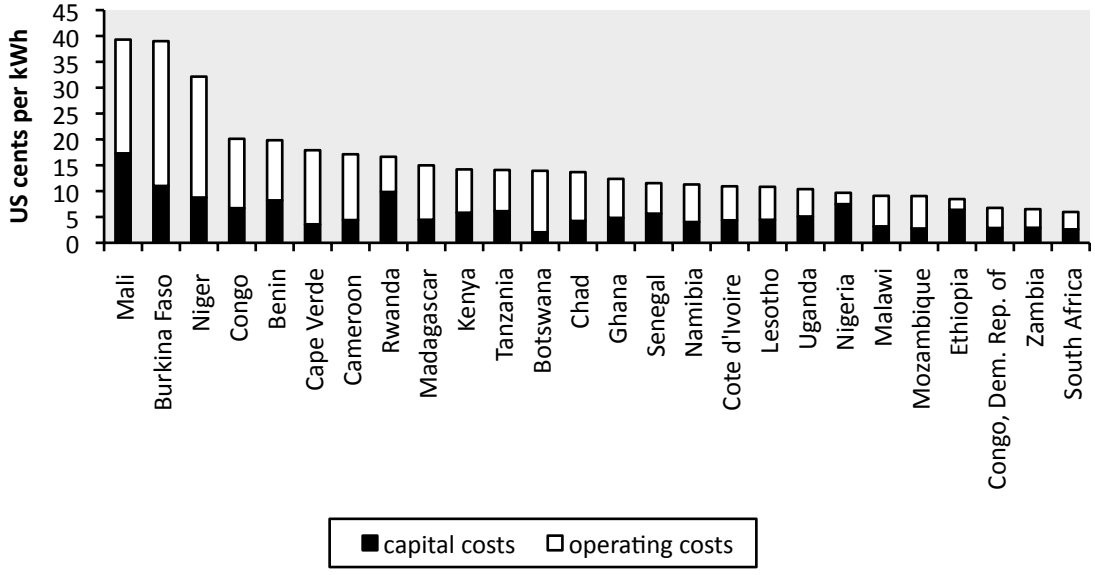
Access to electricity to electricity in Mali more than doubled in the last decade and is now around 17 percent of the population. Compared with its low-income peers, Mali's power generation capacity is average—about 23 megawatts per million people—but residential consumption per capita is much lower than in countries with similar incomes (table 8). Moreover, there is a substantial rural-urban gap in access. Mali's population is 13 million, but there are only about 150,000 electricity connections, two-thirds of which are in the capital city of Bamako. The ratio of urban connections to rural connections is fourteen to one.

The rural-urban electrification divide reveals that the country's improvements in service access and quality were either in areas that were already electrified or were a result of extending the network to areas close to an EDM supply point. Mali's subsidy policy to new connections (which was in place until 2004) and the additional power coming from Manantali supported this outcome. Demand growth has been about

10 percent per year over the last ten years and is not expected to slow down. This is putting an enormous pressure on the country's generation and transmission capacity, which is already stretched too thin.

Going forward, the high (and increasing) cost of power in Mali is one of the country's most salient challenges. The cost of power in Mali between $0.33 and $0.39 per kilowatt-hour, depending on the referential year, is significantly higher than in similar countries (figure 13). This is because Mali's power costs are pegged to international oil prices given its predominantly thermal-based generation capacity, and are prone of additional markups related to transport. Mali has no known reserves of hydrocarbons (oil, gas, or coal) and relies on distant coastal ports (more than 1,000 km away) for fuel imports to meet both its transport and power generation needs, which are currently in excess of half a million tons annually. This poses a long-term challenge, as the way to respond to high power prices is to change the generation mix. However, gaining access to Mali's full hydropower potential will require the consolidation of international agreements on the use of the relevant transboundary river basins (Senegal and Niger) and the materialization of investments in and by neighboring Senegal and Guinea.

Figure 13. Mali's power costs are among the highest in Africa




Source: Eberhard and others 2009.

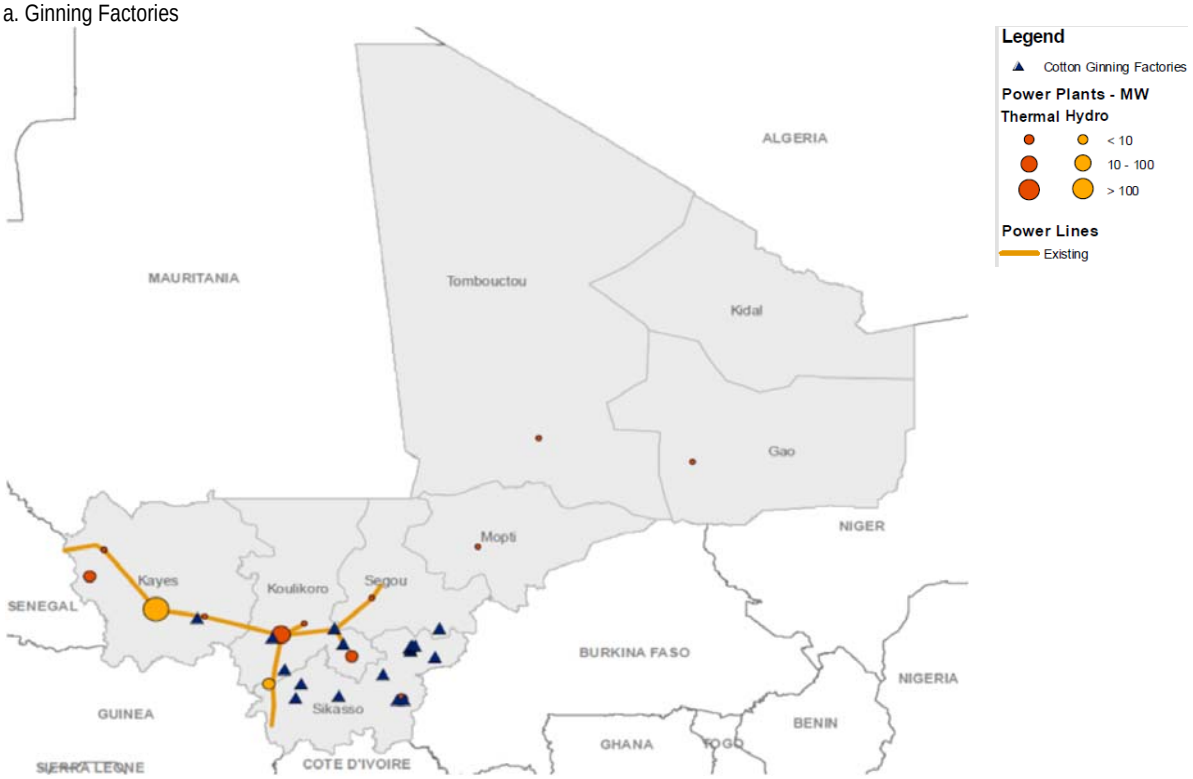
Given the constraints on access to hydropower, diversifying the Mali's generation mix will not be easy. Mali has limited hydropower potential inside its national border (about 1,000 megawatts in total). Furthermore, relying on imports requires significant investments. Mali's electricity grid is not yet connected to neighboring countries, preventing access to cheaper power available on the coast. Long-term investments in interconnectors should help the country to secure access to more cost-effective power sources. The cost of power supply could gradually fall from over $34 cents to $25 cents per kilowatt-hour (Rosnes and Vennemo 2009), which will nevertheless remain one of the highest costs in Sub-Saharan

Africa. The least-cost option for Mali is to build on power trade by interconnecting with Côte d'Ivoire and Guinea, and eventual participation in the West African Power Pool.[3]

Mali would also benefit greatly from decentralized programs for expanding access to energy services. Regions within Mali with the largest concentrations of mining and cotton activities remain disconnected from the grid (figure 14). Not surprisingly, an assessment of energy costs in cotton yarn production reveals that Malian firms' energy costs represent 30 percent of production costs. By comparison, that figure is 15 percent in Kenya, where yarn production costs are similar to Mali, and 4.5 percent in Bangladesh, where yarn production costs are 80 percent of those in Mali (CEM 2006). The high cost of power therefore significantly hampers Mali competitiveness in the international cotton market.

