

# Developing Africa's Infrastructure for Enhanced Competitiveness

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As seen in the previous chapters of this *Report*, Africa suffers from a pronounced infrastructure deficit. Compared with countries in other regions, African countries have a low stock of infrastructure, particularly in energy and transportation, and the potential for information and communication technologies (ICTs) has not been fully harnessed. Coupled with burdensome trade regulations (as noted in Chapter 2.1), these deficiencies have constrained gains in domestic productivity and present a critical bottleneck to more regional integration.

Against this backdrop, this chapter examines the link between infrastructure development and competitiveness in Africa in greater detail. This connection is analyzed while remembering that competitiveness is determined by a number of interrelated factors, policies, and institutional capabilities, as well as the initial conditions as discussed in Chapter 1.1. This chapter focuses on energy, transportation, and ICTs. It examines the state of infrastructure in these sectors and the challenges to infrastructure development in Africa, including its regulatory environment. It also analyzes the impact of infrastructure development on Africa's competitiveness and provides the way forward. The chapter draws on 16 country studies undertaken by the African Development Bank (AfDB), the results of which inform the analysis, conclusions, and recommendations presented here.

Inadequate infrastructure has raised the transaction costs of business in most African economies. Today African countries exhibit the lowest levels of productivity of all low-income countries and are among the least competitive economies in the world (see Chapter 1.1). Inadequate infrastructure has been estimated to shave off at least 2 percent of Africa's annual growth.<sup>1</sup> With adequate infrastructure, African firms could achieve productivity gains of up to 40 percent.<sup>2</sup>

Infrastructure that is sufficient and works properly is crucial for Africa's economic integration. African economies can begin the process of deep integration if their infrastructure networks are designed in such a way as to link production centers and distribution hubs across the continent, as the networks of developed economies do. Such infrastructure will enable Africa to compete effectively, tap into regional markets, and

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This chapter focuses on three sectors—energy, transportation (including roads, railways, air transport, and ports), and ICTs—and is based on 16 infrastructure country studies undertaken by the African Development Bank (AfDB): Algeria, Egypt, and Morocco (North Africa); Cameroon and Chad (Central Africa); Burkina Faso, Ghana, Nigeria, and Senegal (West Africa); Ethiopia, Kenya, Tanzania, and Uganda (East Africa); and Mozambique, South Africa, and Zambia (Southern Africa). The individual country studies were prepared by the following AfDB staff: Gilbert Galibaka, Thierry Kangoye, Succès Assyongar Masra, Ralf Kruger, Audrey Verdier-Chouchane, Jennifer Mbabazi Moyo, Daniel Isooba, Jacqueline Odula, Peter Ondiege, Emilio A. F. Dava; and the following consultants: Ishmael Abeyie, John Luiz, and Thierry Urbain Yogo. The authors also gratefully acknowledge the very useful comments provided by Steve Kayizzi-Mugerwa, Director, AfDB Development Research Department; Issa Faye, Manager, AfDB Research Division; Emelly Mutambatsere and Anthony Simpasa, AfDB Development Research Department; and the above-mentioned individual country study authors.

benefit from globalization through investment and trade. To achieve this calls for the construction of an efficient and secure national and cross-border physical infrastructure as well as a coherent system of regulation for business transactions.<sup>3</sup>

Infrastructure is also critical for the promotion of inclusive and sustainable growth. Rural infrastructure— notably feeder roads and transmission lines that connect rural communities to national grids—enable individuals, households, communities, and small businesses to embark on income-generating activities thanks to improved access to electricity and links to markets. The use of renewable energy or environment-friendly sources of energy—including solar, wind, geothermal, and hydropower, with all of which Africa is well endowed— would contribute to making growth sustainable.

A considerable investment in infrastructure that uses innovative sources of funding is needed to address Africa's low level of competitiveness (see Chapter 1.1). Indeed, the Programme for Infrastructure Development in Africa (PIDA) estimates that Africa will need to invest up to US\$93 billion annually until 2020 for both capital investment and maintenance.<sup>4</sup> Given the substantial amounts involved, governments will need to be innovative in the search for sustainable approaches to infrastructure development as well as financing. The private sector will need to play an increasingly important role. Governments will do well to create conditions where private-sector engagement is encouraged, probably through public-private partnerships (PPPs). Efficiency gains from performance improvements in infrastructure provision are themselves a significant source of finance,<sup>5</sup> and the development of infrastructure bonds as a financing vehicle will need to be encouraged.

Adequate maintenance plans are prerequisites for sustainable infrastructure. Maintenance is not only corrective but also preventative because it inspects assets and reduces the risk of failure. Costs associated with statutory maintenance can be substantial—even considerably larger than the value of the asset—yet providing for these maintenance costs is crucial. Without adequate maintenance, infrastructure deteriorates quickly and is unsustainable.

Indeed, the longer-term performance of the ICT sector should be reviewed in light of the adequacy of maintenance plans. Thus far, ICT sector performance has been good, albeit from a low base. It is noteworthy, however, that although ICT infrastructure is relatively new, it could rapidly become obsolete and downgraded if maintenance plans are not in place and implemented. It is therefore critically important to make adequate provisions to ensure maintenance is undertaken in a timely manner, thereby making gains from ICTs sustainable.

The rest of this chapter will elaborate on issues of African infrastructure and competitiveness, focusing on the energy, transportation, and ICT sectors. The next section considers the impact of infrastructure on country

competitiveness; the following section focuses on the state of Africa's infrastructure and the challenges this presents, and on its regulatory environment in these three sectors. The final section provides the conclusion and way forward.

## THE IMPACT OF INFRASTRUCTURE DEVELOPMENT ON AFRICA'S COMPETITIVENESS

Well-developed energy, transportation, and communication infrastructure networks are a prerequisite for linking less-developed communities to markets in a sustainable way. Effective modes of transport—including quality roads, railroads, air transport, and ports—enable entrepreneurs to get their goods and services to markets in a secure and timely manner, facilitate the movement of workers to the workplace, and encourage foreign direct investment. Economies also depend on electricity supplies that are free from interruptions and shortages so that businesses and factories can work unimpeded. In addition, a solid and extensive telecommunication network allows for a rapid and free flow of information, which increases overall economic efficiency by ensuring that businesses can communicate and make timely decisions, taking into account all available relevant information.

### Infrastructure, competitiveness, and the cost of doing business

Empirical research has shown that there is a positive relationship between infrastructure investment and economic growth. Several researchers demonstrate the beneficial impact of infrastructure investments on growth in African economies; this occurs because solid infrastructure accelerates annual growth convergence rates by as much as 13 percent and also increases per capita annual growth by almost 1 percent.<sup>6</sup> In fact, some of this work argues that the strongest impact comes from telecommunications, followed by roads and electricity. For example, it has been estimated that investing an additional 1 percent of gross domestic product (GDP) in transportation and communications on a sustained basis increases the GDP per capita growth rate by 0.6 percent.<sup>7</sup>

Productivity growth—and thus increasing competitiveness—is higher in countries with an adequate supply of infrastructure services.<sup>8</sup> Infrastructure therefore plays a critical role in enhancing a country's competitiveness and in easing the cost of doing business,<sup>9</sup> as discussed in Chapter 1.1. The flipside of this relationship is that, in countries with inadequate infrastructure, firms are burdened with high costs as they try to provide infrastructure themselves, suffer potentially huge inefficiencies, or are simply unable to conduct activities for which infrastructure services are a prerequisite. The beneficial effects of infrastructure on competitiveness are captured in Box 1.

**Box 1: Infrastructure development indicators and competitiveness, selected countries (2012–13)**

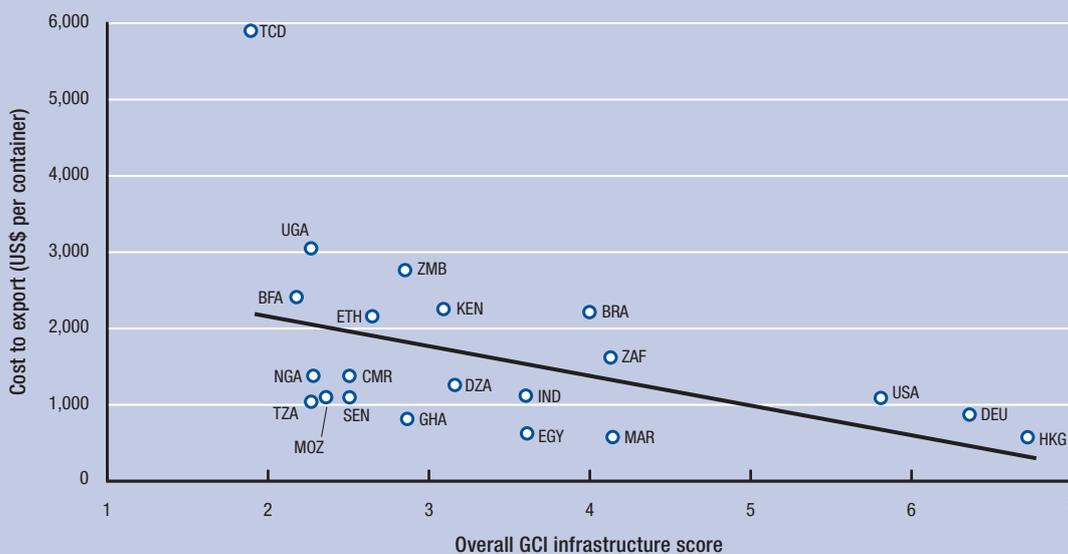
Infrastructure, through improved connectivity, changes the incentive structure and impacts market prices, thereby improving consumer welfare and reducing the cost of doing business. It is well documented in the literature that infrastructure development reduces the asymmetry of information and agricultural market efficiencies in Africa. Improved access to price information through better transport or ICT networks reduces marketing costs, improves farm-gate prices and lessens their volatility, and enhances productive efficiency.<sup>1</sup>

This box illustrates the reciprocal relationship that competitiveness in countries has with infrastructure. Overall

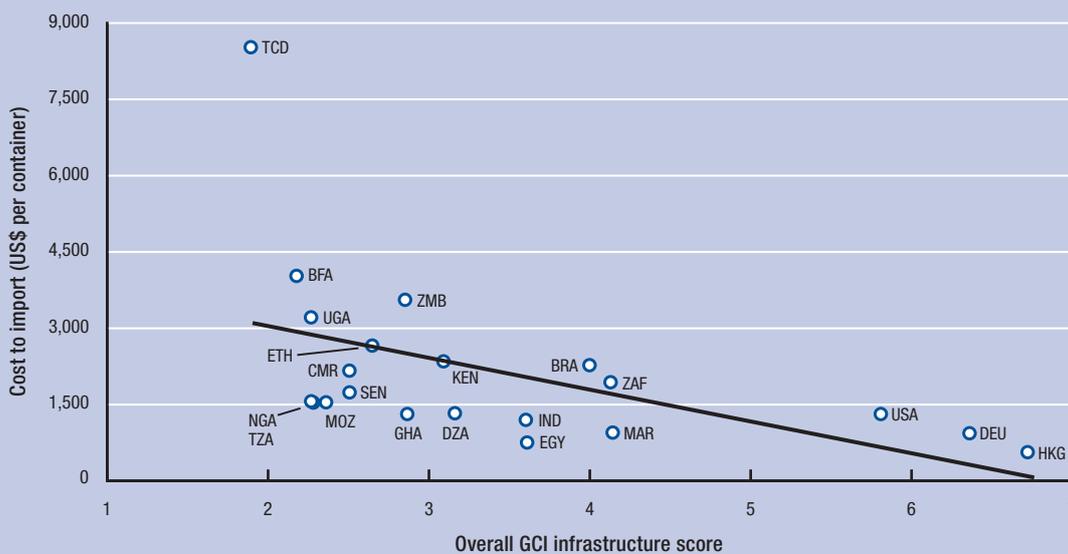
infrastructure scores were obtained by averaging the scores of the two subpillars of the infrastructure pillar of the Global Competitiveness Index (GCI): Transport infrastructure (encompassing the quality of overall infrastructure, the quality of roads, the quality of railroad infrastructure, the quality of port infrastructure, the quality of air transport infrastructure and the available airline seat kilometers) and Electricity and telephony infrastructure (encompassing the quality of electricity supply, mobile telephone subscriptions and fixed telephone lines). The scores range from 1 to 7, with 7 being the best outcome.

