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The SADC's Infrastructure

A Regional Perspective

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Abstract

Infrastructure improvements boosted growth in the Southern African Development Community (SADC) by 1.2 percentage points per capita per year during 1995–2005, mainly from access to mobile telephony. Road network improvements made small growth contributions, while power sector inadequacy had a negative impact. Infrastructure improvements that matched those of Mauritius, the regional leader, could boost regional growth performance by 3 percentage points.

SADC's 15 member countries include small, isolated economies with island states, a mix of low- and middle-income countries, and larger countries with potentially large economies. The economic geography reinforces the importance of regional infrastructure development to create a larger market and greater economic opportunities.

The region's infrastructure indicators are high for Africa. The regional road network is well-developed, and surface transport is comparatively cheap, but subject to delays and long-haul fees. An extensive railway system competes directly with road transport. With integration and improvements, SADC's ports could form an effective transshipment network. Air transport, dominated by South Africa, is the best in Africa. Electricity in southern Africa is well developed; the region leads Africa in generation capacity and low rates, but access is limited. ICT services are the most accessible among the regions, though expensive. Landlocked countries still need to be connected, and greater competition is needed to reduce costs.

Completing and maintaining SADC's infrastructure will require $2.1 billion annually for a decade. For small countries, and large countries with small revenues, the burden may be insurmountable without external assistance.

This paper is a product of the Sustainable Development Unit, the Africa Region. It is part of a larger effort by the World Bank to provide open access to its research and make a contribution to development policy discussions around the world. Policy Research Working Papers are also posted on the Web at http://econ.worldbank.org. The author may be contacted at vfoster@worldbank.org.

The SADC's Infrastructure: A Regional Perspective

Rupa Ranganathan and Vivien Foster

Acknowledgments

This paper draws on contributions from sector specialists from the Africa Infrastructure Country Diagnostic Team; notably, Heinrich Bofinger on air transport, Michael Minges on information and communication technologies, and Alvaro Federico Barra on spatial analysis.

The paper is based on data collected by local consultants and benefited greatly from feedback provided by colleagues in the relevant World Bank teams; notably Yusupha Crookes (director of the Africa Regional Integration Department), Andrew Roberts (Africa Regional Integration Department), Gael Raballand (transport), and Charles Kunaka (International Trade Department). The paper benefited from feedback provided by REC staff at a May 2010 Workshop organized by the Infrastructure Consortium for Africa in Tunis and at other meetings.

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Synopsis

Sound infrastructure is a critical determinant of growth in southern Africa. Over the period 1995–2005, infrastructure improvements have boosted southern Africa's growth by 1.2 percentage points per capita per year. This positive growth effect has come almost entirely from the growth of mobile telephony; improvements in the road network made small contributions. Inadequate power infrastructure has eroded growth more in southern Africa than in other parts of the continent. If southern Africa's infrastructure could be improved to the level of the strongest-performing country in Africa (Mauritius), regional per capita growth performance would be boosted by some 3 percentage points.

Infrastructure in the Southern African Development Community (SADC) ranks consistently above the other regions on a range of infrastructure indicators. But in some areas, such as access to household services—water, sanitation, and power—the differences between the SADC and the leading region for these indicators, the Economic Community of West African States (ECOWAS), are not significant.

Characterized by small and isolated economies including island states and a mix of low- and middle-income countries, the economic geography of the SADC is challenging and reinforces the importance of adopting a regional approach to infrastructure development. Of the 15 member countries, 6 are landlocked, 6 have populations below 10 million people, 10 have economies smaller than $10 billion per annum, and several rely on transnational river basins for their water. South Africa is the economic anchor of the region, but half a dozen of the SADC's member states are large or potentially large economies (including Angola, the Democratic Republic of Congo, Mozambique, Tanzania, Zambia, and Zimbabwe). Knitting these emerging economies more closely together and linking them to markets in South Africa would help to create a larger market and greater economic opportunities in the region.

The SADC has a well-developed regional road network that is in relatively good condition; almost all corridors, with the exception of Nacala and Lobito, are paved. The north-south corridor is the main trading artery connecting South Africa with landlocked Botswana, the Democratic Republic of Congo, Malawi, Zambia, and Zimbabwe and is the preferred route for sea access. Two corridors run east to west and connect South Africa with Namibia through Botswana and Mozambique with Zimbabwe and Malawi. Dar es Salaam serves as an alternative gateway to the sea for Zambia, Malawi, and the Democratic Republic of Congo but is not as heavily used as Durban.

Surface transport in southern Africa is the cheapest in Africa, but still more expensive than other developing countries. The trucking industry in southern Africa is competitive, with lower profit margins than in West and Central Africa. Road transport tariffs are of the order of $0.05 per tonne-kilometer, slightly more expensive than the typical range of $0.01 to $0.04 per tonne-km in much of the rest of the developing world. The implicit velocity of vehicles is 11.6 km per hour, faster than all other regions of Africa but still rather slow. This slow speed has little to do with road infrastructure—which is generally of reasonable quality—and much to do with administrative barriers such as border and customs clearance processes that keep trucks stationary for extended periods of time.

The overall times and costs of moving goods along southern Africa's key trade routes are high. It takes between 400 and 800 hours to move imports from ports to landlocked countries. Inefficiencies at ports due to long dwell times and lengthy customs processes account for the lion's share of the total time required to import freight. The cost of transporting imports costs between $120 and $270 per tonne, which is expensive in absolute terms but nonetheless the cheapest in Africa. The high costs are mainly attributed to ports delays and freight charges that cumulate over long distances.