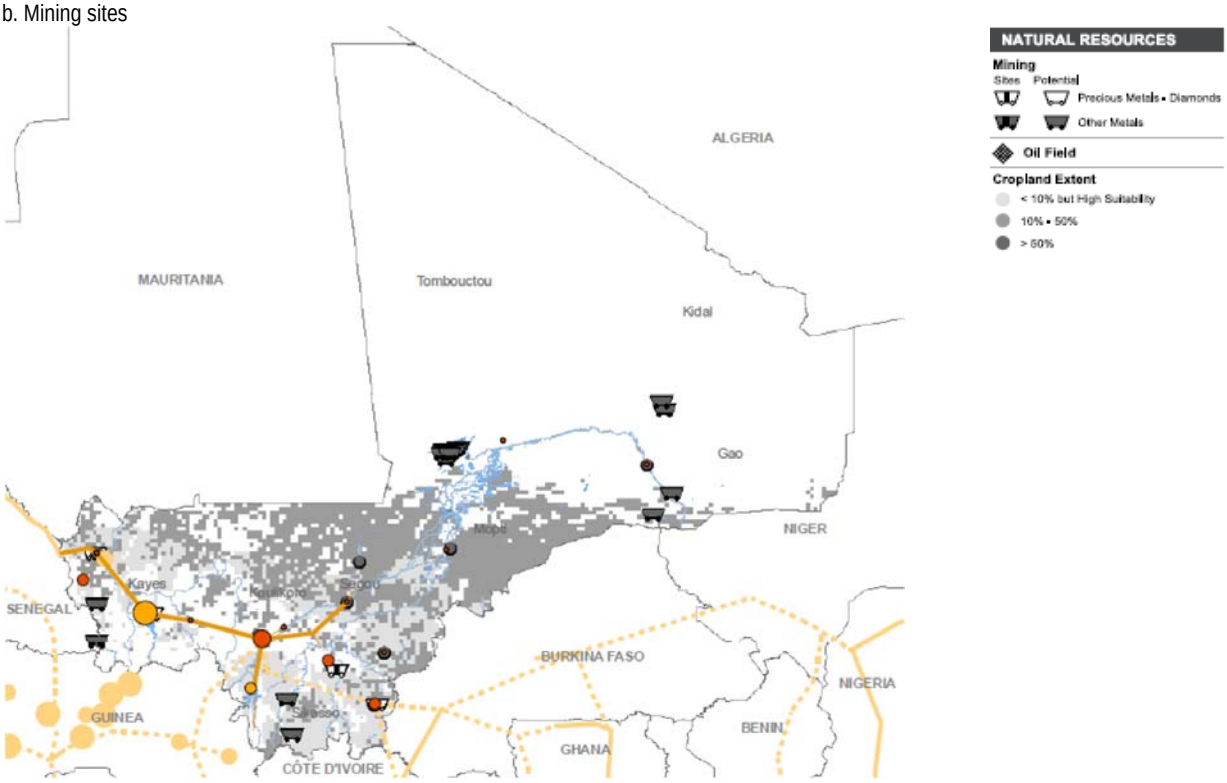
**Figure 14. Mining and cotton activities remain disconnected from the grid**

a. Ginning Factories



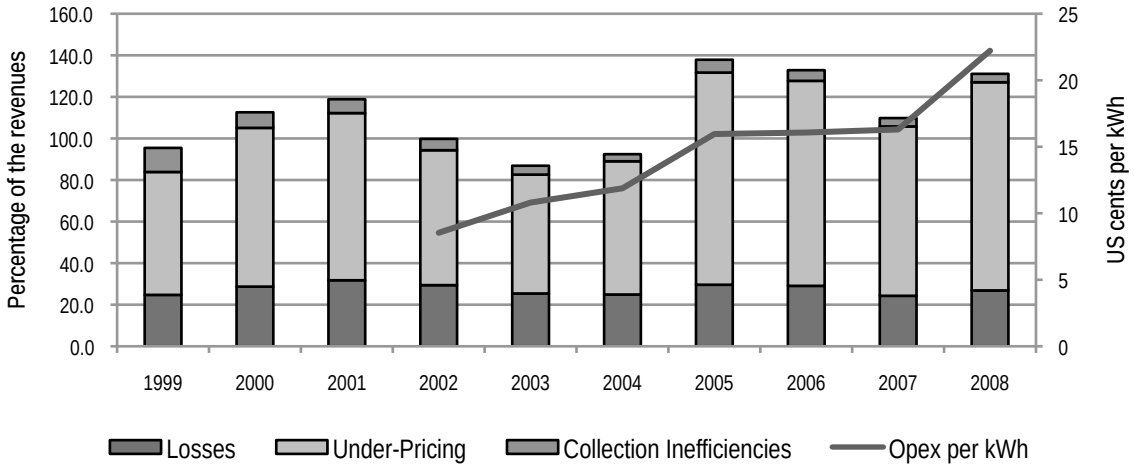

[3] "Discussions are underway for the financing of the Laboa-Ferkessédougou transmission line (in northern Côte d'Ivoire) to allow power exports to Mali of up to 200 MW. Construction work on the Côte d'Ivoire–Mali interconnector has started in Mali. In addition, the Félou hydroelectric plant is expected to be fully commissioned by 2012. This plant will provide Mali with more access to lower cost hydroelectric power from the Organisation pour la Mise en Valeur du Fleuve Sénégal (OMVS) system. Another important regional interconnection project is the West African Power Pool (WAPP) interconnection project, Han (Ghana)–Bobo Dioulasso (Burkina Faso)–Sikasso (Mali)–Bamako (Mali). It is expected that, after the construction of this interconnection line by 2014, Mali would be supplied with an additional 80 MW." World Bank (2009).

b. Mining sites




Source: AICD Interactive Infrastructure Atlas for Ghana downloadable from http://www.infrastructureafrica.org/aicd/system/files/gha_new_ALL.pdf

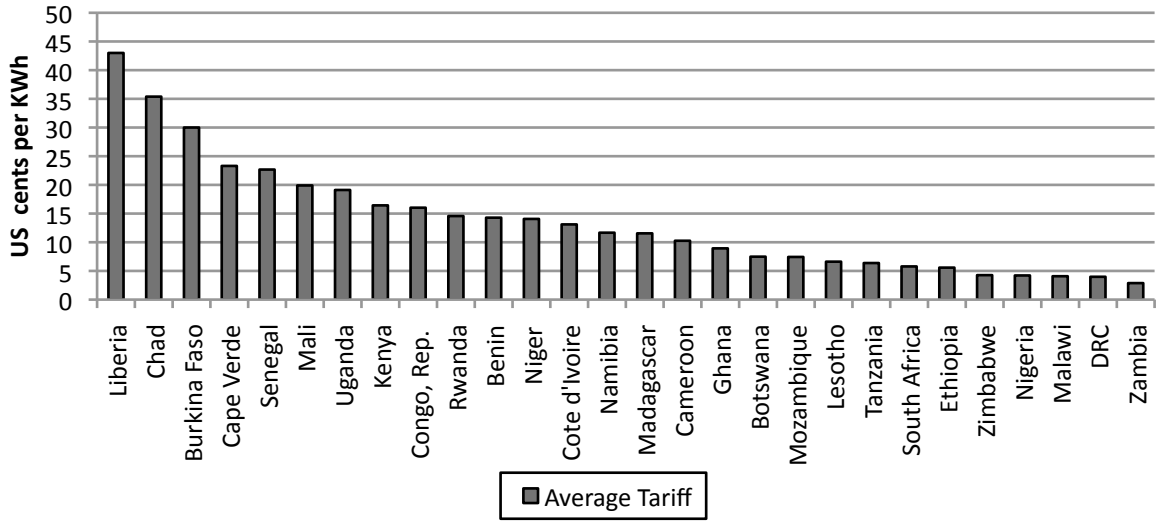
Figure 15. Hidden costs are high in Mali and driven by underpricing




Source: Derived from Eberhard and others 2009 and Briceno-Garmendia and Shkaratan 2010.
Note: Results for 2008 based on preliminary data

But the adjustment of power tariffs present to cover costs represents an enormous challenge for policy makers in Mali. They currently average about $0.20 per kilowatt-hour—already among the highest in the region (figure 16). Regardless, they are not high enough to recover operational costs, let alone the full cost of power. Furthermore, given the pressing demand for power, the country is moving from low-cost hydro generation to more expensive thermal generation to meet short–run demand. It seems inevitable that tariffs will eventually need to be increased to sustain the sector's financial viability and that subsidies and parallel financial schemes will need to be established to keep power affordable and the utility financially viable.

Figure 16. Power prices in Mali are among the highest in Africa




Source: Briceño-Garmendia, Cecilia and Maria Shkaratan 2010.

The emerging policy challenge of underpricing is directly linked to the generation mix that determines such a high cost of power. Manantali demonstrates the importance of a diverse generation mix. While underpricing has remained significant during the last 10 years, during the period 2003–04 the availability of cheaper hydropower from Manantali kept costs low, and as a result the financial burden of underpricing fell slightly. Nevertheless, demand growth for power soon caught up with the additional generation capacity provided by Manantali. Three years after the plant began operation, the expansion of power provision from thermal-based generation made Mali even more vulnerable to the spike in international oil prices. Operational costs doubled between 2002 and 2008. Tariffs did not adjust accordingly, and consequently underpricing reached historical levels.

Underpricing is not the only inefficiency hampering the financial health of EDM. Distribution losses remain extremely high—over 22 percent of electricity production. The financial cost of distribution losses was almost 0.8 percent of GDP in 2008, or just below 25 percent of EDM revenues. Actions to address EDM's distributional losses would relieve some financial pressure and contribute to reducing the utility's supply costs.

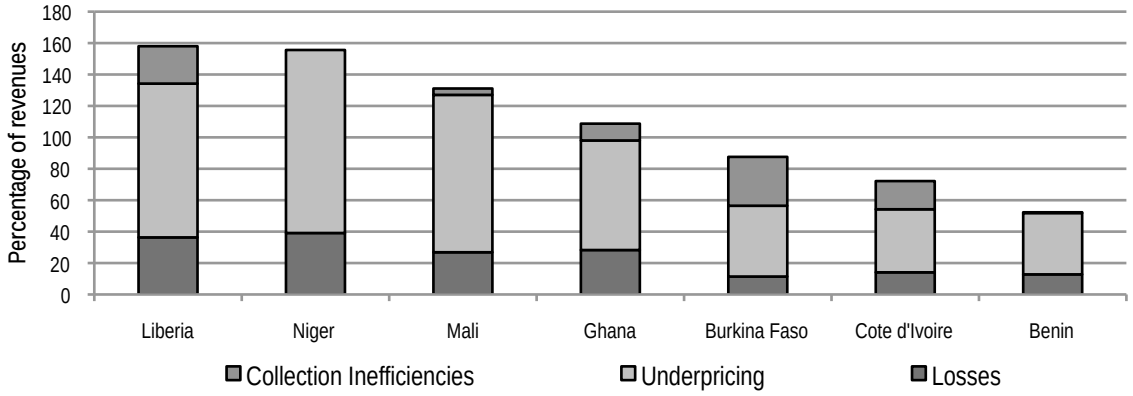
When all these inefficiencies are put together, EDM has one of the highest hidden costs of power utilities in West African countries (figure 17). Hidden costs are about 100 percent of EDM's revenues (table 12), which is almost twice the figure found in other low-income African countries.