As shown in Figures A1 and A2, weak general

**Figure A1: Cost to export**



**Figure A2: Cost to import**



Sources: World Economic Forum, 2012; World Bank *Doing Business Database* 2012/13.

Notes: GCI = Global Competitiveness Index. Country labels are as follows: DZA (Algeria), BRA (Brazil), BFA (Burkina Faso), CMR (Cameroon), TCD (Chad), EGY (Egypt), ETH (Ethiopia), DEU (Germany), GHA (Ghana), HKG (Honk Kong SAR), IND (India), KEN (Kenya), MAR (Morocco), MOZ (Mozambique), NGA (Nigeria), SEN (Senegal), ZAF (South Africa), Tanzania (TZA), Uganda (UGA), USA (United States), and ZMB (Zambia).

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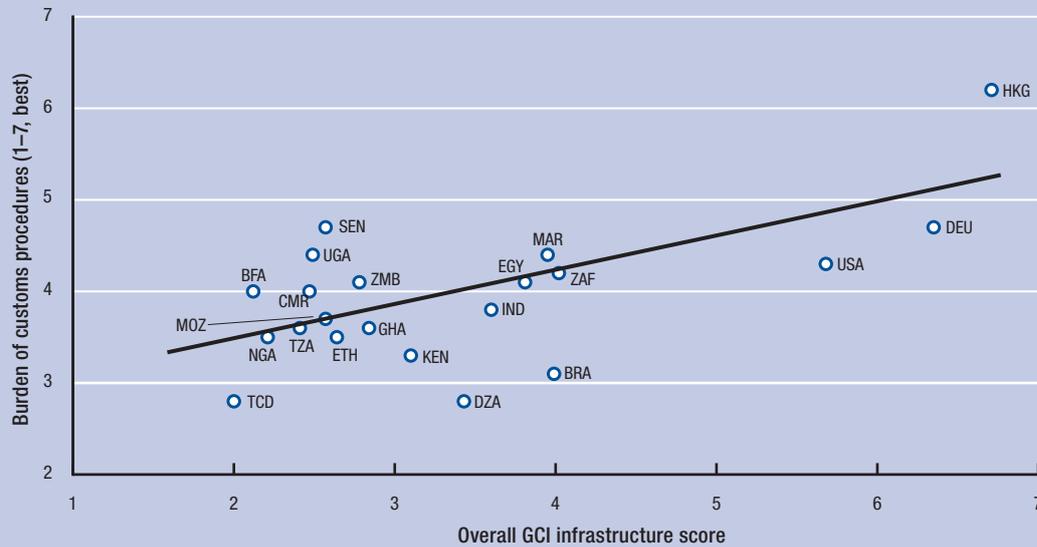
**Box 1: Infrastructure development indicators and competitiveness, selected countries (2012–13) (cont'd)**

infrastructure impedes trade because it results in increased costs.

Countries with better infrastructure tend to have more

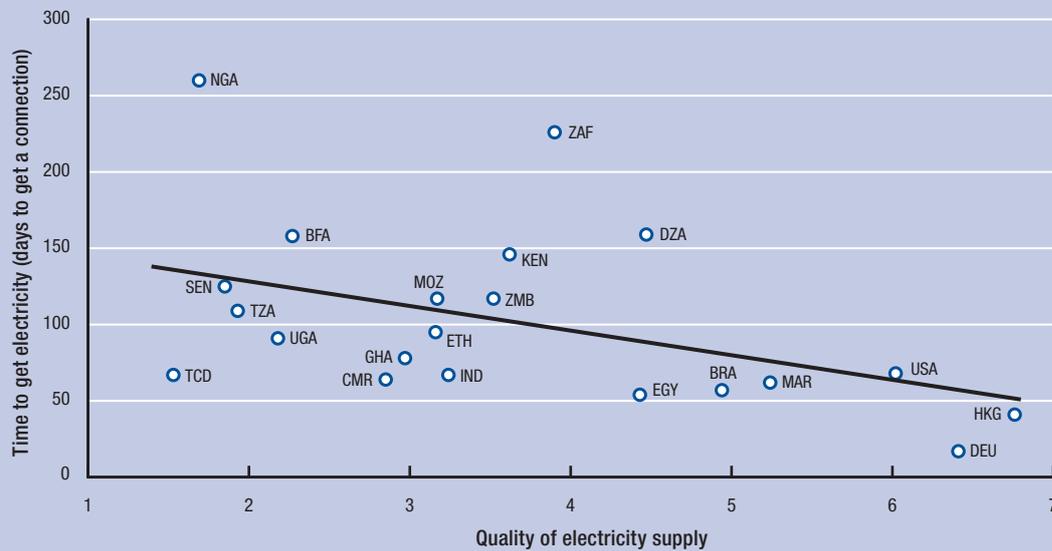
efficient customs procedures (Figure B1). Access to energy is substantially improved in countries with a higher quality of electricity supply (Figure B2).

**Figure B1: Impact of customs procedures**



Sources: World Economic Forum, Executive Opinion Survey 2010–2011 weighted average; World Bank data, available at <http://data.worldbank.org/indicator/IC.ELC.TIME>.  
 Notes: The *burden of customs procedures* measures business executives' perceptions of their country's efficiency of customs procedures, and is computed using answers to the following question: "How would you rate the level of efficiency of customs procedures (related to the entry and exit of merchandise) in your country? [1 = extremely inefficient; 7 = extremely efficient]."  
 GCI = Global Competitiveness Index. For country labels, see the notes to Figures A1 and A2.

**Figure B2: Impact of access to electricity**



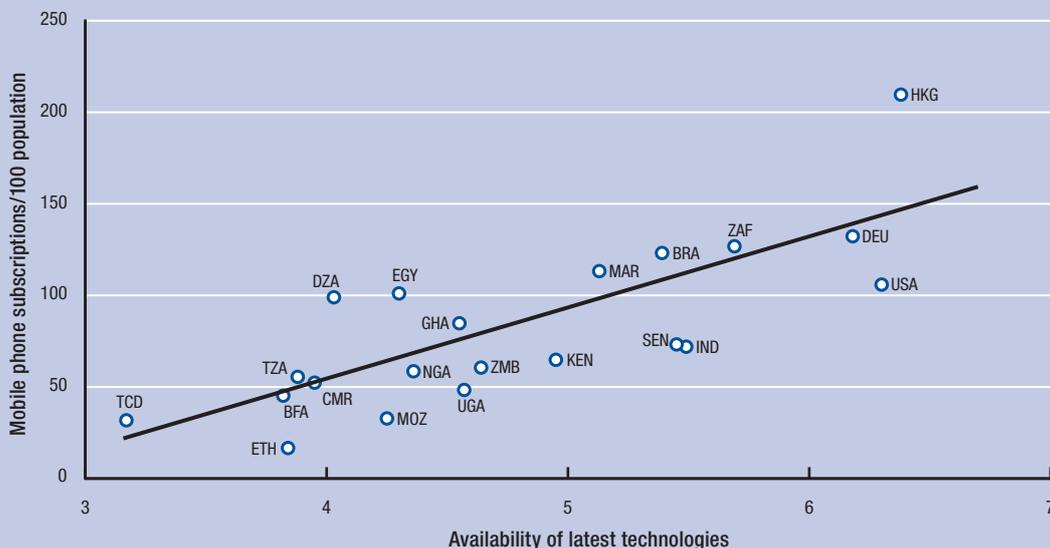
Sources: World Economic Forum, Executive Opinion Survey 2011–2012 weighted average; World Bank data, available at <http://data.worldbank.org/indicator/IC.ELC.TIME>.  
 Notes: *Quality of electricity supply* measures business executives' perceptions of their country's efficiency of electricity supply in answer to the Executive Opinion Survey question "How would you assess the quality of the electricity supply in your country (lack of interruptions and lack of voltage fluctuations)? [1 = insufficient and suffers frequent interruptions; 7 = sufficient and reliable]."  
 GCI = Global Competitiveness Index. For country labels, see the notes to Figures A1 and A2.

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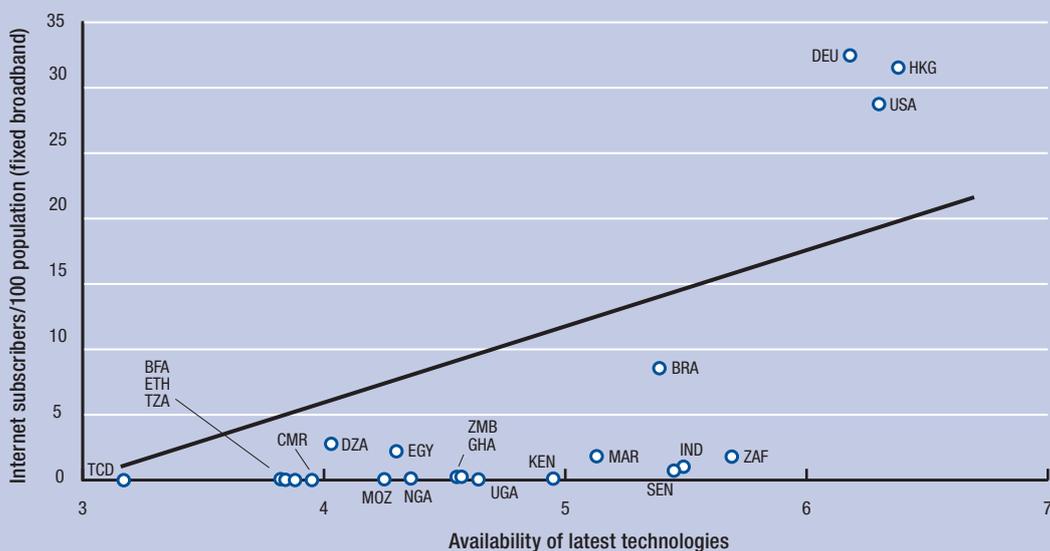
**Box 1: Infrastructure development indicators and competitiveness, selected countries (2012–13) (cont'd)**

The availability of the latest technologies has a positive impact on both the use of mobile cellular phones and on Internet use in developing countries (Figures C1 and C2).

**Figure C1: Impact of the latest technology: Access to mobile phones**



**Figure C2: Impact of the latest technology: Access to the Internet**



Sources: World Economic Forum's Executive Opinion Survey 2011–2012 weighted average; ITU 2012.  
 Notes: *Availability of latest technology* is assessed through a score (positively ranged) that is computed from answers to the Executive Opinion Survey question "To what extent are the latest technologies available in your country? [1 = not available; 7 = widely available]."  
 GCI = Global Competitiveness Index. For country labels, see the notes to Figures A1 and A2.

**Sources:** Adapted from the World Economic Forum data platform (<http://www.weforum.org>) and World Development Indicators online statistics (<http://databank.worldbank.org>).