Southern Africa has an extensive railway system; with national systems form a network centered on Durban and offering direct competition to road transport. Railway tariffs are generally set to be competitive with parallel road freight routes. Nevertheless, rail freight often encounters long delays as it moves across borders. A lack of coordination among national rail systems leads to lengthy locomotive interchange periods. The long delays and poor reliability of rail service often diverts freight to the road network. The pressing priority is to improve the performance of national systems to allow them to compete more effectively with road transport, and to play their appropriate role within a multi-modal transport system.

In the ports sector, southern Africa has the potential to create a more effective transshipment network centered on Durban and perhaps Dar es Salaam. Ports in southern Africa are more advanced than ports in other parts of Africa but are not efficient when compared to global benchmarks, and port charges are relatively high. The ports at Durban and Dar es Salaam face great challenges due to capacity shortfalls, resulting in long dwell times and congestion. Although southern Africa has a number of other significant ports, these are not typically large enough to attract direct calls and suffer from inadequate land-based infrastructure access.

The air transport market in the SADC is the largest in Africa, with a clear hub-and-spoke structure centered on Johannesburg. Air connectivity in the SADC is strong, as nearly all countries have at least one daily fight to Johannesburg. But the fact that South African Airlines remains the dominant player means that the percentage of flights flown under fifth-freedom arrangements (that is, by carriers that are not registered either in the origin or destination country) is lower than in other parts of Africa. The SADC has made relatively little progress toward implementing the Yamoussoukro Decision. Liberalization of the air transport market ranks behind most regions of Africa.

The power transmission network in southern Africa is rather well developed; it leads the rest of the continent in generation capacity and offers power at relatively low costs. Until the recent power crisis in South Africa, outages were lower than in other regions. But despite the relatively high generation capacity, access to power in the SADC is surprisingly low. With power demand likely to increase by 40 percent over the next decade, expanding power infrastructure is critical to the region's economic future.

The Southern African Power Pool (SAPP) has already established the principle of regional trade. Further pursuit of such trade could bring substantial benefits, but this depends on the Democratic Republic of Congo's ability to become a hydropower exporter. The SAPP is the most active trader in the region, the actual volumes of power traded are not large. There is tremendous potential to develop trade much further—in fact, many countries in the region would be better off if they imported more than half of their power needs. Such regional integration would bring numerous advantages. The region's cost of energy would be reduced by $1.1 billion annually. Most countries would significantly cut their national power development costs, and several smaller countries could substantially reduce their long-run marginal costs of power. In addition, regional trade would allow a shift to cleaner energy that would reduce regional carbon emissions by a significant 41 million tonnes per year. Overall, investments in regional interconnection yield an average rate of return of over 160 percent. But most of these benefits hinge on the development of 7,640 megawatts of cost-effective hydropower in the Democratic Republic of Congo, where a host of technical, financial, and political challenges make this a challenging prospect.

The SADC offers the best access to ICT services of any regional economic community, but these services are priced high. While the SADC has some roaming arrangements in place (where customers of a mobile operator can use their phones while visiting another country) these have a number of restrictions and limitations, rendering the SADC less advanced than ECOWAS in this regard. The telecommunications market in the SADC has been open to foreign investors since the early 1990s, several large companies dominate the market. Three countries gained access to a submarine cable and several more will be connected through projects that are under way. No landlocked country has been connected as of yet. Creating competition among landing stations is critical to providing affordable service. In order for the benefits of submarine access to spread throughout the region, it is necessary to complete the 5,100 missing kilometers of terrestrial fiber optic network. Associated investments are small and anticipated returns on reducing the price of broadband access relatively high, with payback periods of less than a year.

Completing and preserving the SADC's regional ICT, power, and transport backbones would require sustained spending of $2.1 billion annually over the course of a decade. This is about 7 percent of the overall infrastructure spending requirements (regional and national) for the SADC region as a whole. Of the total $2.1 billion, around $1.6 billion a year is associated with investment in new regional infrastructure assets, while the balance of $0.4 billion is needed to maintain the regional network in perpetuity once established, most of it associated with road maintenance. By far the largest item on the regional spending agenda is the power sector, with specifically regional power assets demanding $1.4 billion per year over the next decade. The transport sector comes in second place, with an annual spending requirement of $0.3 billion.

Regional infrastructure requirements across all infrastructure sectors represent 1 percent of regional GDP, but for small countries in the SADC, this burden may be insurmountable. In absolute terms, the largest burden would fall on the Democratic Republic of Congo, which would need to spend $961 million a year over the next decade to deliver the infrastructure assets (mainly power) needed for the region. At $265 million a year, Mozambique's spending needs—concentrated in the power sector—pale in comparison to the Democratic Republic of Congo's. The Democratic Republic of Congo's regional spending requirement translates to almost 14 percent of GDP, manifestly beyond what the national economy could plausibly deliver without external assistance. A large group of countries will need to spend between 1 and 5 percent of their GDP for regional infrastructure. Even 2 percent of GDP for a country like Zambia might pose an insurmountable challenge. In terms of current infrastructure spending, the Democratic Republic of Congo would need to spend over 190 percent on regional infrastructure—an impossible proposition.

1 Introduction

The Africa Infrastructure Country Diagnostic (AICD) has conducted extensive data collection and analysis of infrastructure in Africa, including the countries of the Southern African Development Community (SADC). The results have been presented in a variety of continental reports covering different areas of infrastructure—information and communication technology (ICT), irrigation, power, transport, and water and sanitation—and different policy areas, including investment needs, fiscal costs, and sector performance.