Table 12. Evolution of hidden costs associated with EDM (power)

| | Net generation (GWh/year) | Distribution losses (%) | Implicit collection ratio (%) | Average total cost (US$/kWh) | Average effective tariff (US$/kWh) | Total hidden costs (US$m/year) | Total hidden costs (% revenues) |
|---|---|---|---|---|---|---|---|
| 1999 | | 24.9 | 92 | 0.26 | 0.14 | 38 | 95 |
| 2000 | 471 | 25.8 | 92 | 0.26 | 0.14 | 50 | 113 |
| 2001 | 521 | 26.4 | 93 | 0.26 | 0.14 | 69 | 119 |
| 2002 | 590 | 27 | 94 | 0.26 | 0.15 | 71 | 100 |
| 2003 | 557 | 26 | 95 | 0.26 | 0.17 | 70 | 87 |
| 2004 | 639 | 25 | 96 | 0.28 | 0.17 | 87 | 92 |
| 2005 | 711 | 23 | 94 | 0.29 | 0.17 | 140 | 138 |
| 2006 | 764 | 23 | 95 | 0.33 | 0.17 | 147 | 133 |
| 2007 | 836 | 22 | 96 | 0.33 | 0.19 | 148 | 110 |
| *2008* | *884* | *22* | *96* | *0.39* | *0.20* | *202* | *131* |

Source: Derived from Briceño-Garmendia, Smits, and Foster 2009.
Note: Results for 2008 based on preliminary data.

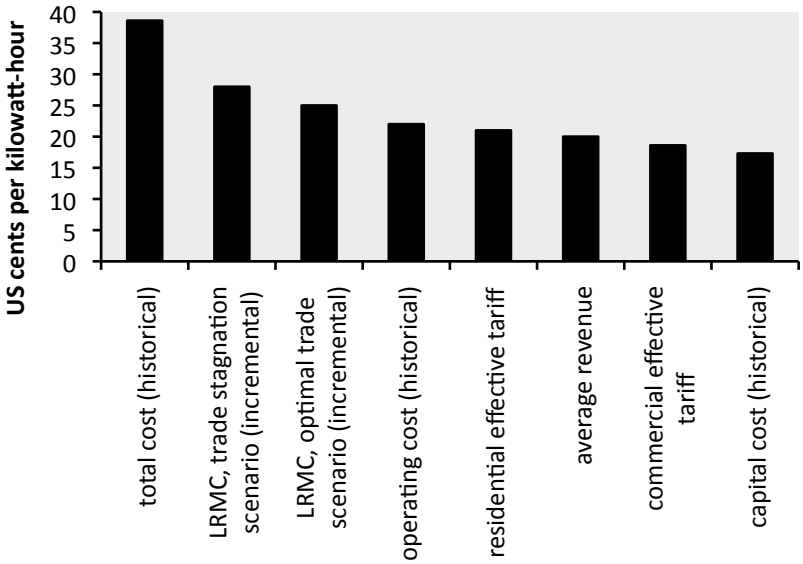
Figure 17. Hidden costs of Mali's power utility are among the highest in West Africa




Source: Derived from Briceño-Garmendia, Smits, and Foster 2009.

In the long-term, the power utility may be closer to achieve cost recovery, particularly if regional power trade is developed (figure 18). If investments on generation are carried out taking into account the least cost alternatives and best utilization or hydropower potential, Mali can produced electricity with a long-term marginal cost of $0.28 per kWh. If further investments are undertaken to develop optimal power trade arrangements, marginal costs can be decreased to an even lower $0.25 per kWh. This puts cost recovery within the reach of the utility with a modest progressive tariff increase between 10 percent (if regional power trade is honed) and 20 percent (under stagnation) over the existing effective tariff.

Figure 18. Prevailing tariffs are insufficient to recover huge operating costs and long-run marginal costs




Source: Rosnes and Vennemo 2009.
Note: LMRC = long-run marginal costs; historical costs as of 2007.

## Information and communication technologies

### Achievements

The ICT revolution has found fertile ground in Mali. The number of people with access to a mobile line grew by 300 percent between 2004 and 2007, allowing Mali to catch up with peers with similar income level and positioning Mali among the best performers in West Africa. These improvements are also reflected in an impressive record of customer satisfaction, low end-user prices, and the development of international corridors of fiber optics to connect with neighbors (table 13). The network of fiber optic with West African peers guarantees the country parallel and independent access to the landing stations of the submarine cable in Senegal and Côte d'Ivoire, allowing Mali to overcome its landlocked condition.

How has this remarkable progress taken place? Since 1998, the development of the mobile market was made possible by institutional reforms including a sound sector policy, the creation of a regulatory body, and the progressive liberalization of the telecommunications market. The results have been striking. In the mobile market, subscriptions went from 10,000 in 2000 to more than 2.5 million in 2007 and mobile penetration rose from less than 7 percent in 2005 to almost 36 percent in 2008—the highest penetration rate in West Africa outside of Nigeria. Annual average growth was the highest in West Africa at 75 percent per year (table 14). GSM coverage remains relatively low when compared to other low-income countries (see table 13), which reflects Mali's challenging geography and demography.

Table 13. Benchmarking ICT indicators

| | Unit | Low-income countries, nonfragile | Mali | | Middle-income countries |
|---|---|---|---|---|---|
| | | 2005 | 2005 | 2007/08 | 2005 |
| GSM coverage | % population under signal | 48 | 18 | 22 | 97 |
| International bandwidth | Mbps/capita | 6 | 2.2 | 17 | 30 |
| Internet | subscribers/100 people | 0 | — | 0.8 | 2 |
| Landline | subscribers/100 people | 1 | 0.6 | 0.7 | 9 |
| Mobile phone | subscribers/100 people | 15 | 7 | 35.4 | 87 |

| *US dollars* | Mali 2007 | Countries without submarine cable | Countries with submarine cable | Other developing regions |
|---|---|---|---|---|
| Price of monthly mobile basket | 11.0 | 11.1 | 11.12 | 9.9 |
| Price of monthly fixed-line basket | 13.1 | 13.6 | 13.58 | nav |
| Price of 20-hour Internet package | 56.5 | 68.0 | 47.00 | 11.0 |
| Price of a call to US per minute | 0.34 | 0.86 | 0.48 | 0.66 |
| Price of an intra-Africa call per minute | 0.29–0.33 | 0.7 | 0.57 | non applicable |

Source: Mali 2005 data together with benchmarks are taken from the AICD Database. Mali 2007/8 is compiled from a variety of World Bank sources in order to give a sense of the progress made during the last four/five years (including Information and Communications for Development database).

Source: Ampah and others 2009.

Derived from AICD national database downloadable from http://www.infrastructureafrica.org/aicd/tools/data

— = data not available. n.a. = not applicable. Numbers reported in the table as of 2007.

Table 14. Mali's skyrocketing mobile teledensity

Subscribers per 100 people

| Country | 2005 | 2006 | 2007 | 2008 | Average annual growth |
|---|---|---|---|---|---|
| Benin | 14.10 | 19.20 | 23.7 | 27.7 | 25.50 |
| Burkina Faso | 5.00 | 7.60 | 11.5 | 14.4 | 42.84 |
| Ghana | 12.10 | 19.30 | 29.4 | 34.6 | 43.17 |
| Mali | 6.70 | 12.90 | 21.1 | 35.4 | 74.63 |
| Niger | 2.70 | 4.40 | 6.7 | 8.5 | 47.37 |
| Nigeria | 14.40 | 24.40 | 34.7 | 44.2 | 46.35 |
| Togo | 8.10 | 10.70 | 13.2 | 15.6 | 24.55 |

Since 1992, private flows to Mali's ICT sector have increased from almost zero to $19.3 million between 2000–03 and to $30.8 million between 2004–08. In 2001, Sonatel/ France Telecom received a license to provide fixed-line, mobile, and internet services. Ikatel entered the market in 2002 and has offered mobile services since 2003. In 2006, Ikatel became Orange Mali. Malitel has served the mobile sector since 1999 and had a market share of 20 percent in 2008. Also, a universal access fund was created to support roll out of services in rural areas.

Prices for telephony remain modest in Mali. End-user prices for international telephony are below those of low-income peers mostly as a result of the roaming agreements that have created cross-country competition despite the existence of a domestic market duopoly (see table 11). Consumer satisfaction has

also improved as prices have fallen. The regulator CTR conducts periodic surveys to determine customers' opinions on the cost and quality of telecommunications services. A comparison of the last two surveys, conducted in 2004 and 2007, shows that the general perception is that the latest developments in the telecom markets have supported economic activity and productivity increases. With respect to prices, the 2007 survey shows a much higher satisfaction with service pricing. The percentage of customers who think that services are affordable more than doubled from 30 percent in 2004 to 67 percent in 2007.

Advanced roaming arrangements for mobile services in ECOWAS area support low call prices. Compared to the rest of Africa, West Africa has made significant progress in promoting preferential roaming arrangements through special intra-operator roaming arrangements. Subscribers who belong to one of these networks can use their mobile handset in the other countries; they do not pay for incoming calls and are charged local rates for outgoing calls. Prepaid users can also recharge their phones in the country in which they are roaming. Two factors explain the relatively advanced integration of ECOWAS's mobile roaming arrangements. One is the existence of the proactive regional regulatory association for ICT: the West Africa Telecommunications Regulators Association (WATRA). The other is the existence of a number of large mobile operators with a presence in multiple ECOWAS countries. Seven large mobile groups with a multicountry presence dominate the regional telecommunications market.[4] These multicountry networks have provided the basis for the regional roaming arrangements that essentially collapsed into three roaming areas: Orange Zone, Zain One, and One World (table 15). Within these areas, roaming charges are very modestly priced.