**Note**  
 1 Aker, 2008; Aker and Mbiti, 2010; Muto and Yamano, 2009.

### Box 2: Planned infrastructure projects and expenditures in selected African countries

- Kenya:** Under Vision 2030 priorities, infrastructure sector financial requirements are estimated to rise from 398.2 billion Kenya shillings (KES) in 2012/13 to KES 486 billion in 2014/15. The government has prioritized the development of high-quality energy and ICT infrastructure, and established the National Construction Authority in 2012 to enhance the efficiency and effectiveness of government service delivery.

Projects include the construction of over 600 kilometers of roads, the expansion of two international airports, the development and expansion of Mombasa Port, the construction of the new Lamu Port, and new railway lines. Energy projects emphasize renewable energy to increase generation capacity and access to energy. The ICT projects will include the development of Konza Techno City, which is expected to contribute 2.8 percent of GDP through ICT projects. They also include the creation of 30 ICT centers, called *digital village projects* or *PASHA centers*.
- South Africa:** Infrastructure plans are estimated at 3.2 trillion South African rand (R), of which about a quarter are being financed and implemented; the remaining three-quarters are under assessment. Sixty percent of funding for infrastructure is allocated to electricity projects, and the cost of providing energy and transportation for these planned electricity projects is 18 percent of the development costs.
- Tanzania:** The 2012/13 budget for infrastructure includes (1) 498.9 billion Tanzania shillings (T Sh) for electricity; (2) T Sh 1,382.9 billion for transportation, and (3) T Sh 4 billion for ICTs. Moreover, the government will implement the construction of a gas pipeline from Mtwara to Dar es Salaam with a Chinese loan of US\$1,225.3 million.
- Zambia:** The 2013 Zambian budget prioritizes roads, rail, and power generation. The government is making efforts to enhance domestic resource mobilization and create the fiscal space needed to support investment in infrastructure and human capital development, and to improve public service delivery. Domestic revenue is expected to increase from 19.0 percent of GDP in 2012 to 20.1 percent by 2015. Zambia has also issued a US\$750 million Eurobond to raise development finance at one of the lowest prices for a debut issue in sub-Saharan Africa. The funds will be used for energy infrastructure (US\$255 million, or 34.0 percent) and road and rail transport infrastructure (US\$430 million, or 57.3 percent).

Source: AfDB, forthcoming.

#### The energy sector

Infrastructure constraints, particularly in transport and energy, are a significant productivity handicap that undermines competitiveness. In East African countries, such as Kenya, infrastructure shortcomings—mainly

in energy and transport—are estimated to account for about 30 percent of the productivity handicap faced by Kenyan firms,<sup>10</sup> which are burdened with high costs as they attempt to provide the missing infrastructure or have to forego the activities that require infrastructure. In Central African countries, such as Cameroon, infrastructure constraints account for about 42 percent of the productivity gap faced by firms.<sup>11</sup>

#### The transportation sector

Reliable transport infrastructure, in all of its four subsectors—roads, railways, air transport, and ports—is an essential component of all countries' competitiveness. It is particularly crucial for landlocked countries, for which it is a prerequisite to opening up production zones. Reliable transport must be in place for companies to import and export goods, to fill orders, and to obtain supplies. For example, 78 percent of Burkina Faso's trade is carried by four main roads and rail corridors linking the country to the gateway ports in Benin, Côte d'Ivoire, Ghana, and Togo.<sup>12</sup> Eighty percent of the economic activity in Senegal is concentrated in Dakar.<sup>13</sup> And in South and East Africa, port congestion and shipment delays undermine the ability to acquire imported production inputs, with resulting production losses and higher production costs.<sup>14</sup>

Improvements in infrastructure therefore have the potential to open up production zones and facilitate product delivery while reducing their costs. The lack of a good road network linking the Casamance region to the other economic zones is hampering the region's enormous agricultural and horticultural production potential. Accordingly, Senegal has embarked on an ambitious program of infrastructure development to foster competitiveness. The program includes the current flagship road infrastructure project, which involves the construction of a 32-kilometer toll highway that will link Dakar to Diamniadio in the western part of the country. This road is part of the Dakar–Njaména–Djibouti corridor, and will serve the Blaise Diagne International Airport, currently under construction.

The list that follows looks at each of the subsectors of transportation in more detail:

- Roads:** Infrastructure, particularly roads, facilitates the entry of new firms into the formal sector. Recent research shows a positive correlation between better road infrastructure and the number and size of startups.<sup>15</sup> Firm-level evidence suggests that more companies offering the same product in one location leads to lower prices and higher productivity. Good roads increase both the number of new firms entering a given location and the geographic size of the relevant market.<sup>16</sup> An assessment of the impact of the new rural road from Daleti to Oda Bildingulu in Ethiopia showed how incentives for farmers changed and resulted in a sixfold increase in the production of sesame over

the 2003/04 to 2007/08 period.<sup>17</sup>

- **Rail transport:** Inefficiencies and an inadequate railroad network contribute to high costs of doing business in the continent. This area is being addressed by several African countries. For instance, Zambia's focus is to improve the operational efficiency of the Zambia Railways and the TAZARA Railway (which connects Dar es Salaam in Tanzania with Kapiri Mposhi in Zambia), and promote new railway developments using the PPP framework. The government also intends to extend the Zambia Railways network to the Botswana Railways network via the planned Kazungula Bridge, which will facilitate the flow of goods and labor. In South Africa, problems with rail transport have resulted in an overuse of road transport. As a result, the World Bank's *Doing Business Database* indicates a drop in the country's overall ranking from 35 to 39 between 2008 and 2013.<sup>18</sup>
- **Air transport:** The importance of air transport, particularly for landlocked countries, cannot be overemphasized. It is imperative that countries enhance this sector's development to improve connectivity and safety and to reduce costs in order to promote intra-African and global trade. Air transport has to be enhanced not only by the amount and quality of physical infrastructure but also, even more importantly, by the way it is operated with regard to air-traffic control and ground-air communications, which are inadequate in much of the region and need to be boosted.<sup>19</sup>
- **Ports:** Enhancing port infrastructure substantially reduces the cost of production for enterprises. Accordingly, in West Africa, for instance, as a result of the recent Dakar Port Container Development Project, Senegal has been able to expand its exposure to international markets. Indeed, recent statistics indicate that the volume of the port traffic has increased by 13.37 percent over the period 2007–11. The average waiting time for ships is estimated to have dropped from 15 hours to 2 hours, and for trucks from several hours to less than 30 minutes, significantly reducing the cost of production for enterprises.<sup>20</sup> The port enhancement project will increase berth capacity by 50 percent and vessel productivity from 20 moves per hour to 61 moves per hour. Moreover, the port will operate the terminal continuously, on a 24-hour-a-day basis. Costs have also been reduced by improving "soft" port infrastructures because the country has implemented an electronic customs clearance system and liberalized the container shipping market.<sup>21</sup>

### *The ICT sector*

Development of an adequate-quality ICT infrastructure network will enhance productivity, reduce communication costs, and promote financial inclusion and regional integration. To this end, AfDB-supported projects such as the Eastern Africa Submarine System (EASSy) cable project (a submarine system of fiber-optic cables connecting Africa to the rest of the world) and the Central African Backbone Program (a system of fiber-optic cables linking African countries to each other) are meant to enhance quality and reduce communication prices in mobile backhaul and mobile telephony. Such projects facilitate regional integration and improve outreach to peri-urban and rural areas. An assessment of the impact of EASSy, for example, suggests a reduction of wholesale bandwidth prices by at least 60 percent in Tanzania and up to 90 percent in Kenya; an increase of 150 percent to 200 percent in international bandwidth utilization within less than six months of submarine cable availability in these countries, including penetration in rural and un-served areas; and high mobile phone penetration rates, which have also improved access to banking services for the unbanked, as evidenced by the deployment of the mobile payment system M-PESA in Kenya (see Box 7). The projects may also contribute to the use of ICT applications such as e-government, e-education, and e-health.

### **Improving infrastructure development and competitiveness: Evidence from selected African countries**

To address the infrastructure gap, governments—in collaboration with the private sector and development partners—have put in place policy reforms, programs, projects, and the necessary financial resources to improve on the quantity and quality of infrastructure (see Box 2). This section highlights a few ongoing and planned infrastructure projects and committed resources in selected African countries. It is expected that the combination of these efforts will contribute to improving countries' productivity and hence their competitiveness in the coming years.

### **Regional infrastructure development: Lessons learned**

In the transportation sector, the AfDB emphasizes the expansion of regional corridors, trunk and rural roads, railways, and urban programs that support or open up economic hubs. In the energy sector, the AfDB focuses on energy efficiency, clean and renewable energy, and the support of regional power pools. In the ICT sector, priority is given to broadband and backbone infrastructure that connect countries to one another and to the rest of the world (see Appendix A for some of the projects in which the AfDB is involved). The AfDB also finances infrastructure development geared toward promoting competitiveness in African countries through regional integration. The lessons learned from the

### Box 3: Regional integration as a catalyst to Africa's economic transformation and competitiveness

Regional integration is essential to achieving structural transformation in African economies, which can boost both productivity per worker and living standards. The regional integration agenda incorporates a range of objectives, which include improving African producers' access to regional markets and integrating them into more productive regional value chains; integrating financial markets to enable capital to flow more readily among national economies; and ensuring the free movement of goods, services, labor, and capital. All these objectives require investments at a number of levels.

The African Development Bank (AfDB)'s Regional Integration Strategy (RIS) for 2009–2012 focuses on regional infrastructure, trade, and regional public goods. Lessons learned in implementing the AfDB's regional program include:

- *Regional projects are complex but transformational.* For example, the Ethiopia–Kenya Power Interconnector and the Zambia–Tanzania–Kenya Power Interconnector will link the Southern Africa Power Pool and the Eastern Africa Power Pool, resulting in a large regional market for electricity.
- *Political buy-in is critical.* An example of problems exacerbated by a lack of political buy-in is seen in the protracted negotiations around the Trans-Gambia Bridge—the bridge linking Gambia and Senegal—with the latter complaining about delays on the Gambian side in finalizing the negotiations.
- *A holistic and inclusive approach is necessary.* Political, economic, and social considerations must all be

considered in project design. One example where this approach has been successful is the Kazungula Bridge, a multinational project linking Botswana and Zambia over the Zambezi River.

- *Capacity and skills are critical.* At the government and regional economic community levels, staff who have the necessary skills to negotiate and deliver projects are essential. Examples of projects that have had access to the necessary capacity and skills include the Tripartite Capacity Building Program, as well as financial and monetary integration programs in the member countries of the Common Market for Eastern and Southern Africa and the Economic Community of Central African States.
- *Hard and soft infrastructure must be blended.* For example, cross-border road projects must be supported by trade facilitation measures such as the One Stop Border Post and customs modernization, among other measures.
- *The private sector can deliver.* It is important to get the private sector involved in regional integration programs. The private sector has played an essential role in the Rift Valley Railways project that connects Kenya and Uganda, for example, as well as in the EASSy cable project that connects Africa to the rest of the world.

**Source:** AfDB: NEPAD, Regional Integration and Trade Department, Regional Integration Strategy (RIS) for 2009–2012.

implementation of these regional integration projects are highlighted in Box 3.

#### The importance of collaboration

In May 2012, in line with ongoing efforts to enhance infrastructure development, Africa's development partners—including the AfDB and the World Economic Forum—formed a Business Working Group (BWG) that draws on partners from multilateral and regional development banks. The aim is to accelerate Africa's infrastructure delivery through private-sector involvement with an emphasis on regional integration projects (see Box 4). This approach was endorsed by the African Union in January 2013.<sup>22</sup> The 20th Ordinary Session of the Assembly of the African Union restated the need for active collaboration among the African Union Commission, the New Partnership for Africa's Development (NEPAD) Planning and Coordinating Agency (NPCA), and the AfDB, in conjunction with the World Economic Forum, in revamping the NEPAD Infrastructure Project Preparation Facility through domestic funding and concerted efforts to increase private-sector involvement in infrastructure development. The implementation of BWG projects will bring in much-needed private-sector infrastructure development finance as well as contribute to improving the productivity and competitiveness of African economies.