The purpose of this regional report is to present the key AICD findings for the SADC community. The main value in doing so is that it makes it possible to benchmark the infrastructure situation in the region against that of other African peers, to identify the main gaps in the regional infrastructure backbones, and to quantify the costs and benefits of regional integration, as well as their distribution across member states.

A number of methodological issues should be borne in mind.

First, owing to the cross-country nature of the data collection, there is inevitably a time lag in the data. The period covered by AICD runs from 2001 to 2006. Most of the technical data presented are for 2006 (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. Given the fast pace of regional integration, the snapshot presented here does not necessarily correspond to today's situation but rather represents the 2006 baseline against which subsequent progress can be measured.

Second, given the need to make comparisons across countries, indicators and analysis had to be standardized and made consistent. That means that some of the indicators may be slightly different from those routinely reported and discussed at the country level.

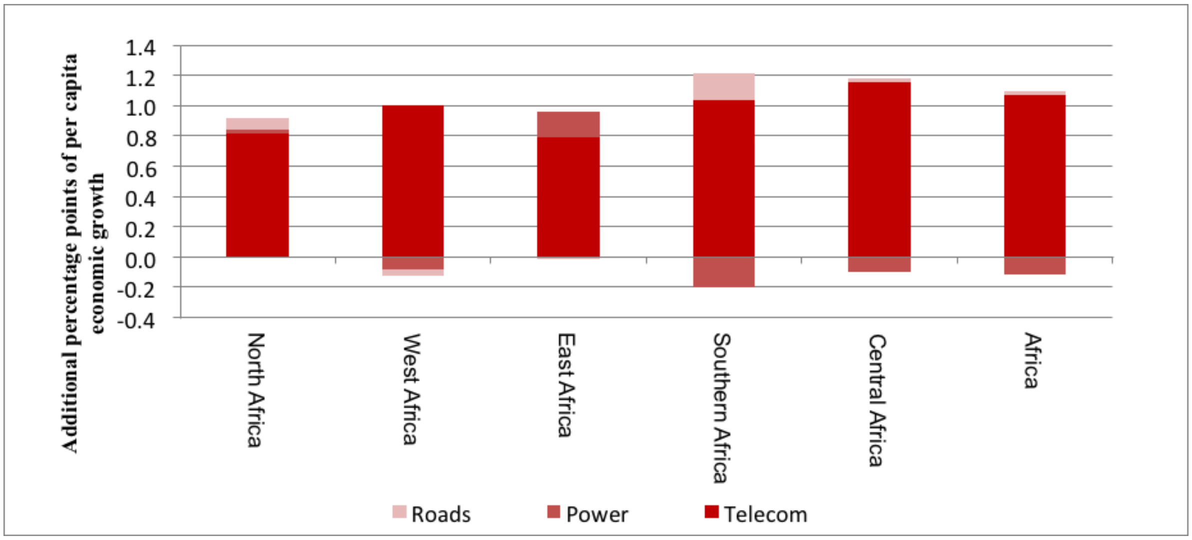
Third, the database on which the analysis is based was designed to give a national and continental picture of infrastructure, as opposed to an explicitly regional picture. But national infrastructure provides the basic building blocks for regional integration, and hence can be used to build up a picture of the regional situation. Nevertheless, some specifically regional issues—particularly of the regulatory and institutional variety—may not have been explicitly addressed in the national data collection effort.

Fourth, while water resource management is an important aspect of regional integration in Africa, this report does not explore water resource issues. The reason is that the AICD project did not cover water resources per se, but rather the specific water resource needs associated with the power, irrigation, and water supply sectors.

Why infrastructure matters

The regional economic community has 15 member states: Angola, Botswana, the Democratic Republic of Congo, Lesotho, Madagascar, Malawi, Mauritius, Mozambique, Namibia, Seychelles, South Africa, Swaziland, Tanzania, Zambia, and Zimbabwe. For the period 1995–2005, all countries for which data are available registered economic growth, albeit at varying rates. The average annual growth, in purchasing power parity (PPP) terms, was above 4 percent for all countries.[1] Infrastructure contributed approximately 1.2 percentage points to growth in southern Africa between 2003 and 2007 (figure 1.1a). Of this, 1 percentage point was due to the growth of mobile telephony, as was the case in all other regions. Improvements in road infrastructure added 0.2 percentage points, more than in other regions. The lack of adequate power infrastructure eroded growth by 0.2 percentage points, more in southern Africa than in other regions.

Figure 1.1a Infrastructure's historic contribution to economic growth, 1995–05



Source: Calderón 2009.

But infrastructure could potentially contribute much more to economic growth in the future than it has in the past (figure 1.1b). Simulations suggest that if southern Africa's infrastructure could be upgraded to the level of the best-performing country in Africa (Mauritius), the impact on per capita economic growth would be of the order of 3 percent. While all areas of infrastructure—ICT, power, and transport—need to be upgraded, improvements in power can impact growth by over 1.5 percent. Infrastructure's potential contribution to growth is far less, however, than the rest of Sub-Saharan Africa. This is because the starting point for infrastructure in southern Africa is higher than for the rest of Sub-Saharan Africa, and so the marginal gains are slightly less.