Table 15. Intra-roaming networks in ECOWAS

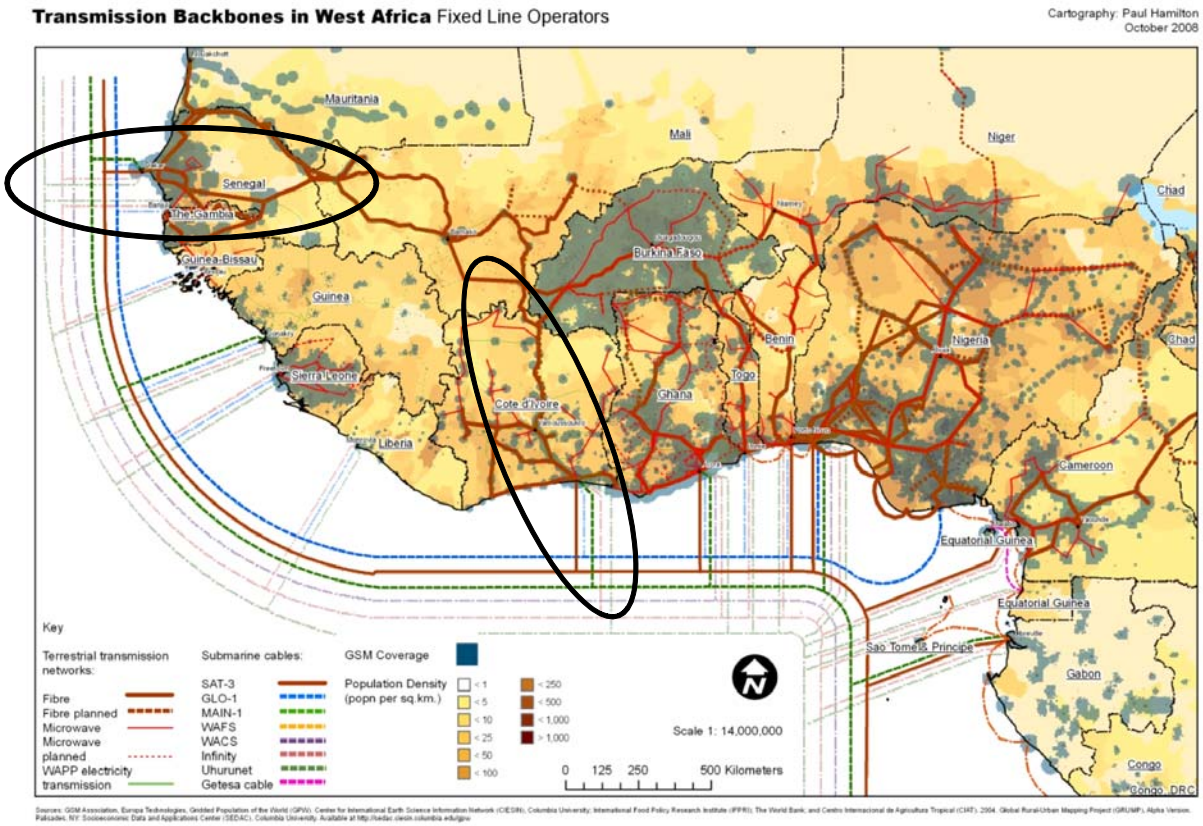
| Network | Countries |
|---|---|
| Orange Zone | Available for subscribers in Côte d'Ivoire, Guinea, Guinea-Bissau, Mali, Niger, and Senegal |
| Zain One | Available for subscribers in Burkina Faso, Ghana, Niger, Nigeria, and Sierra Leone |
| One World of MTN | Available for subscribers in Benin, Côte d'Ivoire, Ghana, Guinea, Guinea-Bissau and Nigeria. |

Source: Derived from Ampah and others 2009 (in AICD ECOWAS Infrastructure, 2010).

Also in a regional perspective, within the recent boom of investment, Mali has been overcoming its condition of landlocked country. Aa a partial and unintended consequence of the lack of coordination among international,  Mali has four exits to the international submarine cable South Atlantic 3 (SAT-3)/WASC, which extends from Malaysia to South Africa and then up the West Coast of Africa to Portugal and Spain. There are 2 different corridors (Bamako–Dakar, and Bamalo–Abijan) but 4 parallel links (figure 19). This duplication of infrastructure, while inefficient from the economic perspective, represents in practice a concrete mechanism for operators to guarantee their access to international facilitates.

[4] Etisalat, France Telecom, Maroc Telecom, Millicom, MTC (Zain), MTN, and Comium.

Figure 19. Mali has secured access to SAT3 through landing stations in Senegal and Côte d'Ivoire




Source: Mayer and others 2009.

Access to submarine cables generally reduces costs, particularly if there is competition at the gateway (table 16). Therefore, Mali's parallel fiber optic infrastructure (4 exit points) has two major benefits: it guarantees operators access to an international gateway and also implicitly creates condition of competition between landing points. The government is eager to explore additional connections through other neighbors with access to SAT- 3 and ACE cable to create more competition for international capacity, which will result in further cost reductions for international calls and Internet services.

Table 16. Access to submarine cable and competition result in lower international call charges

| US$ | Cost of call within region | Cost of call to United States | Cost of Internet dial-up | Cost of Internet ADSL |
|---|---|---|---|---|
| Without submarine cable | 1.34 | 0.86 | 68 | 283 |
| With submarine cable | 0.57 | 0.48 | 47 | 111 |
| monopoly on international gateway | 0.70 | 0.72 | 37 | 120 |
| competitive international gateway | 0.48 | 0.23 | 37 | 98 |

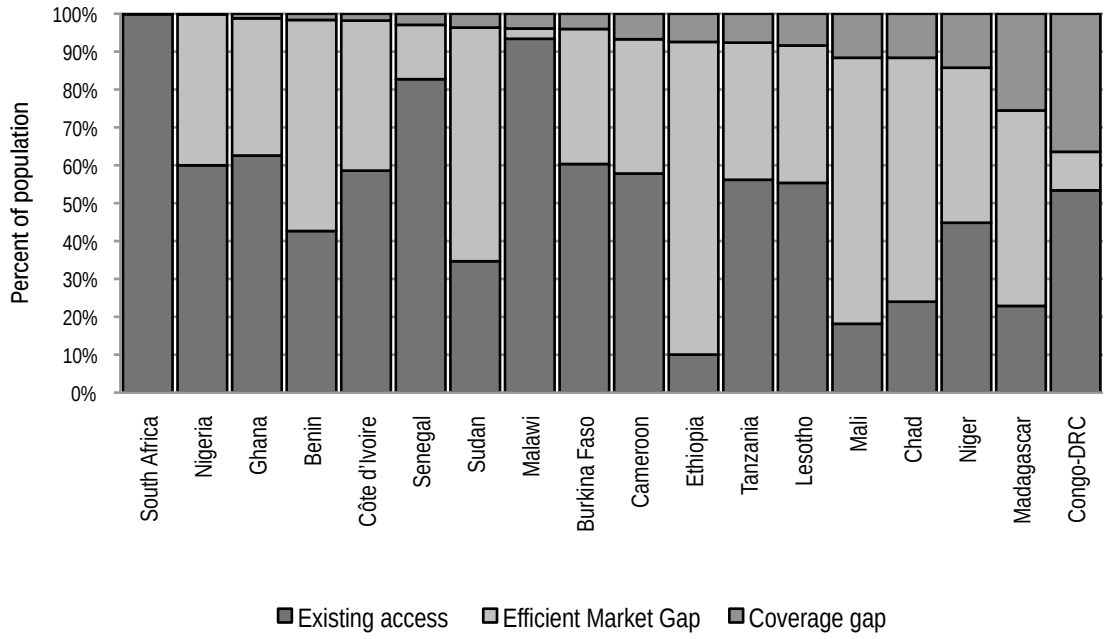
Source: Ampah and others 2009.

### Challenges

Geography poses the greatest challenge to the development of Mali's ICT sector. ICT services are highly concentrated in the Bamako area, which has only 10 percent of the country's population. As a result, most of the country's physical territory remains without coverage. As of 2007, Bamako had 80 percent of the fixed-line capacity and 75 percent of the users in Mali. Consequently, there is a large disparity in access between urban and rural areas. Out of 11,000 villages only 253 have access to telecommunication services.

In 2007, close to 18 percent of Mali's population was covered by a GSM signal. However, as much as an additional 70 percent of the population living in areas without GSM coverage could be reached on a commercially viable basis (figure 20). The remaining 12 percent of the population (including much of the north of the country, figure 21) can be reached by a GSM signal only under a subsidy scheme. This result is based on the assumption that 4 percent of local income in each area could be captured as revenues for voice telephony services. In the case of the broadband market, access is more challenging. If universal access for broadband services were a target for Mali's government, subsidies should be granted to more than 20 percent of the population. Other West African countries—such as Ghana, Benin, Côte d'Ivoire, and Senegal—would require little subsidy to reach universal service, as the market would provide coverage on a commercial basis.