#### AFRICA'S INFRASTRUCTURE AND REGULATORY ENVIRONMENT: CURRENT STATE AND CHALLENGES

Africa has a considerable infrastructure deficit: it lags behind other developing regions, particularly in the area of energy and transportation but also in ICTs. According to the World Bank Enterprises Survey, 26.9 percent of sub-Saharan enterprises identified transportation and 49.2 percent identified electricity as major constraints for their business in 2009.<sup>23</sup> In fact, only 30 percent of the population is estimated to have access to electricity in Africa, compared with 70 percent to 90 percent in other developing regions. Furthermore, road access in Africa is limited to about 34 percent of the population, compared with 50 percent in other parts of the developing world. Although considerable progress has been made in ICTs, as evidenced by the tremendous increase in mobile telephone connections over the last 10 years, Africa started from a low base and its Internet penetration rate is only about 6 percent, compared with an average of 40 percent elsewhere in the developing world.<sup>24</sup> Moreover, as shown in Chapter 1.1, results from the World Economic Forum's Executive Opinion Survey for 2012–2013 point to substantial gaps that remain in technological readiness (pillar 9).<sup>25</sup>

Nonetheless, the state of infrastructure development varies between and within regions and countries.

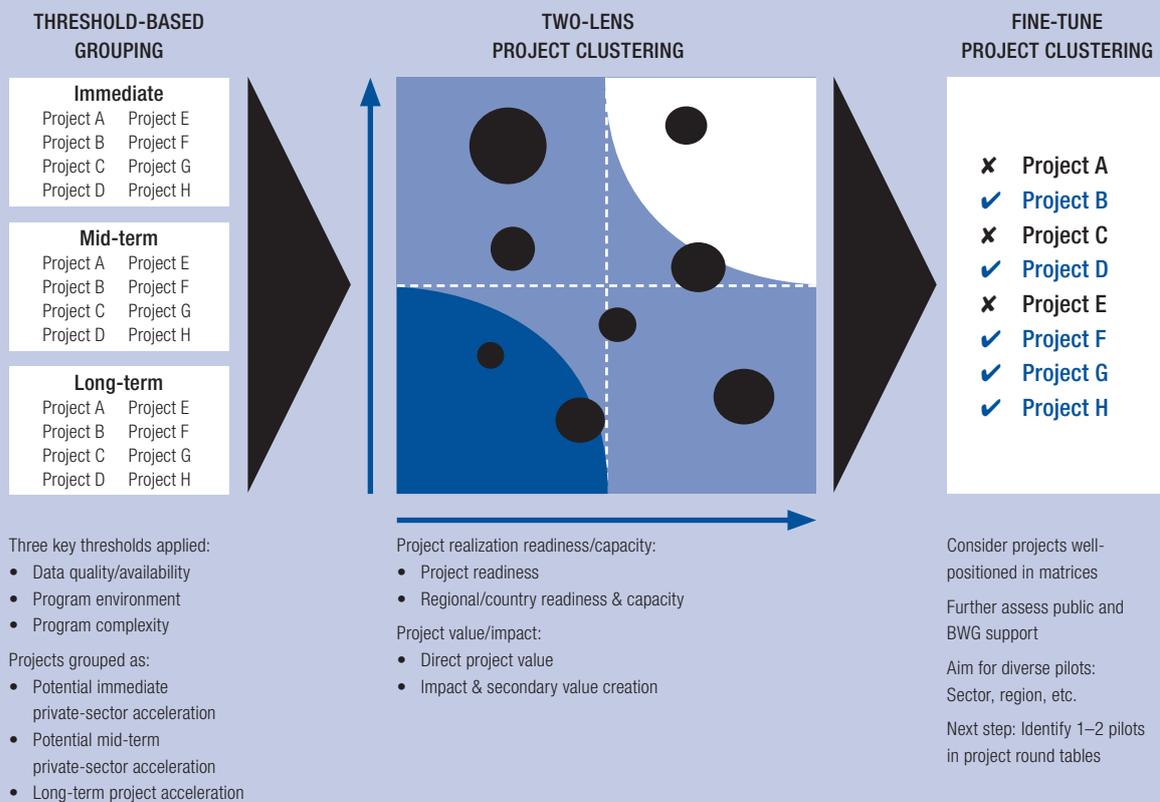
### Box 4: AfDB–World Economic Forum partnership: The African Strategic Infrastructure Initiative as a platform for private-sector involvement

The Business Working Group (BWG)—a multi-stakeholder group currently composed of 35 companies and organizations—was conceived in 2012 as a way of getting international and African business leaders involved in accelerating the delivery of Africa's infrastructure by “accelerating the implementation of the PIDA (Program for Infrastructure Development in Africa) ‘Priority Action Plan’ programs and projects.” PIDA—which was developed by the African Union Commission (AUC) in partnership with the United Nations Economic Commission for Africa (UNECA), the African Development Bank (AfDB), and the NEPAD Planning and Coordinating Agency (NPCA)—provides a strategic long-term framework to enable African stakeholders to build the infrastructure necessary to boost trade, spark growth, and

create jobs. The private-sector role in Africa's infrastructure is critical. This partnership was endorsed by African heads of state, who recognize that effective public-private partnerships (PPPs) in the delivery of Africa's infrastructure are part of the key to unlocking Africa's huge economic and development potential.

In this context, the BWG has defined a methodology for identifying programs that could be accelerated based on criteria that the private sector considers to comprise minimum requirements for them to become involved in Africa's infrastructure projects, including PIDA. These BWG criteria focus on the project's attractiveness and bankability, its technical feasibility, and its potential economic impact from the private-sector perspective (see Figure A). In particular,

Figure A: BWG methodology for identifying infrastructure programs to be accelerated



Source: World Economic Forum, in collaboration with The Boston Consulting Group, 2013, forthcoming.

the criteria stress the need for quantitative financial return metrics, a good legal and regulatory framework, sufficient funding for project preparation, the establishment of a project-implementing authority, and demonstrated positive economic impacts as well as strong stakeholder consultation and involvement and political will, particularly for cross-border projects.

Within PIDA, the Priority Action Plan (PAP) focuses on short-term programs expected to be initiated by 2020. PAP presents 51 immediately actionable programs across the four sectors of energy, transport, water access and food security, and ICTs, all promoting regional integration. Through this methodology, the private sector has identified an initial list of 10 priority projects from PAP for possible acceleration.

As a next step, the public-sector support and private-sector interest for each program will be confirmed at several regional roundtables to be held during 2013 and at the World Economic Forum on Africa in May 2013 in Cape Town, which will include a major pillar on Boosting Strategic Infrastructure.

The BWG also enables the public sector to benefit from objective, transparent, and informed input from the private sector on the key issues impacting on Africa's infrastructure delivery. If properly addressed through results-driven dialogue, this could create immense opportunities for private-sector participation in driving infrastructure in Africa.

**Source:** AfDB: NEPAD, Regional Integration and Trade Department, 2012, World Economic Forum: African Strategic Infrastructure initiative, 2013, forthcoming.

**Box 5: Infrastructure in selected African countries, 2000–10**

Considering the infrastructure development by region, as the figures in this box show, North African countries have, on average, better infrastructure than sub-Saharan African economies, with the exception of South Africa.<sup>1</sup> This can be seen with regard to electricity generation and telephone subscribers and also, to a large extent, paved roads. These figures also illustrate the varied level of infrastructure development across and within the regions. In fact, within sub-Saharan Africa, West Africa appears to have the strongest infrastructure, while Central Africa appears to have the weakest. Within West Africa, however, the infrastructure development of countries such as Burkina Faso still trails that of others. Even within countries, infrastructure development is highly uneven, with the

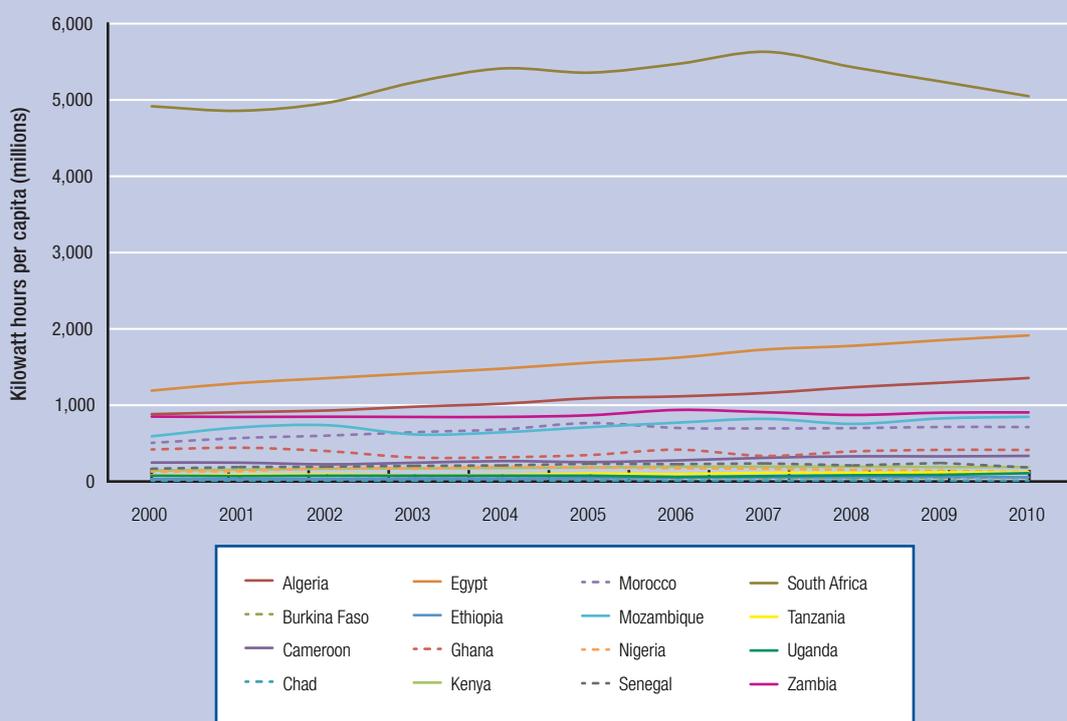
urban areas benefitting considerably more than the rural areas.

African countries generally exhibit unimpressive progress in electricity generation, with South Africa outperforming the rest and Central African countries lagging even further behind (Figure A).

However, telephone subscriptions in North Africa in the last decade have seen phenomenal growth, and West African countries are performing better than other sub-Saharan African countries in that area (Figure B).

Relatively stagnating performances have been typical in road infrastructure improvement in most sub-Saharan African countries, which are clearly outperformed by North African countries (Figure C).

**Figure A: Net electricity generation**



Source: AfDB Statistics Department.