Why regional integration matters

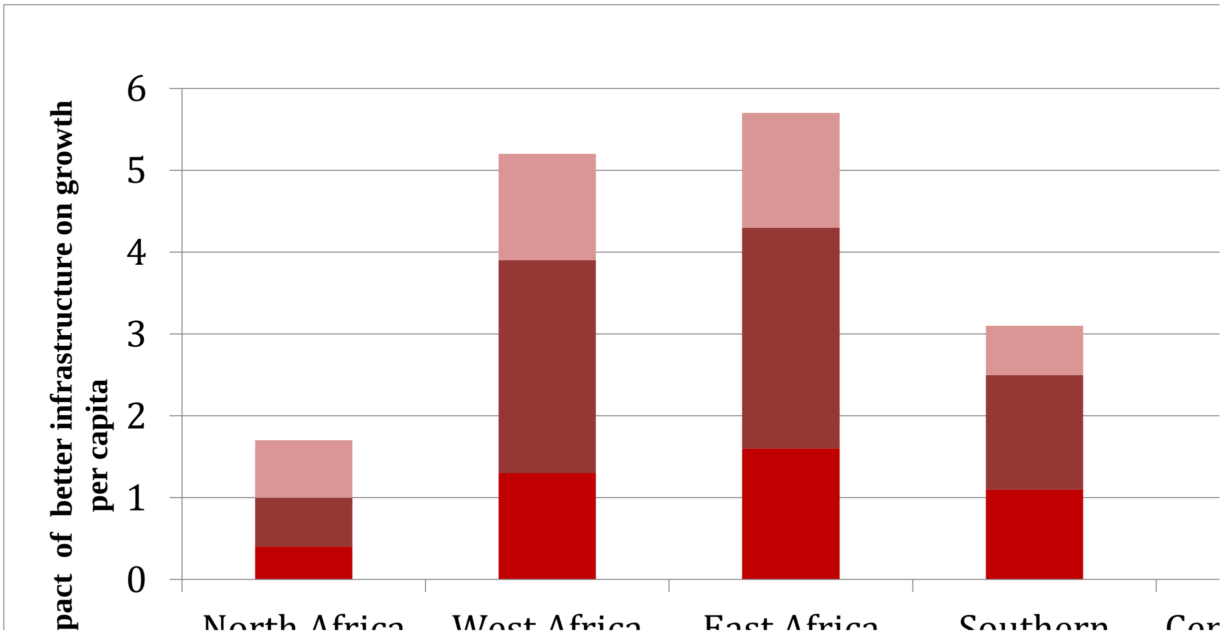
With its large number of relatively small and isolated economies, including island states, the SADC's economic geography is challenging. Of the 15 member countries, 6 are landlocked, 6 have populations below 10 million people, 10 have economies smaller than $10 billion per annum, and several rely on transnational river basins for their water resources (figure 1.2a).

Unlike other regional economic communities, the SADC has five middle-income countries, with the economy of South Africa exerting the strongest influence on the region and serving as an economic

[1] Except Zimbabwe, where no data are available for the years after 2005.

anchor for the rest. Half a dozen of the SADC’s member states are large or potentially large economies—such as Angola, the Democratic Republic of Congo, Mozambique, Tanzania, Zambia, and Zimbabwe. Knitting these emerging economies more closely together and linking them to markets in South Africa would help to create a larger market and greater economic opportunities in the region.

Figure 1.1b Infrastructure’s potential future contribution to economic growth (% GDP per year)



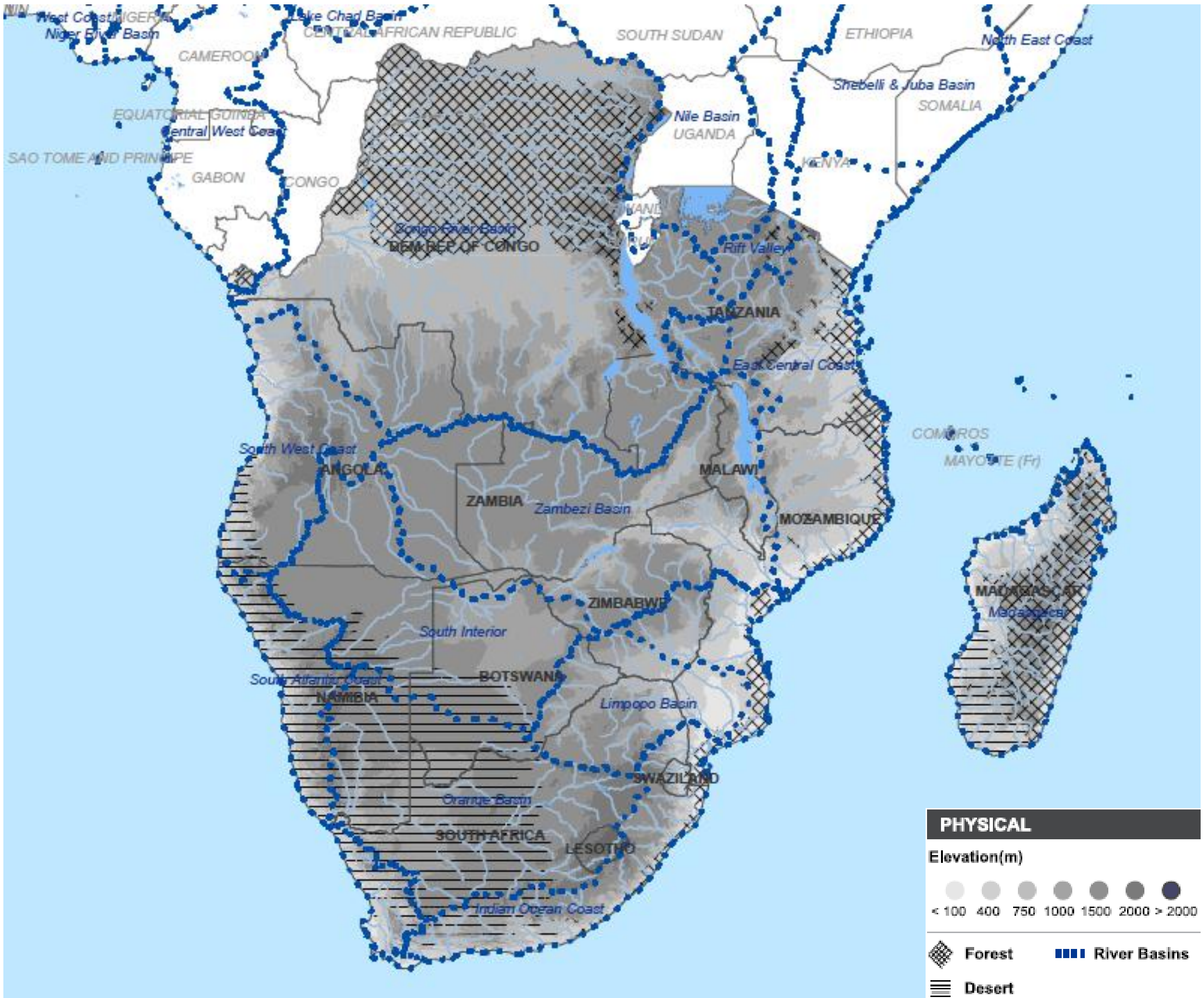
Source: Calderón 2009.
Note: GDP = gross domestic product