Figure 20. A large part of Mali's population can be reached by GSM signal on a commercially viable basis



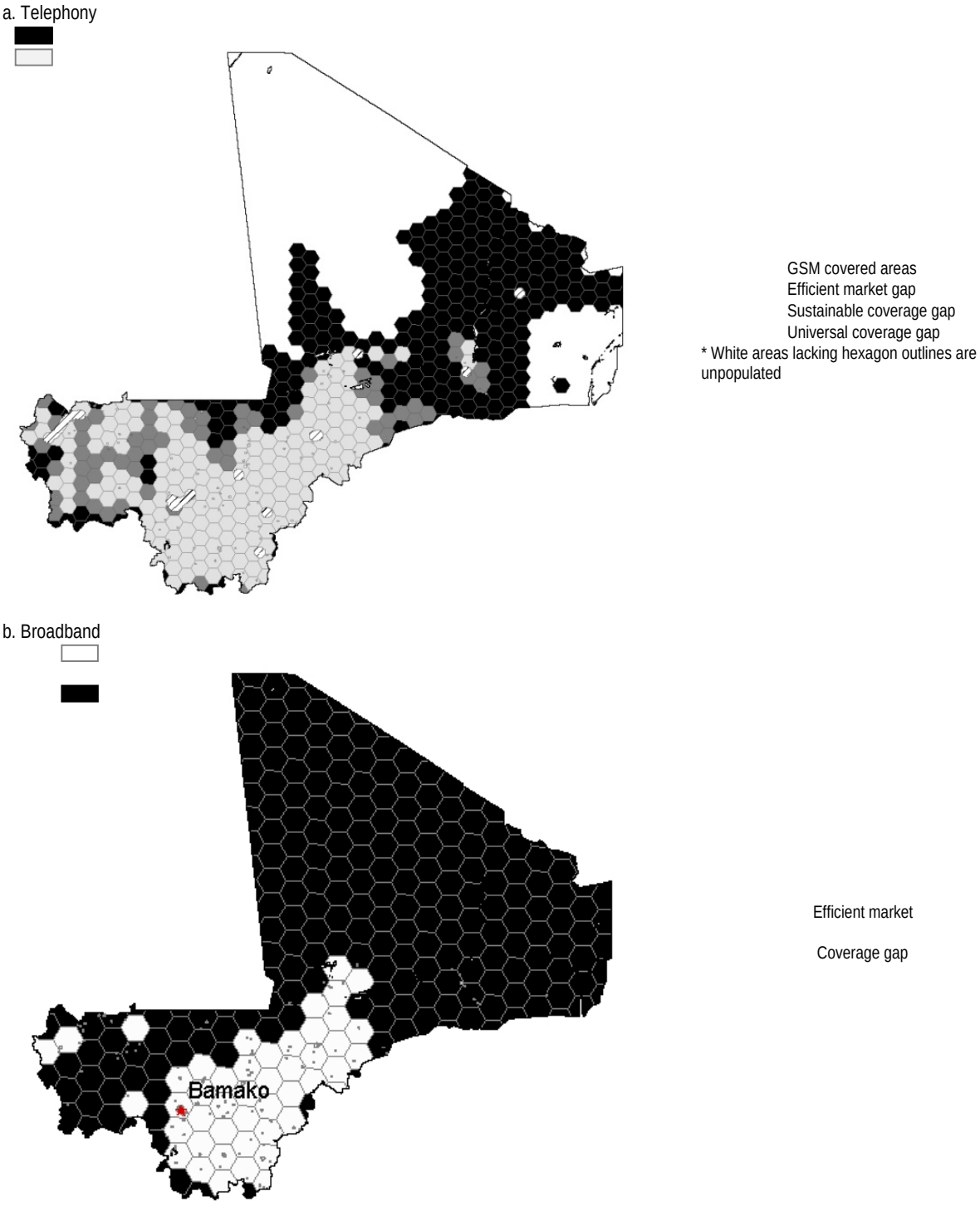

Source: Mayer and others 2008.

Existing Access represents the percentage of the population currently covered by voice infrastructure as of 3rd quarter 2006.

Efficient market gap represents the percentage of the population for whom voice telecommunications services are commercially viable given efficient and competitive markets.

Coverage gap represents the coverage gap—the percentage of the population for whom services are not viable without subsidy.

Figure 21. Geography and demography limit telecommunications coverage in the north of Mali

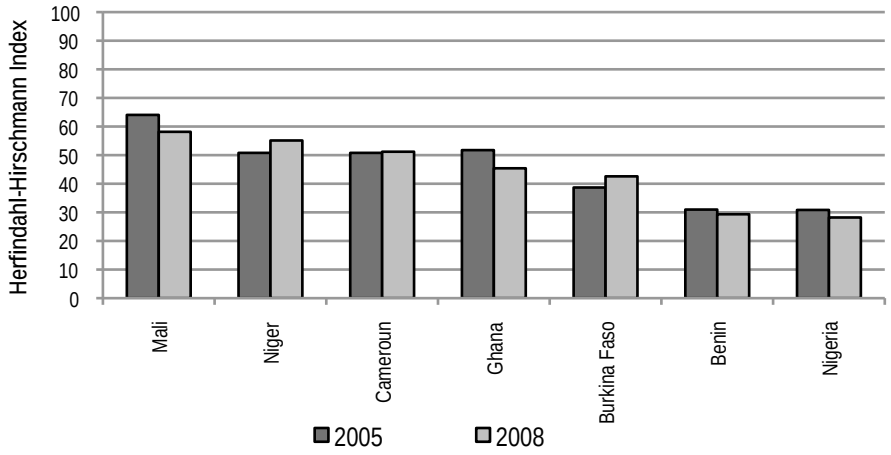



Source: Mayer and others 2008.

Despite the recent period of expansion, the development of Mali's ICT sector faces several challenges. The first is related to the way private participation is materializing. Although investment is increasing in absolute terms, the mobile market remains a duopoly, with Orange Mali and Malitel holding

70 percent and 30 percent of the market share, respectively. At close to 60 percent, Mali's mobile market has the highest Herfindahl-Hirschmann index in West Africa (figure 22).

Figure 22. The mobile market in Mali is highly concentrated




Source: World Bank (2009a)

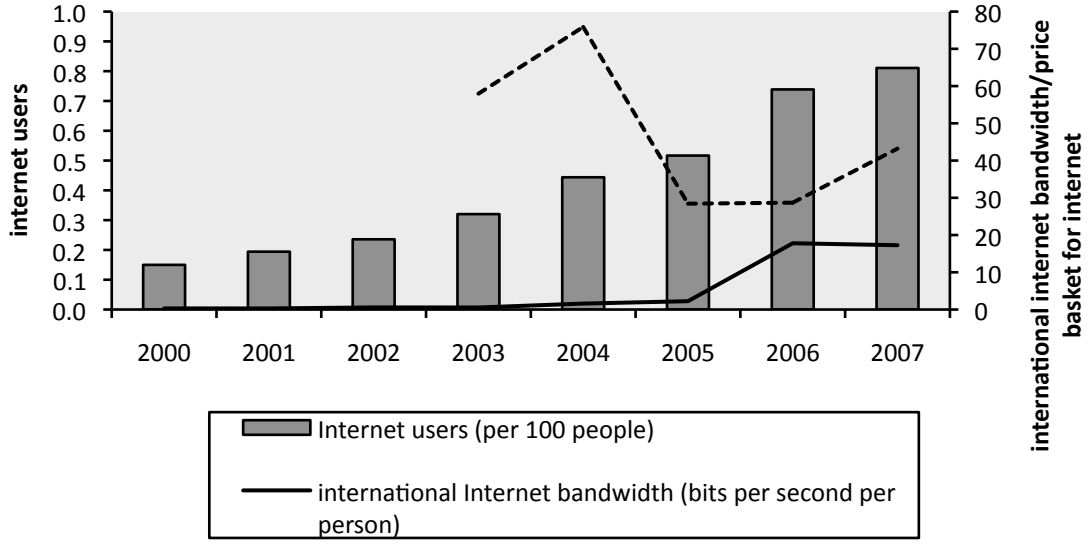
Note: Herfindahl-Hirschmann index (HHI) is a commonly accepted measure of market concentration. It is calculated by squaring the market share of each firm competing in the market and then summing the resulting numbers. A HHI of 100 indicates the market is a monopoly, while a lower the HHI the more diluted is the market power as exerted by one company/agent.

The second challenge is related to the Internet market. Over the last seven years, Internet penetration has increased substantially, and prices have dropped. In 2000, use of the Internet was almost nonexistent; by 2007, penetration had risen to 6 percent. The increase in access coincided with an increase in service quality. In 2000, connection speeds were very slow at less than 1 Mbps. In 2007, after Sotelma and Orange Mali had connected to SAT-3, connection speeds had reached 17 Mbps per person. Still, Mali lags behind other West African countries in both internet penetration and international internet bandwidth (figure 23).