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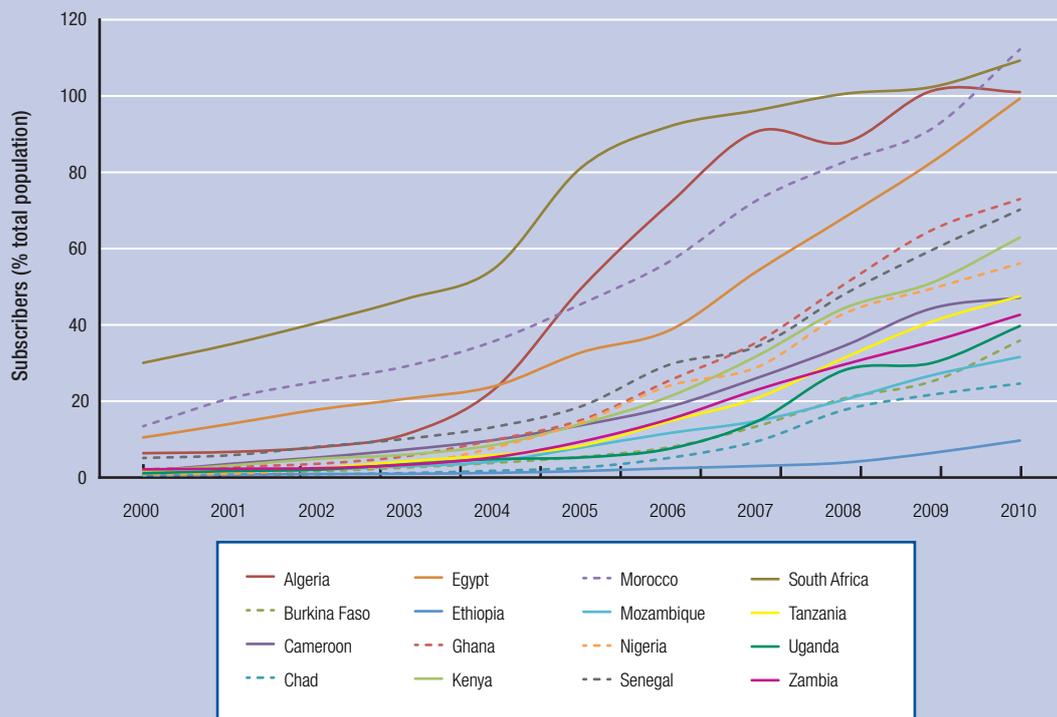
Chapter 1.1 shows that all African countries improved their Global Competitiveness Index scores at varying rates from 2006 to 2012. However, Box 5 indicates that the picture varies according to indicators and countries. In general, progress has been very slow or even negative regarding electricity generation and roads paved, while improvement in telephone subscriptions has been fast and impressive during the last decade.

Landlocked countries in Africa face particular challenges arising from the lack of multimodal

infrastructure. The continent's 15 landlocked countries are constrained in getting their goods to markets and in importing goods because of the lack of multimodal infrastructure that can accommodate their particular requirements. The role of a network of infrastructure linking producers to markets through a connected platform including feeder roads, national roads, airports, and ports in connecting markets, particularly in landlocked countries, cannot be overemphasized.

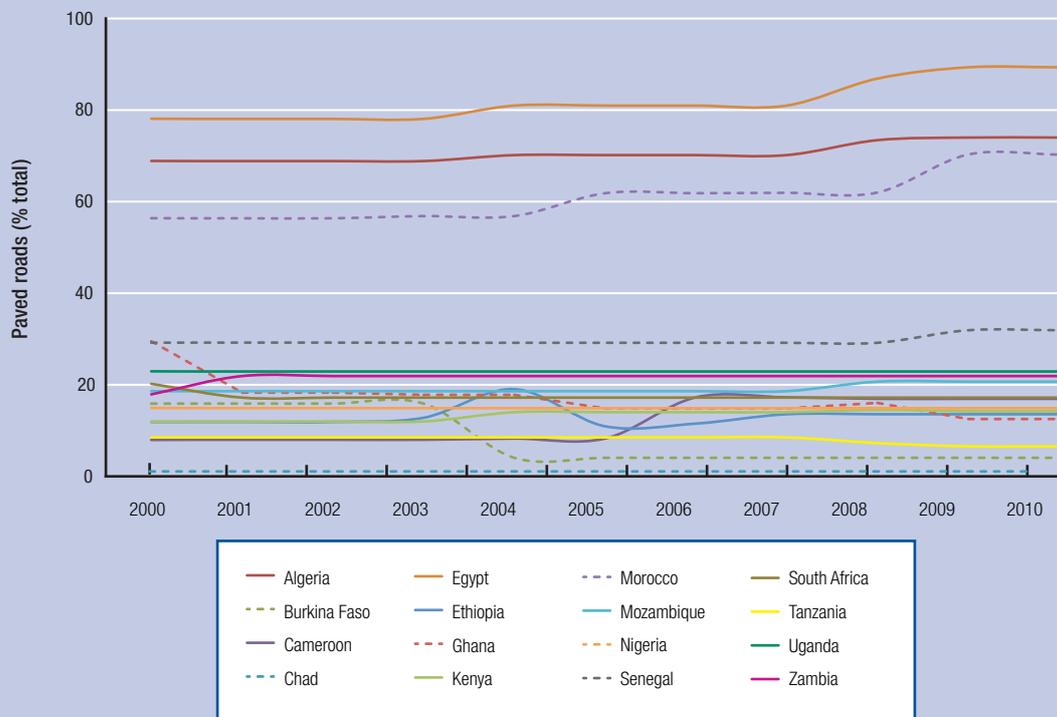
Box 5: Infrastructure in selected African countries, 2000–10 (cont'd)

Figure B: Mobile and fixed line telephone subscribers



Source: AfDB Statistics Department.

Figure C: Paved roads



Source: AfDB Statistics Department.

Note

1 South Africa performs better than North Africa, notably in terms of electricity generation per capita and telephone subscribers in percentage of the population (see Figures A and B).

## Energy

Africa faces a huge energy deficit: the 48 countries of sub-Saharan Africa, with a combined population of 800 million, are estimated to generate roughly the same power output as Spain, a country of 45 million.<sup>26</sup> This energy deficit is the result of the region's limited generation capacity—the result, in turn, of a lack of long-term financing to cater for the sector's needs. The lack of large-scale investment is a consequence of the limited participation of private players and the difficulties in mobilizing long-term financing from African financial systems to fund big-ticket items such as infrastructure.

Furthermore, electrification is weak and largely uneven, and tariffs make it unaffordable for the poor. The household electrification rate is 42.7 percent, on average, for Africa, and 28.3 percent for low-income African countries. North African countries, with electrification rates of 94 percent in 2009, fare better than sub-Saharan African economies, with rates of 32 percent.<sup>27</sup> Within sub-Saharan Africa, the rate often falls to just 10 percent, on average, in rural areas. For example, in Ethiopia, electricity access is very good in urban areas (86 percent) but very limited in rural ones (2 percent). In Zambia, access to electricity is only 20 percent—less than half the African average, with much of that power going to the mining sector, crowding out domestic consumption. In Chad, access is less than 3 percent, with the capital city of Ndjamena accounting for 80 percent of the total electricity consumption in the entire country. In Kenya, 31 percent of households have access to electricity in the best-served province, five times more than the least-connected province at 6 percent. Although Africa's power tariffs vary widely, they are all largely unaffordable for the poor, thus limiting access or connectivity for the poor in both urban and rural areas.

System losses compound the energy deficit in Africa. On average, electric power transmission and distribution losses in Africa were estimated at 12 percent of output in 2010, equivalent to the average losses in other low-income developing countries.<sup>28</sup> This estimate largely masks differences across Africa. This problem seems especially pronounced in Central Africa, particularly the Democratic Republic of Congo, where the losses were estimated at 83 percent in 2010. In Southern Africa, the losses were lower but still high, at 56 percent in Botswana and 25 percent in Namibia. In East, West, and North Africa, system losses have in general declined, although they remained high at the end of 2011: 26 percent in Uganda, 24 percent in Ghana, 21 percent in Tanzania, 20 percent in Algeria (2010), and 18 percent in Senegal.

### *Energy sector infrastructure*

In addition, aging infrastructure and rising demand have led to intermittent blackouts across all regions of Africa, undermining competitiveness. The blackouts largely started in the 1990s in East and West Africa, in 2007

in South Africa, and later (2010) in North Africa, notably in Egypt. Although these blackouts are declining, they continue to cause considerable production disruptions and losses that damage competitiveness in both low- and middle-income African economies.

Consequently, there is a critical need for innovative investments in the energy sector, including investment from domestically mobilized resources. However, the attractiveness of this investment is undermined by non-cost reflective tariffs as well as subsidies that distort relative prices and profitability. Energy facilities across Africa are in urgent need of new and innovative sources of investment, particularly for generation, transmission lines, and distribution. This much-needed investment is held back because across Africa—especially sub-Saharan Africa—even though tariffs are very high, they do not reflect actual cost because they account for only about 50 percent of the historical production costs (about 44 percent in Zambia, Niger, and Nigeria and 52 percent in Tanzania).<sup>29</sup> In addition, in North African countries, such as Egypt, indirect subsidies from the government also undermine investment in energy. In Mozambique, the single-buyer model (a government monopoly) currently in place utilizes unattractive fixed electricity tariffs that have been unchanged since 1997, discouraging investment in the sector.

Even beyond the much-needed physical investment, there is an urgent need to invest in the diversification of the energy mix so as to make the infrastructure sustainable. In East and Southern Africa, overreliance on hydropower energy makes the economies vulnerable to hydrological conditions. The major drought in the mid-2000s caused substantial economic losses—as high as 4 percent of GDP in Tanzania—and increased the demand for expensive emergency diesel power generation. In Northern and Western African countries, the energy mix depends largely on gas and oil reserves (thermal energy), which is more reliable than hydropower but more costly. Box 6 presents a snapshot of the AfDB's green energy initiatives.

At the regional level, urgent attention should be given to the development of regional energy infrastructure to achieve economies of scale. In the power sector, only Southern Africa has made the transition to a competitive regional power market. Only a few major investments have been made in regional energy infrastructure on the continent; these include the Ethiopia–Djibouti and Ethiopia–Kenya connections, as well as the 300 kilovolt (kV) Nigeria–Benin coastal transmission backbone. Other planned regional initiatives include the North–South power transmission corridor of 8,000 kilometers covering 11 countries from Egypt to South Africa, and the North Africa transmission line that will run from Morocco to Egypt. The NELSAP project, funded by the AfDB together with other donors, is another major regional initiative that interconnects the electric grids of the Nile Equatorial Lakes countries

of Burundi, Kenya, the Democratic Republic of Congo, Rwanda, and Uganda. Indeed, developing additional cross-border power pools will help countries achieve economies of scale and provide significant savings. For example, plans to extend the Inga hydropower site could lead to a large expansion in low-cost hydropower for the Democratic Republic of Congo, resulting in energy available for export to countries such as Zambia. Adopting a regional approach could save Zambia US\$160 million annually. Tanzania also has the potential to play a significant role in regional power trade within the framework of both the East African Power Pool and the Southern Africa Power Pool.<sup>30</sup>

#### *Energy sector regulatory challenges*

At the national level, legislation is generally adequate to regulate the industry in countries that have electricity regulators, but its enforcement should be strengthened and the roles of energy administrators clarified. This will serve to support the principles of regulatory independence. For example, Kapika and Ebehard state that, in Zambia, although the Energy Regulation Board determines all retail electricity tariffs and has the authority to carry out general administrative functions, the principles of regulatory independence for the regulator are undermined by its lack of final authority in decision making.<sup>31</sup> In several other countries, such as Senegal, the duplication of efforts with several agencies and institutions involved in the administration of energy issues should be addressed. The administration should be streamlined and the involvement of different stakeholders clarified.