There are two bands of intense economic activity in the region. The first and more intense band runs from Durban in South Africa northward up through Lesotho, Gauteng, Zimbabwe, and into the Zambian copper belt. The second (less intense) band runs from northern Angola across the southern Democratic Republic of Congo and all the way through Tanzania. Outside these areas, economic density trails off steadily in the arid areas of Botswana, Namibia, southern Angola, and Western Zambia; the forests of northern Democratic Republic of Congo; and the more depressed agricultural areas of Malawi and northern Mozambique (figure 1.2b).

Regional integration is the only likely way to overcome existing handicaps and to allow the SADC member states to participate in the global economy. Sharing infrastructure addresses problems of small scale and adverse location. Joint provision increases the scale of infrastructure construction, operation, and maintenance. Economies of scale are particularly important in the power and ICT sectors. Big hydropower projects that would not be economically viable for a single country make sense when neighbors share their benefits. Connecting countries via undersea cable or satellite communications requires large up-front investments that require a regional approach. Integrating physical infrastructure is both a precursor to and enabler of deeper economic integration, thereby helping countries to gain scale economies and harness regional public goods.

As well as assessing the current state of regional infrastructure, this report identifies the basic infrastructure needed to provide a minimum level of transport, power, and ICT interconnection. Basic needs include smooth land corridors among landlocked countries and ports, as well as between major cities within a given country or region; cost-effective power generation technologies harnessed at an efficient scale in the context of a regional trading pool; and fiber optic access to submarine cables through a robust communications network interlinking capital cities. Missing physical links will be identified throughout the report, and detailed cost estimates presented in the final section.

Figure 1.2a Topographical profile of the SADC region



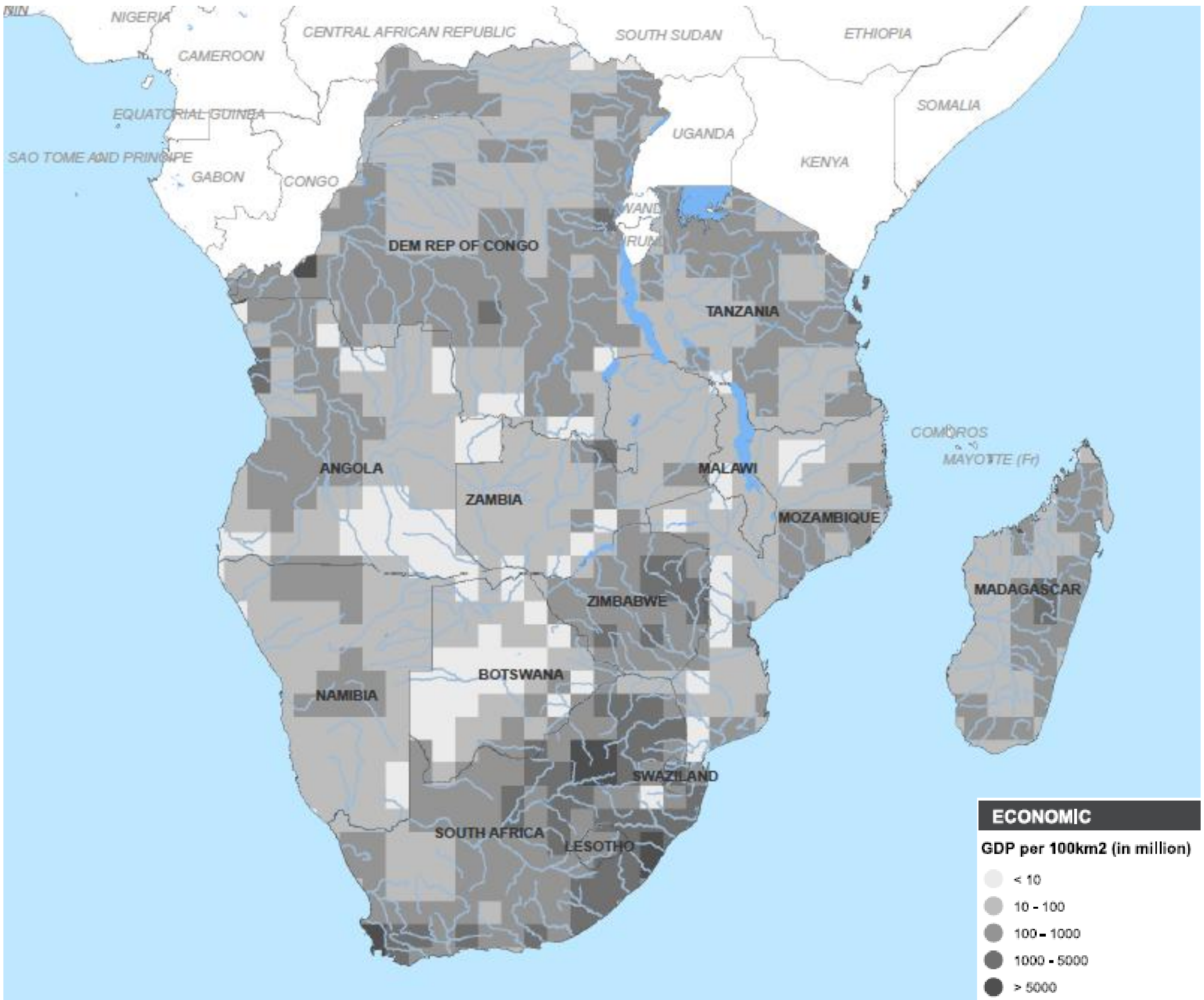
Source: AICD.