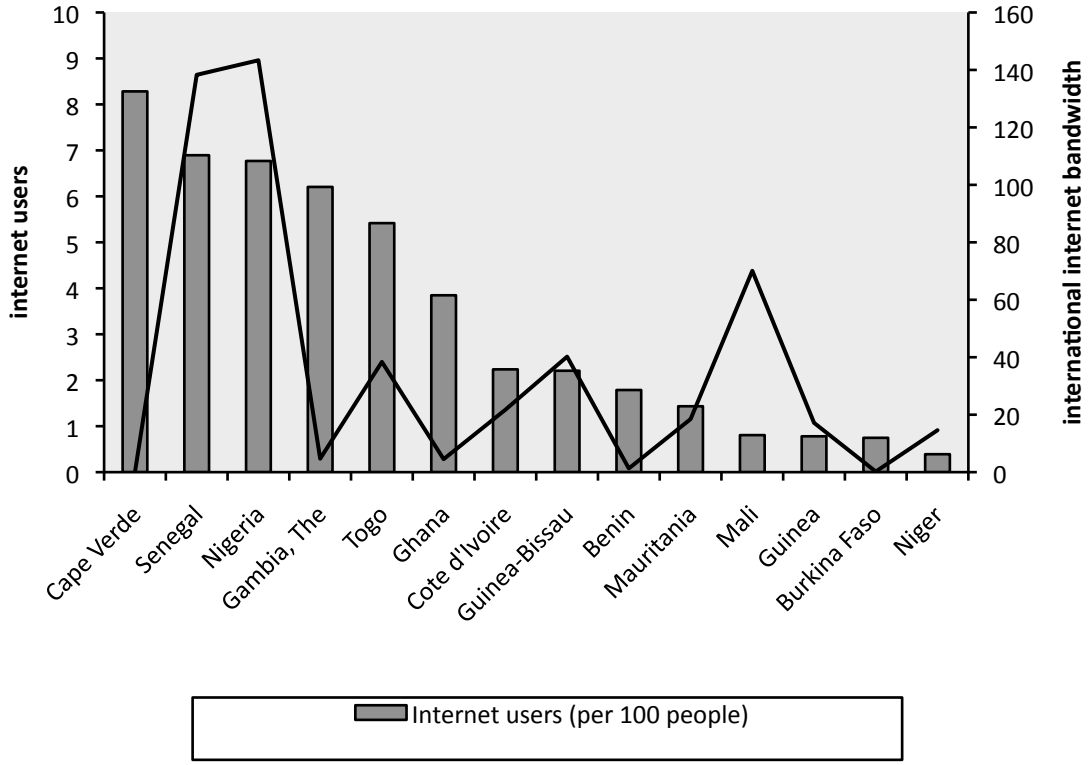
In terms of the internet market, the institutional framework of Mali's ICT sector, which allowed for the expansion of mobile markets, is now becoming a major deterrence for the expansion of Internet. A good illustration of the legal gap is the regulatory vulnerability of Internet Service Providers (ISPs). After reaching 20 active ISPs in 2008, Mali now has only 5 ISPs, two of which are wholesalers of bandwidth. The two largest operators make access difficult engaging in predatory and discriminatory practices against small ISPS, overcharge for bandwidth, and bundle their service in such a way that the market is unattainable for new and small ISPs.

Figure 23. Despite improvements, Mali's Internet market lags behind West African peers

a. Internet service trends




b. Mali's internet and West African peers




Source: World Bank, including Information and Communications for Development database.

# Financing Mali's infrastructure

To meet its most pressing infrastructure needs and catch up with developing countries in other parts of the world, Mali needs to expand its infrastructure assets in key areas (table 17). The targets outlined below are purely illustrative, but they represent a level of aspiration that is not unreasonable. Developed in a standardized way across African countries, they allow for cross-country comparisons of the affordability of meeting the targets, which can be modified or delayed as needed to achieve financial balance.

Table 17. Illustrative investment targets for infrastructure in Mali

| | Economic target | Social target |
|---|---|---|
| ICT | Fiber optic links to neighboring capitals and submarine cable | Universal access to GSM signal and public broadband facilities |
| Power | 284 MW new generation*<br>0 MW interconnectors* | Electricity coverage of 39%<br>(100% urban and 7% rural) |
| Transport | Regional connectivity by good quality 2-lane paved road<br>National connectivity by good quality 1-lane paved road | Rural network gives access to 14% agricultural production<br>Urban population within 500-meter paved road<br>Clear sector rehabilitation backlog |
| WSS | n.a. | MDG targets for water and sanitation |

Sources: Mayer and others 2008; Rosnes and Vennemo 2009; Carruthers and others 2009; You and others 2009.
* Assuming trade stagnation scenario.

Meeting these illustrative infrastructure targets for Mali would cost around $1 billion per year through 2015. Capital expenditure would account for 65 percent of this requirement. The highest annual price tag is associated with the water and power sectors, each of which requires around $300 million. The transport and ICT sectors are also in need of significant funding—around $236 million and $178 million per year, respectively. The water sector spending is associated with meeting the MDG target for water and sanitation. The power sector spending is associated with providing 284 megawatts of new generation capacity to meet demand over the next decade and boosting electrification from 13 percent to 39 percent (table 18).

Table 18. Indicative infrastructure spending needs in Mali, 2006–15

US$ million per year

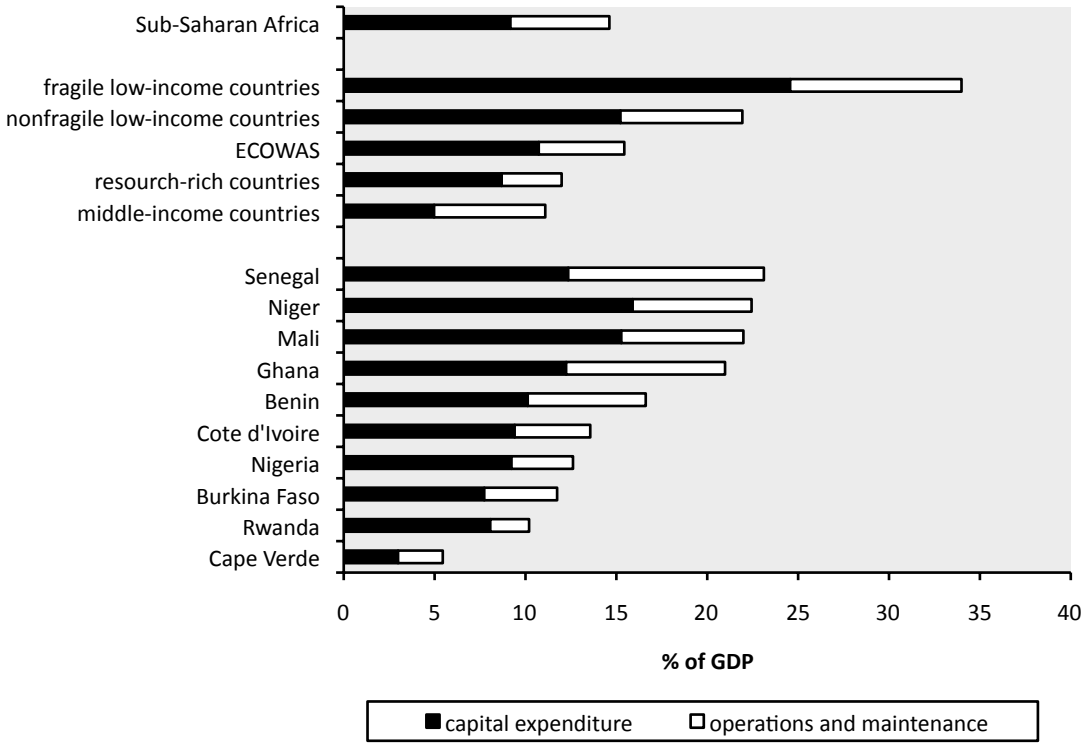
| Sector | Capital expenditure | Operations and maintenance | Total needs |
|---|---|---|---|
| Information and communication technologies | 79 | 99 | 178 |
| Power | 220 | 82 | 302 |
| Transport | 144 | 92 | 236 |
| Water supply and sanitation | 229 | 82 | 311 |
| Total | 672 | 355 | 1027 |

Sources: Mayer and others 2008; Rosnes and Vennemo 2009; Carruthers and others 2009; You and others 2009.
Derived from models that are available online at http://www.infrastructureafrica.org/aicd/tools/models

Mali's infrastructure spending needs are particularly high relative to the country's GDP—around 19 percent of GDP annually for a decade. Infrastructure investment alone would absorb 13 percent of GDP, close to the 15 percent of GDP China invested per year in infrastructure during the mid-2000s. Nevertheless, Mali's spending needs relative to GDP are on par with other low-income nonfragile African countries, which would need to spend 22 percent of GDP per year (figure 24).

Figure 24. Mali's infrastructure spending needs are substantial relative to GDP

Estimated infrastructure spending needed to meet targets, as percentage of GDP




Source: Foster and Briceño-Garmendia 2009.

Mali currently spends only $555 million on meeting its infrastructure needs (table 19). About 60 percent of the total is allocated to capital expenditure and 40 percent to operating expenditures. Operating expenditure is entirely covered by budgetary resources and payments from infrastructure users. The two largest sources of funding for infrastructure investment are the public sector and donors, both of which provide an average of $120 million per year. The private sector has been investing at about half of this level. Existing spending is predominantly channeled to the ICT, transport, and power sectors, with WSS spends at half this level.

Spending on infrastructure in Mali is about 10 percent of GDP, which is comparable to other low-income African countries (figure 25). The sources of infrastructure investment finance in Mali differ somewhat from the peer group. In particular, ODA has a pronounced role in the transport sector and a limited role in the power sector, and public investment is important for ICT (figure 26). Mali has benefited from non-OECD finance in the transport and power sectors.