Moreover, the mandate for planning has to be clarified within the sector, particularly in hybrid power markets, to coordinate the planning and procurement functions. Kapika and Ebehard argue that planning is crucial for ensuring orderly market entry and the adequacy and reliability of power supplies.<sup>32</sup> In hybrid power markets such as Zambia's, where there is a dominant, vertically integrated state-owned utility and also private companies that operate on the margins of the sector, the planning issue can easily become hazy. Those responsible for planning should work closely with those responsible for procurement processes, so that the planning of new capacity is coordinated with the initiation of new bids.

In addition, the renewable energy potential has not been fully harnessed in Africa because of high installation costs as well as gaps in renewable energy policies, strategies, and regulatory mechanisms. Indeed, renewable energy represents an interesting alternative that could potentially help reduce the cost of access to energy for enterprises, though the installation and operating costs of some renewable energy-based power plants are still high because the related technologies are not fully mastered in most of the countries. Not only have these technical considerations been impeding the development of the sector, but renewable energy

#### **Box 6: Green energy and the AfDB's initiatives**

Africa's huge gaps in conventional energy infrastructure make it well placed to pursue low-carbon solutions. Africa has more than half of the world's renewable energy potential: its wind, geothermal, and hydropower potential has barely been tapped. For example, the Grand Inga Dam in the Democratic Republic of Congo has the potential to produce 100,000 megawatts (MW) of electricity, but currently yields a mere 650 MW to 750 MW. The potential to generate 7,000 MW of geothermal electric power exists in the Great Rift Valley in Eastern Africa. However, to date, only 130 MW has been exploited in Kenya and less than 8 MW in Ethiopia because of high upfront engineering costs and lack of local expertise. Regarding solar energy, many countries have favorable daily radiation levels. Some encouraging initiatives to extend access to lower-income households and public institutions are under way in several countries, including Morocco, Tunisia, Mauritius, Seychelles, and South Africa. For wind energy, countries with good potential include Cape Verde, Eritrea, Kenya, Madagascar, Mauritania, Morocco, South Africa, and Tunisia. In fact, the Cabeolica wind farm in Cape Verde, a project that received debt financing from the African Development Bank (AfDB), won the African renewable energy project of the year award in 2011.

The AfDB has recognized the green energy potential on the continent and has taken the lead with US\$57 million in establishing a fund, with some other contributors, for renewable energy projects across the continent. Accordingly, it has developed energy policy with two priority areas: ensuring access to modern energy and fostering clean energy investments. Going forward, its pipeline embraces several green energy projects, including support to a 2,000 MW solar-thermal power project to export energy from Tunisia to Europe; the Turkana Wind Project (which has received US\$870 million from the joint fund) in Kenya; and, in partnership with other donors, the Menengai Geothermal Plant, also in Kenya, to provide clean energy to 500,000 households.

**Sources:** AfDB: NEPAD Regional Integration and Trade Department, Regional Integration Strategy (RIS) for 2009–2012; [http://en.wikipedia.org/wiki/Renewable\\_energy\\_in\\_Africa](http://en.wikipedia.org/wiki/Renewable_energy_in_Africa).

policies, strategies, and regulatory gaps also hamper investments. Although increasing investments is key for closing the energy infrastructure gap, very few countries in Africa have managed to implement appropriate public policies and regulatory mechanisms that provide investors with predictable tariffs, secured off-take agreements, access to national grids, and business-easing measures. In some countries, such as Burkina Faso, the regulatory framework for renewable energy resources is simply nonexistent, keeping potential investors' risk perception of the sector relatively high.

At the regional level, it is imperative that planning for regional infrastructure projects be coupled with the requisite regional legal and regulatory framework. For example, in the power sector, regional power pools need to harmonize with national power regulations and

Figure 1: Africa's main road corridors



Source: ICA, 2009.

develop dispute resolution mechanisms, which to date has been slow.

### Transportation

The ensuing discussion of the transportation sector considers the state of the infrastructure and the challenges confronting the road, rail, air, and port subsectors, as well as the regulatory framework of the entire transportation sector.

Africa's prolonged underinvestment in transportation has resulted in a dilapidated transport infrastructure. Indeed, compared with other developing countries—excluding the provision for maintenance—African countries invested 15 percent to 25 percent of GDP in transport infrastructure over the period 2005–12, on average, while India and China invested about 32 percent and 42 percent of GDP, respectively, in the same period.<sup>33</sup> This underinvestment has resulted in a decrepit infrastructure and considerably higher transport costs (by as much as 100 percent) in Africa than experienced by other low-income developing countries. This poses a fundamental constraint to Africa's global competitiveness and economic growth.

### Road infrastructure

Although roads are the predominant mode of transport for freight and passengers in Africa, major deficits exist in road infrastructure throughout the continent. A significant percentage of Africa's road network is unpaved (52.8 percent in 2011), isolating people from basic education, health services, transport corridors, trade hubs, and economic opportunities. In Tanzania, more than 92 percent of the road network is unpaved and is therefore unusable during the rainy season. In South Africa, about 80 percent of the road network is unpaved and about 78 percent of the national road network is older than the 20 years for which it was originally designed.<sup>34</sup>

Moreover, access to the road network is uneven, with rural areas largely underserved. This unequal access makes the flow of goods and services to and from rural areas difficult and expensive. The urban-rural disparity in the road network is a concern across all regions of Africa. In Ethiopia, only 10.5 percent of the rural population lives within two kilometers of an all-weather road. In Zambia, Tanzania, and Burkina Faso, the comparable figures are 17 percent, 24 percent, and

Figure 2: Railways in Africa



Source: AfDB, 2010.

less than 25 percent, respectively, which are still very low.

Poor road maintenance is prevalent across Africa. Recognizing that there are several sources of road funding, including loans and tolling, several African countries now have road funds supported by fuel levies; others have autonomous road agencies that contract out to specialist maintenance agencies. However, more needs to be done. Fuel levies are often too low and road funds and agencies do not meet international best-design criteria. For example, fuel levies vary considerably across countries, ranging from US\$0.16 to US\$0.30 per liter, with the latter considered the minimum for adequate road maintenance. Unofficial fees or bribes and delays contribute to low collection rates. In addition, toll roads operate in only a negligible portion of the region's classified road network, and almost all of them are in South Africa.<sup>35</sup>

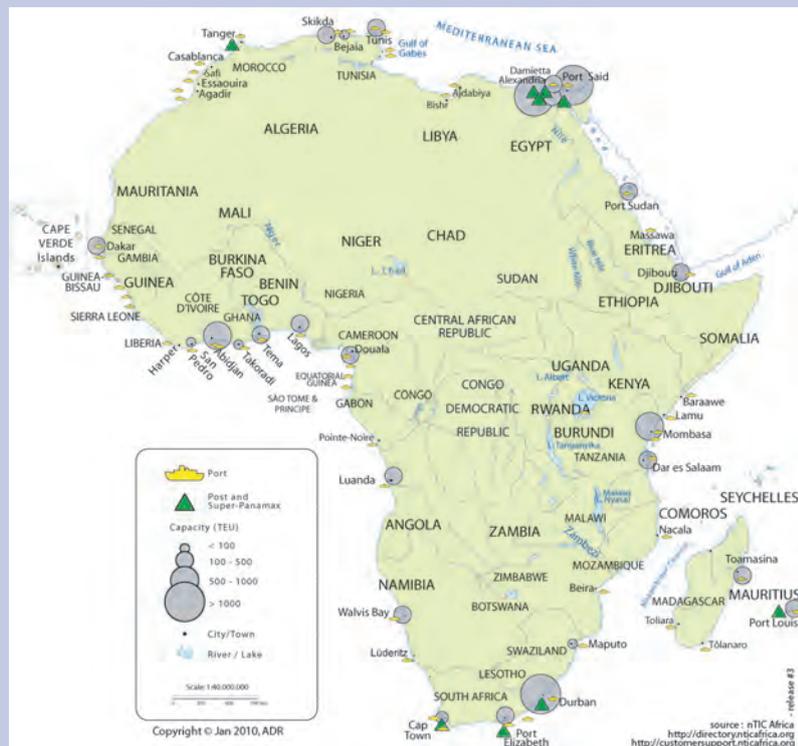
Further complicating the issue, roads do not last for their planned construction life span because the overloading of vehicles causes the roads to age prematurely, resulting in high maintenance costs. The road network in several African countries continues to

suffer from very high overloading rates (e.g., in Uganda, overloading rates are close to 55 percent) as determined at some major static weigh-station locations, pointing to the need for more weigh stations to be constructed. A harmonized regional axle load control act—such as the East Africa Axle Load Control Act, which will soon be adopted—is also needed.

A high incidence of road fatalities, a consequence of the continent's poor infrastructure, is prevalent in Africa, resulting in sizeable losses to the economy. The World Bank estimates that road crashes cost approximately 1 percent to 3 percent of a country's annual GDP (US\$100 billion every year in developing countries).<sup>36</sup> For example, Uganda has one of the worst road safety records in sub-Saharan Africa, with an average rate of 45 fatalities per 10,000 vehicles. The country is estimated to lose about 2.7 percent of its GDP through losses of life and property. This is equivalent to the proportion of GDP spent on the road sector.

The underdevelopment of the road network has also resulted in severe traffic congestion in several African capitals, causing direct loss of time and productivity. Urban traffic congestion is common across the main

Figure 3: Ports in Africa



Source: AfDB, 2010.

cities of Africa. Indeed, traffic congestion is estimated to cause direct loss of time and productivity at an annual cost of roughly 4 percent of GDP (US\$8 billion) in Cairo, US\$19 billion in Lagos, US\$0.89 billion in Dar es Salaam, and US\$0.57 billion in Nairobi.<sup>37</sup> Poor air quality and road accidents may actually double the direct cost of congestion.

The large number of landlocked countries in Africa (15) and those with a vast hinterland, such as the Botswana, the Democratic Republic of Congo, and Sudan, underlines the importance of the cross-border corridors. These transport corridors link markets—particularly important for landlocked countries—and enhance intra-African trade. The map in Figure 1 shows Africa's main corridors. The Trans-Africa Highway (Cairo–Dakar) is the most ambitious road network on the continent: it comprises nine interlinked highways with a total length of 56,683 kilometers.<sup>38</sup> Other planned or ongoing regional projects include the Abidjan–Ouagadougou–Bamako Transport corridor, connecting Côte d'Ivoire, Burkina Faso, and Mali. However, the effectiveness of the cross-border links is undermined by border inefficiencies, which are discussed in Chapter 2.1.

#### Road regulatory challenges

At the national level, several legal and legislative issues regarding roads need to be addressed. Legislation relating to axle overload is needed to tackle overloading on roads as well the related costing/funding for road maintenance. In addition, in some countries (such as Uganda), although a PPP policy is in place, the relevant law has not yet been enacted. With the exception of a few countries (including Senegal and South Africa), toll roads are not yet completed. Going forward, however, several countries (including Uganda) are planning expressways, so it is imperative that, in addition to a tolling policy, a tolling law be enacted.