The state of the SADC's infrastructure

The SADC's infrastructure ranks consistently above the other Sub-Saharan African regions on all aggregate infrastructure indicators (table 1.1). But in some areas such as access to improved sources of water and sanitation, as well as electricity, the differences between the SADC and the Economic Community of West African States (ECOWAS)—the next-best performer in terms of aggregate performance—are not significant. In terms of electricity generation and mobile and mainline density, the SADC performs significantly better than all the other regions. The aggregates for the SADC, however, mask country variations within the region.

The following sections of the report review the main achievements, challenges, and future benefits of regional integration for each type of network infrastructure. Table 1.2 summarizes the main findings of this sectoral review. The final section of the paper explores the overall financial costs and affordability of implementing the regional integration agenda in southern Africa.

Figure 1.2b Spatial distribution of economic activity within the SADC



Source: AICD.

Table 1.1 Benchmarking the SADC against other economic communities

	Western	Eastern	Southern	Central
Paved road density	38	29	92	4
Fixed-line telephone density	28	6	80	13
Mobile telephone density	72	46	133	84

	Western	Eastern	Southern	Central
Internet density	2	2	4	1
Generation capacity	31	16	176	47
Electricity coverage	18	6	24	21
Improved water	63	71	68	53
Improved sanitation	35	42	46	28

Source: AICD.

Table 1.2 Progress of and challenges to regional integration in the SADC

Sector	Achievements	Challenges	Promise of regional integration
Road transport	Several major international gateways in southern Africa that facilitate trade within the region and with East Africa.	Lengthy delays due to trade facilitation issues. Portions of major international corridors are in disrepair.	Reducing costs and delays associated with surface transport of goods within the region.
Railways	Seven interconnected national railway networks form an extensive and well-developed railway network in southern Africa, spanning half a dozen countries and extending from the Democratic Republic of Congo all the way to Durban in South Africa. Compatible gauges.	Low levels of passenger and freight traffic, poor operational performance of railways outside South Africa. Railways face stiff competition from other modes of transport. Huge challenges to the interconnection of services and lengthy delays.	
Ports	Burgeoning container and general-cargo traffic. Has a strong transshipment hub in Durban (highly efficient) and in Dar es Salam (moderately efficient).	Port capacity is stretched by traffic. Handling charges are very high. Ports in the western area of southern Africa are not very competitive. Extensive delays at ports hinder movement of freight to landlocked countries.	
Air transport	Best regional connectivity. Steady growth in air traffic. Strong hub-and-spoke structure centered on Johannesburg. Fleet has been upgraded.	Very low level of progress toward liberalization of the sector. Air safety standards across the region are highly variable.	Collaborating on improvement of safety record and making progress toward achieving liberalization of the sector.
Power	High level of existing capacity. Demand is generally being met. High electrification rates. Principles of regional trade already well established.	Cost recovery relatively low among utilities. Low levels of access.	Deepening regional integration would save the SAPP area $1.1 billion in annual energy costs, and annual savings in carbon emissions of some 40 million tonnes. Long-run marginal cost of power in the SAPP would fall by $0.01 per kilowatt-hour. Overall rate of return on regional integration investments is 167%.
ICT	Access to ICT services among the highest in Africa. Significantly cheaper to call on a landline within the SADC than outside the region.	Countries pay high prices for critical ICT services. Landlocked countries and Namibia along the coast are not connected to the submarine cable. Roaming arrangements are not as advanced as in other regions.	Achieving regional integration of ICT will cost only $139 million and bring benefits of $204 million annually. Benefits derive primarily from lower prices inducing higher rates of subscription to broadband services. The overall rate of return on regional integration investments is over 168%.

Source: AICD.
Note: SAPP = Southern African Power Pool; ICT = information and communication technology.

2 Surface transport

Surface transport of goods in Africa is much slower and costlier than elsewhere in the developing world. Across the developing world, freight can typically be moved around at rates of between $0.01 and $0.04 per tonne-kilometer (tonne-km). A recent study of road transport costs and prices across Africa found rates of between $0.05 and $0.13 per tonne-km—well above the global benchmark. It also found that despite the relatively good condition of the road corridors, freight movements were astonishingly slow when all delays were taken into account. At an effective speed of 6–12 kilometers per hour, they did not move much faster than a horse and buggy (table 2.1).