Table 19. Financial flows to Mali's infrastructure, average 2002 to 2007

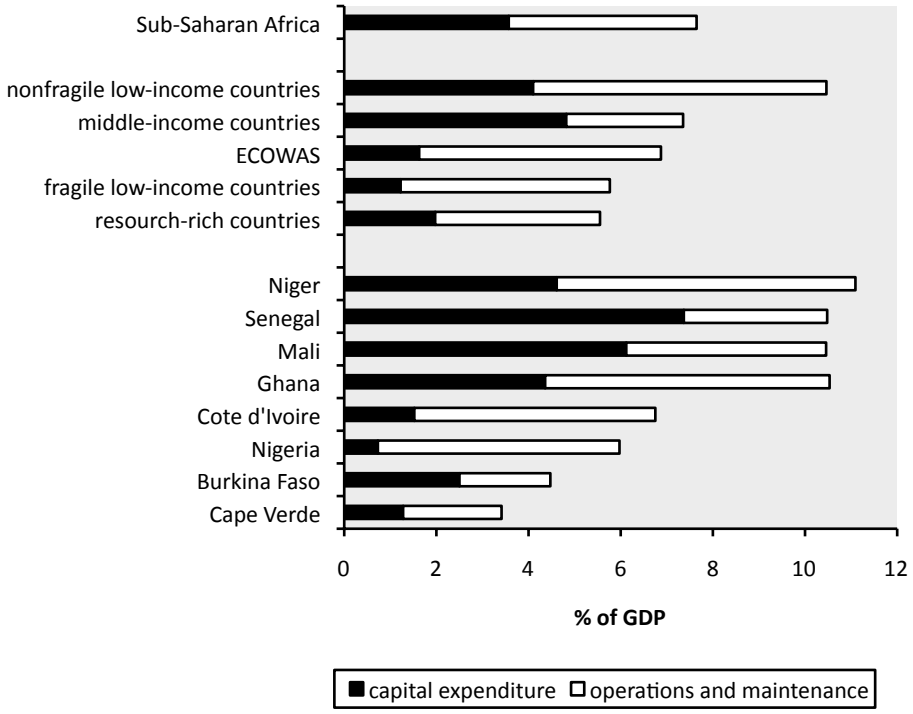
US$ millions per year

| | O&M | Capital expenditure | | | | | |
|---|---|---|---|---|---|---|---|
| | Public sector | Public sector | ODA | Non-OECD financiers | PPI | Total CAPEX | Total spending |
| Information and communication technologies | 101 | 41 | 1 | 1 | 28 | 72 | 173 |
| Power | 94 | 19 | 10 | 12 | 20 | 61 | 155 |
| Transport | 10 | 42 | 79 | 24 | 5 | 150 | 159 |
| Water supply and sanitation | 26 | 7 | 34 | 1 | 0 | 42 | 68 |
| Total | 230 | 109 | 124 | 38 | 53 | 325 | 555 |

Source: Derived from Foster and Briceño-Garmendia 2009.

O&M = operations and maintenance; ODA = official development assistance (from OECD member states); PPI = private participation in infrastructure; CAPEX = capital expenditure; OECD = Organisation for Economic Co-operation and Development.

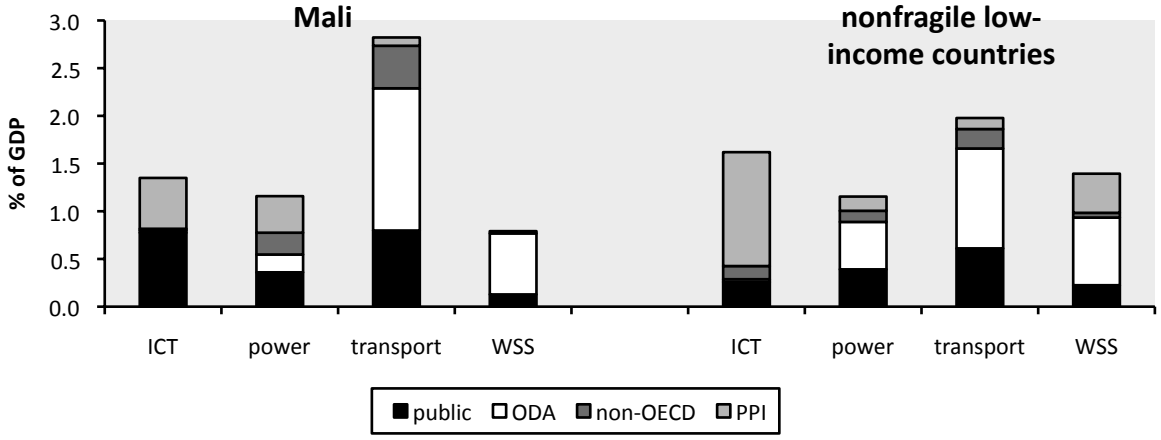
Figure 25. Mali's existing infrastructure spending is typical for a low-income country




Source: Derived from Foster and Briceño-Garmendia 2009.

Figure 26. Mali's pattern of capital investment in infrastructure differs from that of comparator countries

Investment in infrastructure sectors as percentage of GDP, by source




*Note:* Private investment includes self-financing by households.
*Source*: Derived from Briceño-Garmendia, Smits, and Foster 2009.

## How much more can be done within the existing resource envelope?

About $200 million of additional resources could be recovered each year by improving efficiency (table 20). By far the largest area of inefficiency is underrecovery of costs, which accounts for 89 percent of the total. Reducing distribution losses to a reasonable benchmark in power and water could save up to $37 million each year. Optimizing staffing levels and increasing collection efficiency respectively could reduce costs by $9 million and $6 million per year, respectively. Budget underexecution (that is, the share of budgeted funds that is actually spent) does not seem to be an issue for Mali. The two sectors that present the largest potential efficiency gains are power and water.

Table 20. Potential gains from greater operational efficiency

US$ millions per year

| Source of inefficiency | ICT | Power | Transport | WSS | Total |
|---|---|---|---|---|---|
| Underrecovery of costs | n.a. | 110 | — | 38 | 148 |
| Overstaffing | — | 9 | n.a. | 0 | 9 |
| Distribution losses | n.a. | 33 | n.a. | 4 | 37 |
| Undercollection | n.a. | 5 | — | 1 | 6 |
| Low budget execution | 0 | 0 | 0 | 0 | 0 |
| Total | 0 | 157 | 0 | 43 | 200 |

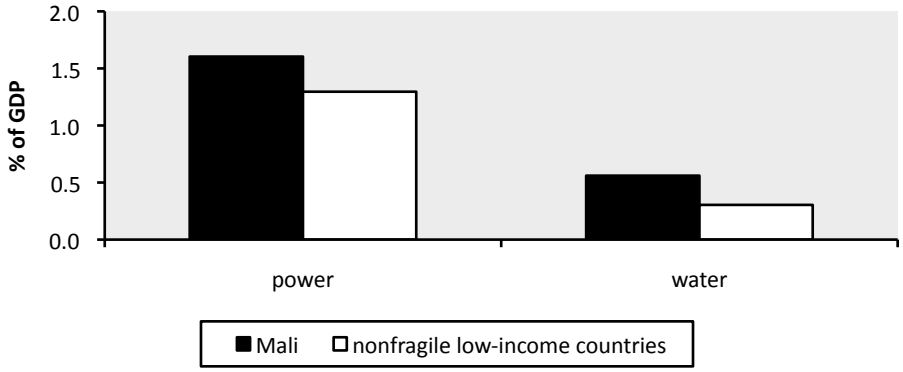
Source: Derived from Foster and Briceño-Garmendia 2009.
Note: Estimations based on operating performance data up to 2007.
— = not available; n.a. = not applicable

Underpricing of power and water services costs Mali about US$148 million each year. In the power sector, it is estimated that the average total cost of producing electricity has been $0.33 per kilowatt-hour historically (as of 2007), but the average effective residential tariff is only about $0.20. This is sufficient to cover operating and maintenance costs (barely), but not investments. Overall, the power utility covers 50 percent of costs, leaving the capital investment unfunded. The financial burden associated with

underpricing of power is close to 1.6 percent of GDP, which is considerably higher than in comparator countries (figure 27). In the water sector, tariffs are $0.34 per cubic meter compared to the estimated cost recovery tariff of $1.07 per cubic meter. The financial burden associated with underpricing of water is 0.6 percent of GDP, which is lower than that for power in Mali but higher than in comparator countries.

Figure 27. Underpricing of power and water in Mali is costly relative to comparator countries

Financial burden of underpricing in 2007, as percentage of GDP

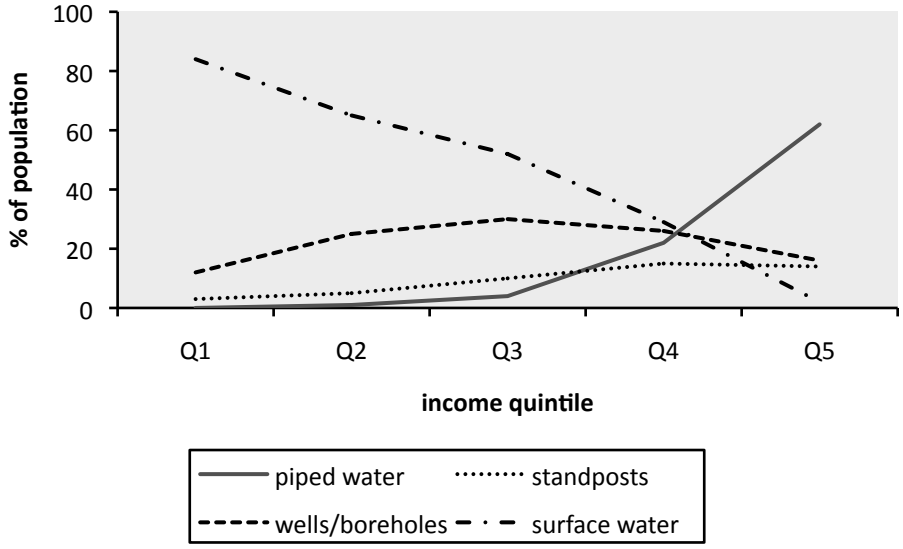



*Source*: Derived from Briceño-Garmendia, Smits, and Foster 2009.
Note: Estimations based on operational performance data up to 2007.