#### Rail infrastructure

Outdated infrastructure and limited maintenance have undermined the effectiveness of railways across Africa. The result has been a significant reduction in useable track. North Africa, particularly Egypt, boasts the oldest railway network in Africa, but it has had only a few upgrades since its inception. In West Africa, as evidenced by Senegal, the rail network has deteriorated substantially in recent years because of

**Table 1: Air travel cost per passenger, selected cities**

Origin	Destination	Distance (km)	Average cost (US\$)	Average cost per 1,000 km (US\$)
Johannesburg	Accra	4,670	1,000	214.13
Nairobi	Lagos	3,811	800	209.92
Accra	London	5,116	1,000	195.47
Dubai	Singapore	5,841	500	85.60
London	Moscow	2,498	400	160.13
Dubai	London	5,475	800	146.12

Sources: Travel websites Opodo.com, tripadvisor.com, and expedia.com, and authors' calculations.

administrative difficulties, locomotive breakdown, and lack of investment and maintenance. In Southern Africa, the Chinese-built Tanzania–Zambia railway has suffered from underinvestment for the past 30 years. Overall, the amount of useable track has declined across Africa between 2005 and 2011, dropping from 58,000 to 50,000 kilometers, underscoring the pressing need for rehabilitation and maintenance in the sector (Figure 2).<sup>39</sup>

Differences in rail gauges (which specify the spacing between the tracks in a railway) undermine the regional integration of rail networks. When rail improvements are undertaken, the need for a uniform rail gauge among countries cannot be overemphasized. This complication highlights the need for a regional approach; addressing it effectively will enable trains to cross boundaries. Indeed, the variation in the rail gauges is currently a serious constraint for rail network development, especially between East and Southern Africa.

#### *Rail regulatory challenges*

At the regional level, several legal and legislative issues regarding the harmonization of rail gauges in railroads across countries need to be addressed. Customs regulatory framework for the cross-border movement of goods and services will also need to be put in place to facilitate railroad transportation across Africa.

#### *Air transport infrastructure*

Air transport in Africa, while crucial, is expensive by international standards. By providing a quick link to export markets, air transport enables the trade of time-sensitive, perishable exports such as cut flowers, vegetables, fruits, meat, and fish, which are becoming increasingly important foreign-exchange earners for African countries. The International Airline Transport Association (IATA) reports that traveling by air is more costly in Africa than anywhere else. This is mainly because of lower passenger traffic, limited liberalization of air space, high passenger and airport taxes, safety issues, and limited infrastructure (airports, runways, and safety systems). Africa still records the lowest safety standards in air transport of any region in the world. Table 1 illustrates the high cost of travel in Africa.

African airlines have also lagged behind in terms of technological upgrades, notably surveillance equipment and fleet modernization. Although Africa boasts some

strong airlines—including Royal Air Maroc, South African Airways, Kenya Airways, Egypt Air, and Ethiopian Airlines—the lack of modern air traffic surveillance technology poses critical challenges for the industry in several countries. For example, in Ethiopia, extra distance and time separation between aircraft are necessary to compensate for the lack of civilian radar. In terms of fleet modernization, Africa's demand for new airplanes represents only 3 percent of the world demand and is concentrated in three or four companies.<sup>40</sup>

Progress in several countries is hampered by poor basic airport infrastructure and inadequate air connections. Although the continent boasts some world-class airports—such as the Johannesburg International Airport—in general, basic airport infrastructure is lacking in most airports across Africa. For example, because of poor airport infrastructure in Tanzania, safe, reliable, and comfortable air transport services are assured only during the dry season. In addition, there are insufficient air connections within Africa. Indeed, Eastern Africa and Southern African subregions are more connected than the West African subregion.<sup>41</sup> The three major hubs in sub-Saharan Africa are Addis Ababa, Johannesburg, and Nairobi. Most international carriers fly from Southern Africa and Eastern Africa, which have more-established national and regional carriers than other regions.

#### *Air transport regulatory challenges*

Regulatory challenges in the air sector relate mainly to the liberalization of air space. Despite some countries having liberalized their airspace after the Yamoussoukro Declaration of 1988, several countries in Africa—such as Angola and the Democratic Republic of Congo—have not. This limits competition from foreign-owned airlines, resulting in higher prices for international air travel of both passengers and freight.

#### *Port infrastructure*

Many African ports have serious capacity problems that are accentuated by an ineffective inland transport system. Figure 3 is a map showing Africa's major ports, which include Abidjan (Côte d'Ivoire), Dar es Salaam (Tanzania), Durban (South Africa), Mombasa (Kenya), Port Said (Egypt), and Tangier (Morocco). In North Africa, ports are more developed and have adequate container-handling equipment and faster turnaround times than

ports in sub-Saharan Africa. In East Africa, Dar es Salaam and Mombasa have reached their container-storage limits. New capacity needs to be introduced, not only in the ports themselves but also in downstream linkages, to ensure that cargo can be efficiently moved onto road and rail infrastructure.<sup>42</sup> Similar constraints are evident in other regions of Africa, such as the ports of Lagos (Nigeria) and Tema (Ghana).

Inefficiencies at African ports lead to slow processing times and result in higher charges than those of comparators. Tariffs in South African ports tend toward the high end of the global spectrum, yet performance is well below international benchmarks. In East Africa, there are also significant cost differences within the region. For example, Mombasa charges considerably more than Dar es Salaam in East Africa, primarily because Mombasa's volume of trade is considerably higher.

In the port subsector, although private-sector involvement has provided some additional financing, it has not achieved the same gains in Africa as it has elsewhere and volumes fall substantially short of requirements. However, the private sector has contributed significantly to improving operational performance, leading to the recovery of funds lost through inefficiency in a variety of areas.<sup>43</sup> Nonetheless, the gains have been undermined by the limited clarity of the public sector's objectives; the lack of close coordination among the different institutions involved (port institutions, customs, transport ministries, and labor unions); and the absence of other efficiency-enhancing factors, such as pro-competitive policies and arrangements in the sector.<sup>44</sup>

#### *Port regulatory challenges*

In the port subsector, ensuring regulatory independence will be crucial to maximize gains from previous reforms. Evidence suggests that reform packages that include regulatory reform and independence of the regulator from government interference will allow other ongoing policy reforms a greater chance of success.<sup>45</sup>

### **ICTs**

The ensuing section considers developments in the ICT sector, notably in mobile telephony, Internet, and undersea and terrestrial cables. It begins with a discussion of the state and challenges of infrastructure in the ICT sector and then proceeds with a discussion of the regulatory framework.

#### *ICT infrastructure*

Africa has made progress in ICTs, particularly with regard to laying out the infrastructure using undersea cables and mobile technologies. Indeed, in 2011, 19 undersea cables connected Africa to the rest of the world—up from only 3 in 2005.<sup>46</sup> As a consequence, cumulative capacity increased from 2,900 gigabytes to 102 terabytes over the period. Africa is leapfrogging fixed-line networks and moving directly to mobile technologies.

The mobile telephony subsector has been the most vibrant of all, with the share of population receiving mobile signals increasing by a factor of 10 in five years.<sup>47</sup> Some African countries, such as Ghana and Nigeria, have gone further and are expanding into satellite communication technology. Investment in ICTs, unlike investment in the transport subsector, is largely private-sector driven. However, major differences in the levels of financing available exist between coastal and landlocked countries.<sup>48</sup>

Nonetheless, access to the Internet is still low throughout the continent, and it is expensive and skewed in favor of urban areas. The penetration rate is much higher in North Africa (where 27 percent of the population have Internet access, on average) than in Southern Africa (13 percent), East Africa (12 percent), West Africa (9.5 percent), and Central Africa (4.5 percent).<sup>49</sup> The situation in Central Africa is illustrated by Chad, where 80 percent of Internet users complain about the slow connection speeds and the very high cost of bandwidth, which ranges between US\$1,600 and US\$2,000 per month—astronomically higher than in Kenya, where it is US\$100–US\$150, and Burkina Faso, where it is about US\$600. Across Africa, unequal access is particularly prevalent in rural areas, indicating the need for continuing public investment to create incentives to extend services to these areas.

One of the most outstanding innovations in the use of ICTs in Africa has been the mobile money sector. This has seen phenomenal growth in East Africa, primarily in Kenya. Box 7 presents the case of the successful M-PESA mobile-payments system in Kenya.

#### *ICT regulatory challenges*

Although the ICT subsector has been the most vibrant of the infrastructure subsectors, progress in some countries has been limited by government monopoly, which has resulted in excess costs and undermined the access to and quality of ICT services. Consequently, the price of broadband and international calls is excessive, and the absence of competition has a negative impact on both revenue and productivity of public and private firms, thus undermining investment. This is evident across all regions of Africa, including Ethiopia and South Africa.

The central challenge for those countries that have not liberalized their ICT sectors is to introduce competition through a modernized institutional and regulatory framework. These markets—such as Ethiopia—could potentially benefit from licensing additional mobile operators, which would accelerate the expansion of the global system for mobile communications (GSM) coverage to improve access. While Zambia's GSM coverage is comparatively low by regional standards, simulations indicate that more than 95 percent of Zambia's population could be reached by a GSM signal if measures were taken to dismantle behavior that is counter to competition. In addition, establishing a coherent policy framework that

is not weakened by policy reversals is crucial. Such a framework does not always exist. For example, in Zambia, progress in the ICT sector was undermined by the privatization and subsequent renationalization of the telecommunication and Internet provider Zamtel.

For the countries that have liberalized, there is an urgent need to improve private participation in the information technology backbone infrastructure. In several countries, including Uganda, because of its public nature, the backbone project is undertaken by the government. Nonetheless, the introduction of more competition on the backbone side, as advocated for in Zambia, will go a long way toward reducing prices and broadening access.

Reforms to address fragmentation and overlap of regulatory authorities and mandates are necessary to tackle current market challenges arising from the convergence of ICT technologies. Rapid technological advances in the sector, along with their convergence, underline the need to create and operate in an open, dynamic, and responsive legal and regulatory framework that supports the development of ICTs. The situation is exemplified in Uganda, where there is considerable overlap between the National Information Technology Authority Uganda—which plays a dual role as an operator of the backbone infrastructure and the regulator in charge of government information infrastructure (including e-government and the government's master plan)—and the Uganda Communications Commission, which regulates telecommunications, broadcasting, and postal services. Clearly, there is a strong case for regulatory convergence that would result in one regulator for the ICT sector that deals with the issuance of licenses as well as planning and managing ICT developments. A periodic review of the operations, provisions, and directives making up the legal and regulatory system is key for ICT sector reforms, including convergence in the industry.

While mobile money has seen phenomenal growth, the requisite regulatory guidelines and oversight have not kept in step. As mentioned in Box 7, in several regions of Africa, particularly in East Africa, mobile money has become increasingly important: annual transactions are estimated to be worth over US\$8 billion in Kenya; monthly transactions were estimated at over US\$200 million in Uganda in 2012. However, regulatory guidelines and clarity are needed to guide the mobile money industry. For example, establishing whether mobile money is considered to be an information technology service or a financial service will determine the requisite regulatory infrastructure.

## CONCLUSION AND THE WAY FORWARD

This chapter has demonstrated that, although Africa has made some improvements in increasing its infrastructure stock in recent years, it remains underdeveloped relative to other emerging regions. Improved infrastructure will

### Box 7: The success of Safaricom's M-PESA

The mobile money sector in Kenya consists of M-PESA, Airtel Money, Essar yuCash, and Orange Money. M-PESA, a mobile payments system operated by Safaricom, was launched in March 2007. It was the first mobile money system to appear in Kenya and is now the most developed and successful mobile money payment system in the world. M-PESA allows people to transfer funds on a person-to-person basis, pay bills, purchase goods, and buy airtime. In addition, people can use M-PESA to remit funds from the United Kingdom to Kenya. Safaricom also launched M-KESHO in March 2010, which allows for the movement of funds to and from an interest-bearing account with Equity Bank.

M-PESA had 15.2 million subscribers out of the more than 19 million mobile money subscribers in the country as of the end of October 2012, up from a mere 19,071 subscribers in 2007. M-PESA uses over 45,540 M-PESA agents across the country. The remaining three mobile money service providers have 9,000 agents, of whom 6,000 work for Airtel. Of the total estimated mobile transfers of US\$10 billion in 2012, most (90 percent) are undertaken by Safaricom operating on the M-PESA money platform. It has four bank partners for deposits: Commercial Bank of Africa, Standard Chartered Kenya, CFC Stanbic, and Equity Bank Kenya.