Table 2.1 Relative performance of transport corridors in Africa

Corridor	Length (kms)	Road in good condition (%)	Trade density (US$ millions per km)	Implicit velocity* (kmph)	Freight tariff (US$ per tonne-km)
Western	2,050	72	8.2	6.0	0.08
Central	3,280	49	4.2	6.1	0.13
Eastern	2,845	82	5.7	8.1	0.07
Southern	**5,000**	**100**	**27.9**	**11.6**	**0.05**

Source: Teravaninthorn and Raballand 2009.

Note: *Implicit velocity is the total distance divided by the total time taken to make the trip, including time spent stationary at ports, border crossings, and other stops.

The volume of goods carried on southern African corridors per kilometer is significantly higher than all other parts of Africa—as much as three times higher than West Africa, the region with the second-largest traffic volumes. This suggests that the Southern African Development Community (SADC) region benefits from scale economies in regional road freight transportation to a greater extent than is possible in other parts of Africa.

Transit corridors in southern Africa perform significantly better than in other parts of Africa. Road freight tariffs, at 5 cents per tonne-km in southern Africa, are the lowest in the continent; meanwhile, an effective velocity of 11.6 miles per hour allows goods to move faster than in other parts of the continent. On select corridors in the SADC, such as from Durban to Lusaka, price and performance levels approach those of regions outside Africa. Yet, as will be discussed below, transit times leave much to be desired.

The 2010 Logistics Performance Index (LPI) confirms that the costs associated with overall logistics in southern Africa are lower than those in East and West Africa but marginally higher than those of the average lower-middle-income country in the world.[2] Within southern Africa one finds variation at the country level. South Africa has logistics systems that are comparable with those of Europe, but other countries, by virtue of being island states or landlocked, have very low connectivity. Namibia and Angola are among the worst performers globally. Logistics in southern Africa also suffer from high import costs, the second highest in the world after West Africa (World Bank 2010a; 2010b).

[2] LPI is an annual survey of international freight forwarders. The survey aggregates the perception of survey respondents into an index that integrates several factors—transport, warehousing, border clearance, and so on—in order to rank them, and rates global logistics for trade.

Unlike in West and Central Africa, the trucking industry in southern Africa is advanced in terms of regulatory frameworks and logistics. The transport market and operations of southern Africa combine liberalization with enforcement of quality and load control rules applicable to all trucking operators. Operations in southern Africa are governed by bilateral agreements, which unlike in other parts of Africa prohibit the setting of quotas. These agreements facilitate the establishment of direct contracting between shippers and transporters, and create incentives for transporters to be more efficient.

Truck utilization levels are much higher in southern Africa than in West and Central Africa. For example, trucking companies in southern Africa are able to utilize their vehicles at a level of 10,000–12,000 km a month—the level of European transporters—as compared with 2,000 km per month in West and Central Africa. The better truck utilization in southern Africa provides incentives for investments in service quality, including investments in better and newer trucking fleets relative to the rest of Africa. The Zambian trucking fleet, though generally old, manages to achieve a higher annual trucking mileage. Truck operators in southern Africa are not infamous for overloading trucks, unlike in West and Central Africa. At 20–60 percent, profit margins in southern Africa are much lower than in West Africa, where large profit margins averaging 80 percent negatively impact transport prices.

In southern Africa, transport costs are adversely impacted by the opportunity costs of delays at border crossings, weighbridges, and ports, and by lengthy customs processes. Simulations suggest that reducing border delays can reduce transport costs significantly. Delays at Beit Bridge (on the border between South Africa and Zimbabwe) and Chirundu (a border post between Zambia and Zimbabwe) have resulted in a significant economic drain. Beit Bridge is the busiest border post in the region, handling as many as 500 trucks a day; delays for northbound traffic are 34 hours and for southbound traffic 11 hours. Evidence from the Chirundu border indicates that it takes northbound traffic approximately 39 hours to cross the border and southbound traffic 14 hours. The total cost of trucks standing at these two border posts is over $60 million per year. When costs of standing at other borders—such as Groblersbrug/Martins Drift and Kazungula—are factored, the costs increase by as much as an additional $100 million per annum (Curtis 2009).

In large part, these delays are attributed to the complexity of the consolidated loads (loads with multiple consignors/consignees) being cleared, the variety of duty rates, and the fact that often only one clearing agent is involved. The northbound delays are significantly more than the southbound delays at the Chirundu border because the Zambian Revenue Authority takes on average 17.4 hours to process documents and inspect loads. Idle time for northbound loads is approximately 10.9 hours per trip due to delays in document handling upon truck arrival, border clearance, and driving (Curtis 2009). More recently, there have been significant efforts to reduce border delays and subsequent transport costs at these borders.

Administrative costs and times associated with moving freight across borders are significant and include lengthy documentation time and high customs clearance fees and terminal handling charges. A Mozambican company entering Zimbabwe must pay a road user fee of $25 per 100 kilometers, an entry visa that costs approximately $30 for a month, and a guarantee of $120 per year (USITC 2009). These administrative costs add greatly to the costs of trade.