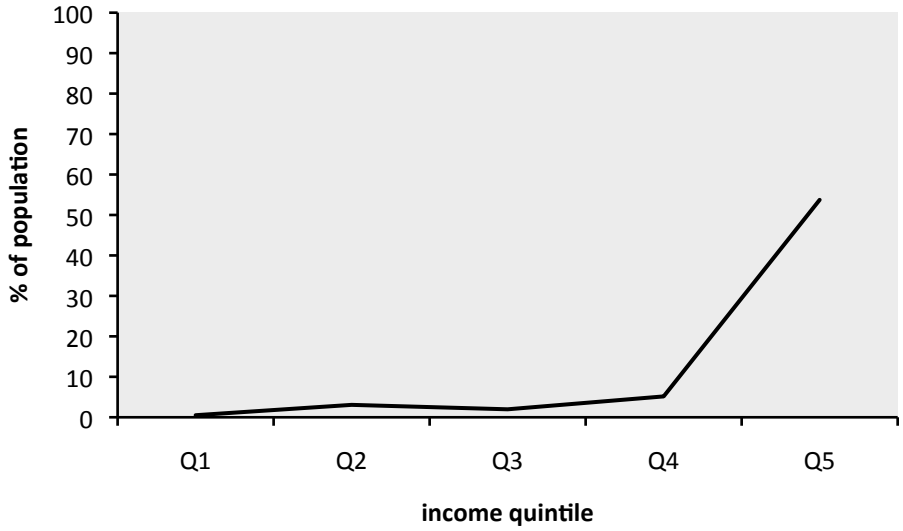
About 90 percent of people with electricity or piped water connections belong to the top income quintile; connections are virtually nonexistent for poorer households (figure 28). This highly inequitable distribution of connections virtually guarantees that any price subsidy to these services will be extremely regressive.

Figure 28. Consumption of infrastructure services in Mali is highly differentiated by household budget

a. Mode of water supply, by income quintile




b. Prevalence of connection to power grid among Kenyan population, by income quintile

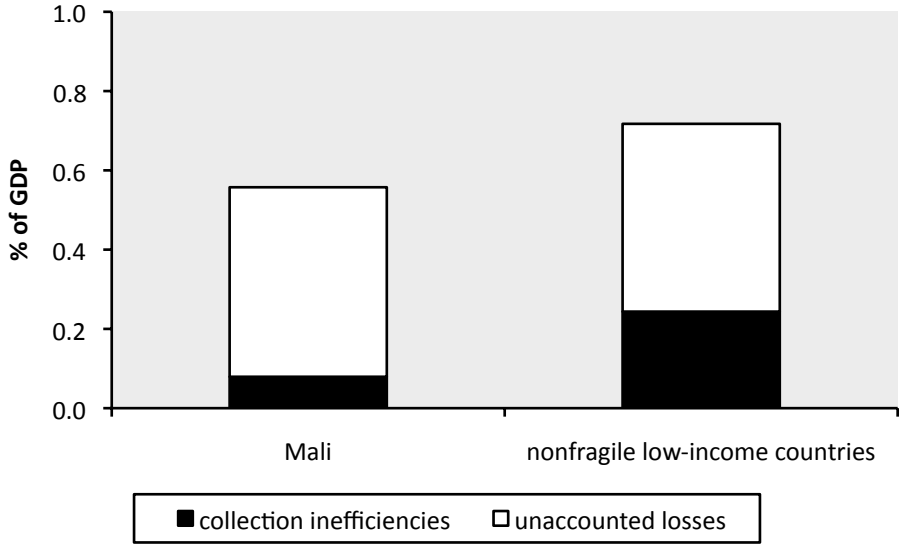



Legend: Q1 – first budget quintile, Q2 – second budget quintile, etc.
Source: Banerjee and others 2009.

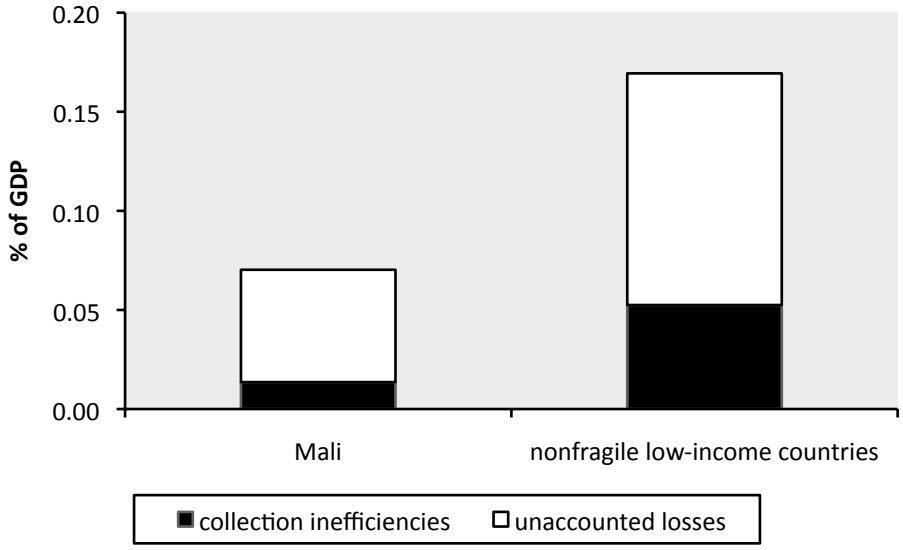
Operational inefficiencies of power and water utilities cost Mali $52 million each year, or 0.8 percent of GDP. Mali's power utility faces distribution losses of 24 percent (around twice best practice levels). As a result, Mali's power utility generates major hidden costs for the economy. The utility's collection rate is comparatively high at around 96 percent. In the case of water, revenue collection inefficiencies are comparatively low, and distribution losses stand at 29 percent compared to the best practice benchmark of 20 percent. Due to the smaller financial turnover of the water sector, these hidden costs weigh less heavily on GDP (figure 29).

Figure 29. Mali's power and water utilities burden of inefficiency

a. Uncollected bills and unaccounted losses in the power sector, as a percentage of GDP




b. Uncollected bills and unaccounted losses in the water sector, as a percentage of GDP




*Source*: Derived from Briceño-Garmendia, Smits, and Foster 2009.
Note: Estimations based on operational performance data up to 2007.

## Annual funding gap

Mali's infrastructure funding gap amounts to $283 million per year, or about 5 percent of GDP. More than half of the funding gap is in the water sector, for which the annual shortfall for meeting the Millennium Development Goals is $200 million (table 21). Another significant part of the gap is found in the transport sector, which requires an additional $77 million to meet the country's development goals. Our analysis finds no funding gap in the power sector since the potential efficiency gains could compensate for the shortfall.

Table 21. Funding gaps by sector

US$ millions per year

| | ICT | Power | Transport | WSS | Total |
|---|---|---|---|---|---|
| Needs | (178) | (302) | (236) | (311) | (1027) |
| Spending traced to needs | 171 | 143 | 154 | 68 | 536 |
| Within-sector reallocation | 2 | 12 | 5 | 0 | 19 |
| Potential efficiency gains | 0 | 157 | 0 | 43 | 200 |
| (GAP) or surplus | (6) | | (77) | (200) | (283) |

Source: Derived from Foster and Briceño-Garmendia 2009.

Note: Potential overspending across sectors is not included in the calculation of the funding gap, because it cannot be assumed that it would be applied toward other infrastructure sectors. Inefficiency estimations based on operational performance data up to 2007

— = data not available.

## What else can be done?

The most obvious way to address Mali's funding gap is to raise additional finance. At the current level and pattern of spending even if all inefficiencies are corrected, Mali would need to increase its spending by 50 percent what have been seen in recent years. Additional finance might be hard to secure. Even if additional finance is not secured, Mali can reduce the infrastructure funding gap through its own policy choices, and in particular through the technology choices to meet its infrastructure targets. The largest measure that the country could take to reduce its infrastructure spending needs would be to integrate itself more closely within the West Africa Power Pool. If it were to do so, the country would become a net importer of power, importing up to 12.7 terawatt-hours of electricity by 2015, which would reduce annual investment requirements by $124 million (table 22). Another $77 million a year could be saved by adopting lower cost technologies—such as standposts, boreholes, and improved latrines—to meet the targets set in the Millennium Development Goals. Finally, $83 million a year could be saved by adopting appropriate technologies for surfacing of paved roads. If all of these policy measures were adopted, Mali could save $285 million per year, reducing the infrastructure funding gap to $104 million per year.

Table 22. Potential gain from innovation

US$ millions

| | Before innovation | After innovation | Savings | Savings as % of sector funding gap | Savings as % of total funding gap |
|---|---|---|---|---|---|
| Power trade | 302 | 178 | 124 | No gap | 44 |
| WSS, appropriate technology | 311 | 234 | 77 | 39 | 27 |
| Roads, appropriate technology | 236 | 153 | 83 | 108 | 29 |
| Total | 849 | 565 | 285 | 101 | 101 |

Source: Derived from Foster and Briceño-Garmendia 2009.

If all else fails, it may be necessary to extend the time horizon for meeting the infrastructure targets beyond the 10-year period considered here. Simulations suggest that even if Mali is unable to raise additional finance, the identified infrastructure targets could be achieved within a 15-year horizon as long

as inefficiencies can be addressed. Without stemming inefficiencies, however, the existing resource envelope will not suffice to meet infrastructure spending needs in the 10-year time horizon forecasted.

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This country report draws upon a wide range of papers, databases, models, and maps that were created as part of the Africa Infrastructure Country Diagnostic. All of these can be downloaded from the project website: www.infrastructureafrica.org. For papers go to the document page (http://www.infrastructureafrica.org/aicd/documents), for databases to the data page (http://www.infrastructureafrica.org/aicd/tools/data), for models go to the models page (http://www.infrastructureafrica.org/aicd/tools/models) and for maps to the map page (http://www.infrastructureafrica.org/aicd/tools/maps ). The references for the papers that were used to compile this country report are provided in the table below.

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