**Source:** Ncube and Ondiege, 2012.

increase Africa's competitiveness and productivity, lower the cost of doing business, and facilitate trade and foreign direct investment as well as deepen economic and social integration and create employment opportunities. We must address Africa's infrastructure gap to further boost economic growth and foster integration, not only across the region, but also with the rest of the world. However, Africa needs colossal financial investments and support to close the region's infrastructure gap and set itself on a par with the rest of the developing world.

African countries must therefore undertake infrastructure sector reforms and innovation to generate more resources for the sector, because traditional sources of finance will not be enough. A regional approach to infrastructure development is key, and interconnecting infrastructure across country boundaries is the best way to promote trade and regional integration, and thus connect markets in Africa. Possible reforms and innovative solutions are outlined below:

- *Energy sector:* Given its high unexploited potential in terms of wind, solar, and hydropower, Africa could easily satisfy its energy needs at no cost to the environment. Promoting green energy could leverage more funds from development partners and private players than investment in non-green energy. Furthermore, given the prevalence of non-cost reflective tariffs that undermine investments

in several African countries, governments should commit to having cost-recovery tariffs that will, in turn, spur much-needed investment. A regional approach should be pursued, with urgent attention given to the development of regional energy infrastructure.

- *Transportation sector—Roads:* Feeder roads are of great importance for poverty reduction, especially in rural areas. Together with the development of corridors, rural roads provide economic opportunities and access to markets. Accordingly, emphasis should be given to developing rural roads so as to enhance access, and also upgrading urban roads, with a focus on those with cross-border connections. Making provisions for adequate maintenance (both corrective and preventative) for roads is vital, as this ensures sustainability. In addition, it will be essential to address the overloading of vehicles by means that include harmonized legislation in the form of regional axle load control acts. Furthermore, to stem the incidence of road fatalities that result in sizeable losses to the economy, road safety programs need to be enhanced and adequately funded.
- *Transportation sector—Railroads:* Outdated infrastructure and limited maintenance programs have resulted in a significant reduction in useable track and undermine the effectiveness of railways across Africa. Addressing these needs will both require further investments in the sector and ease pressure on African roads. A regional approach should be taken, with an emphasis on establishing uniform rail gauges to enable trains to cross country boundaries.
- *Transportation sector—Air transport:* The importance of air transport, particularly for landlocked countries, cannot be overemphasized. It is imperative that countries enhance this sector's development to improve connectivity and safety and to reduce costs in order to promote intra-African and global trade.
- *Transportation sector—Ports:* Countries should put in place measures to address the serious port capacity problems that, coupled with an ineffective inland transport system, abound in Africa. They also need to deal with inefficiencies that slow processing times and result in higher charges than those of comparators. This calls for encouraging private involvement, which can also provide much-needed additional financing.
- *ICT sector:* Although the ICT sector has made impressive gains, such as the now well-known M-PESA mobile money payment system in Kenya, overall, the potential of ICTs— for example, to support e-government—has not been fully exploited.

The need for more investment in backbone (fiber optic) to improve connectivity across countries is urgent. Countries also need to put in place carefully planned maintenance measures to address the anticipated obsolescence of ICT infrastructure and technology, because this is a fast-growing and evolving industry.

The importance of infrastructure development to enhance the continent's productivity is discussed further in Chapter 2.3. That chapter focuses on infrastructure investment policy reform processes in the context of developing growth pole projects that would enhance Africa's competitiveness.

## NOTES

- 1 Calderón 2008.
- 2 AfDB et al. 2010.
- 3 Blank and Lee 2009.
- 4 Mayaki 2012.
- 5 Foster and Briceño-Garmendia 2010.
- 6 See Estache and Goicoechea 2005; Boopen 2006; Calderón 2008; Estache and Woodon 2011; Briceño-Garmendia and Domínguez-Torres 2011.
- 7 Easterly and Rebelo 1993.
- 8 Calderón and Servén 2004.
- 9 Estache and Goicoechea 2005; Calderón 2008.
- 10 Escribano et al. 2009.
- 11 Domínguez-Torres and Foster 2011.
- 12 World Bank 2009.
- 13 APIX 2011.
- 14 USITC 2009.
- 15 Shiferaw et al. 2012.
- 16 Siba et al. 2012.
- 17 ERA 2011.
- 18 World Bank's *Doing Business Database*.
- 19 AfDB 2011.
- 20 AfDB 2010.
- 21 AfDB 2010.
- 22 The 20th Ordinary Session of the Assembly of the African Union (Heads of State and Government), which met in Addis Ababa on January 27–28, 2013, in their Decision on the Report of the Heads of State and Government Orientation Committee (HSGOC) on the NEPAD —Doc. Assembly/AU/4(XX)—and recalling their earlier approval of PIDA, re-stated the need for active collaboration among the Commission, the NEPAD Planning and Coordinating Agency, and the AfDB in revamping the NEPAD Infrastructure Project Preparation Fund through domestic funding by Member States and concerted efforts to increase private-sector involvement in infrastructure development in conjunction with the World Economic Forum.
- 23 See the Enterprise Surveys of the World Bank, available at <http://www.enterprisesurveys.org>.
- 24 SOFRECO-led Consortium 2011.
- 25 See World Economic Forum 2012.
- 26 AfDB 2012.
- 27 AfDB 2012.

- 28 See the World DataBank, available at <http://databank.worldbank.org/>.
- 29 See the African Development Bank Group's AICD Database for the power sector, available at <http://www.infrastructureafrica.org/sectors/power>.
- 30 Shkaratan 2012.
- 31 Kapika and Ebehard 2013b, pp. 92–93.
- 32 Kapika and Ebehard 2013b, p. 101.
- 33 UNCTAD 2011.
- 34 DBSA 2012.
- 35 AfDB 2010.
- 36 See <http://www.worldbank.org/transport/roads/safety.htm>.
- 37 Estimates were produced by Hammer 2012; Dina 2012; see also Kanyabwoya 2010 and IMB 2012, respectively.
- 38 AfDB 2010.
- 39 AfDB 2012.
- 40 See Boeing's *Current Market Outlook 2012–2031*.
- 41 AfDB 2011.
- 42 An example is the One Stop Border at Chirundu—funded by the Japan International Cooperation Agency, the Department for International Development, and World Bank—which is between Zimbabwe and Zambia.
- 43 World Bank 2009.
- 44 AfDB 2010.
- 45 AfDB 2010.
- 46 AfDB 2012.
- 47 Foster and Briceño-Garmedia 2010.
- 48 AfDB 2012.
- 49 Authors' calculations, based on the Miniwatts Marketing Group's Internet Worlds Stats database, available at <http://www.internetworldstats.com/stats1.htm#africa>.
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## Appendix A: AfDB infrastructure development projects, selected countries, 2012–14

The African Development Bank (AfDB) has been involved in projects to develop infrastructure on the continent for several years. It focuses on projects in areas of need but where there is an enabling environment. Some of the main infrastructure development projects currently being implemented are listed below.

### ENERGY

#### **The Menengai Geothermal Development Project**

**(Kenya):** This project is a Scaling-Up Renewable Energy Program (SREP) under the Climate Investment Funds for which AfDB Group is an implementing agency. The project will set the stage for investments that will help meet Kenya's rapidly increasing demand for power and transform the country into a competitive clean energy economy; it will also help diversify the country's sources of power supply by developing its substantial geothermal potential. The Menengai field alone has a potential of up to 1,600 megawatts (MW). The AfDB group support will help develop the steam field for a generation capacity of up to 400 MW in a first phase, representing a 20 percent increase in Kenya's installed capacity.

The project will result in substantial increase in the provision of reliable, clean, and affordable energy equivalent to the current consumption needs of 500,000 Kenyan households (of which 70,000 will be in rural areas) and 300,000 small businesses, with some 1,000 gigawatt hours (GWh) available for other businesses and industries. The project will also help reduce emissions by some 2 million tons of carbon dioxide per annum.

**Senegal Coal Power Plant Project:** The project will generate 925 GWh of electricity, which represents 40 percent of 2008 national consumption; reduce annual power shortages from the 176 days reported in 2008 to 40 days by 2014; improve national electrification coverage (with a target of increasing from 46 percent in 2008 to 66 percent in 2015); and contribute to meeting the projected 7.8 percent annual growth in energy demand.

### TRANSPORTATION: ROADS

#### **The Mombasa–Nairobi–Addis Ababa Road Corridor**

**Project, Phase III (Kenya and Ethiopia):** The objective of the multinational project is to enhance trade, strengthen regional integration, and contribute to poverty reduction in both countries. This third phase covers

the Turbi–Moyale section, which is part of the Trans-Africa Highway network. It involves the construction of 320 kilometers of the road corridor, including the 122-kilometer Turbi–Moyale road section in Kenya and the 198-kilometer Hawassa–Ageremariam road section in Ethiopia. The project includes transport and trade facilitation consultancy services to harmonize cross-border procedures. It will contribute a minimum increase of 25 percent in intra-COMESA (Common Market for Eastern and Southern Africa) and increase trade between Kenya and Ethiopia by at least 200 percent by 2017; it will also increase household incomes by an average of at least 10 percent by 2020.

**Nacala transport corridor (Mozambique, Malawi, and Zambia):** The project will upgrade a major regional corridor and convey significant benefits, including reduced user costs, increased access to social services, and responses to projected traffic increases. It will increase the capacity to handle cargo at Nacala port from 0.9 million tons in 2009 to 1.6 million tons in 2015, and reduce transport and transit costs by 25 percent in 2015.

### TRANSPORTATION: RAILROADS

#### **The Tangiers Marrakech Railroad project (Morocco):**

The project has the potential of connecting the country to its North African neighbors. When completed in 2016, it is expected to significantly boost rail travel, with an improvement in rail traffic fluidity and increased frequency of shuttle, mainline, and freight trains; increase population mobility in the project area; and create direct and indirect jobs during project implementation and operational phases.

### TRANSPORTATION: AIR

#### **Blaise Diagne International Airport project**

**(Senegal):** This airport will have an annual capacity of 3 million passengers, 80,000 flights, and 53,000 tons of cargo freight (a 3 percent capacity increase). Subsequent expansions will increase capacity to 10 million passengers annually and eliminate over-capacity operation at existing airports. It will be served by the new toll highway (Dakar–Diamniadio), which will facilitate air cargo transportation in reduced time, contributing to the reduction of production costs and the improvement of business productivity.

## ICTS

### **Other 3 billion Networks (O3b) multinational project:**

The O3b project will have a constellation of eight medium-orbit satellites in nine countries. The project will deliver affordable, high-bandwidth, high-quality Internet and cellular access to inland markets in developing countries and island economies. O3b is dedicating one-third of its capacity to Africa's needs. It will reach "white spaces" (unused channels of the wireless spectrum) and fragile states with high-quality ICT infrastructure; it will connect 18 million households (in nine Africa countries) to cellular backhaul, 1.6 million broadband users to global backbone, and 4,000 firms to corporate voice/data networks. The total cost savings over the equivalent capacity from high-orbit satellites is estimated at US\$1.3 billion net present value.

The project will promote private-sector development with growth in revenues of the nine African off-takers (those who buy Internet services from the O3b investors) and Internet and telecommunication operators, projected at US\$490 million net present value. It will promote regional integration by expanding broadband Internet and cellular access across several Africa countries: Cameroon, the Democratic Republic of Congo, Ghana, Kenya, Malawi, Nigeria, Sierra Leone, and Zambia.

**Source:** AfDB: various infrastructure project reports.