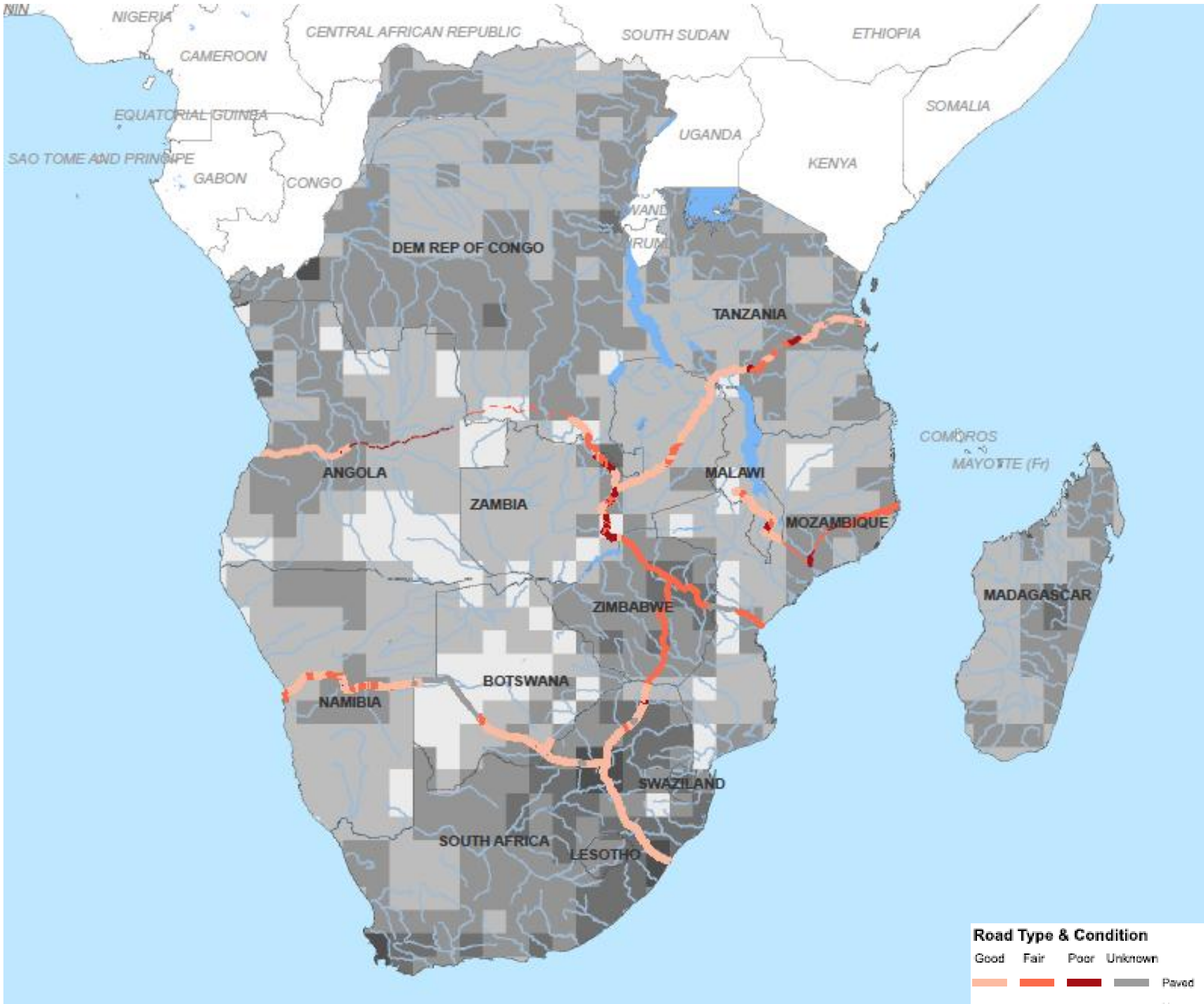
The main trading artery in the SADC region is the north-south corridor, running north from the port of Durban in South Africa toward the southern Democratic Republic of Congo and Tanzania. This corridor is currently the preferred route to sea access for landlocked Botswana, the Democratic Republic of Congo, Malawi, Zambia, and Zimbabwe. Durban is the largest and most efficient port in the area—although by no means the cheapest—and accounts for over three-quarters of the total traffic in the region.

Most landlocked countries in the SADC region have at least one other route to the sea, usually through an east-west branch from the north-south corridor (figure 2.1a and 2.1b). Thus, Lubumbashi has access to Dar es Salaam and in the near future may see its access to Lobito (in northern Angola) restored. Lusaka has access to Dar es Salaam, Lilongwe has access to Nacala in northern Mozambique, Harare has access to Beira in central Mozambique, and Gabarone has access to Walvis Bay in Namibia. But, at present, most of these secondary options are used lightly. This is in part due to the poor condition of the corridors through Angola and Mozambique. Significant investments are under way to improve the infrastructure on the Walvis Bay route. Another factor is that the ports on these secondary corridors are much smaller than Durban and hence receive few, if any, direct calls from international shipping lines. Consequently, traffic going through these corridors will in any case undergo transshipment through Durban.

With the exception of the Nacala and Lobito corridors, all of the aforementioned routes are almost entirely paved (table 2.2). There are two corridors where only three-quarters of the roads are in good or fair condition. These are Harare to Beira and Gaborone to Walvis Bay. Only about half the roads in Mozambique and Botswana along the two corridors are in good condition. The quality of the roads connecting landlocked Zimbabwe to the port of Beira is poor, hindering the competitiveness of the port even though the distances from Zimbabwe are significantly shorter than the distances to Durban, which is the primary port for freight from Zimbabwe. Similarly, the road connecting Botswana and Namibia also requires upgrading, hindering the use of Walvis Bay as the primary port for freight from Botswana. Even though the corridor connecting Durban to Lusaka—a significant portion of the north-south corridor—is in good condition overall, only a little more than half of the corridor that goes through Zambia is in good condition, reducing the effective speed of freight that moves through this route.

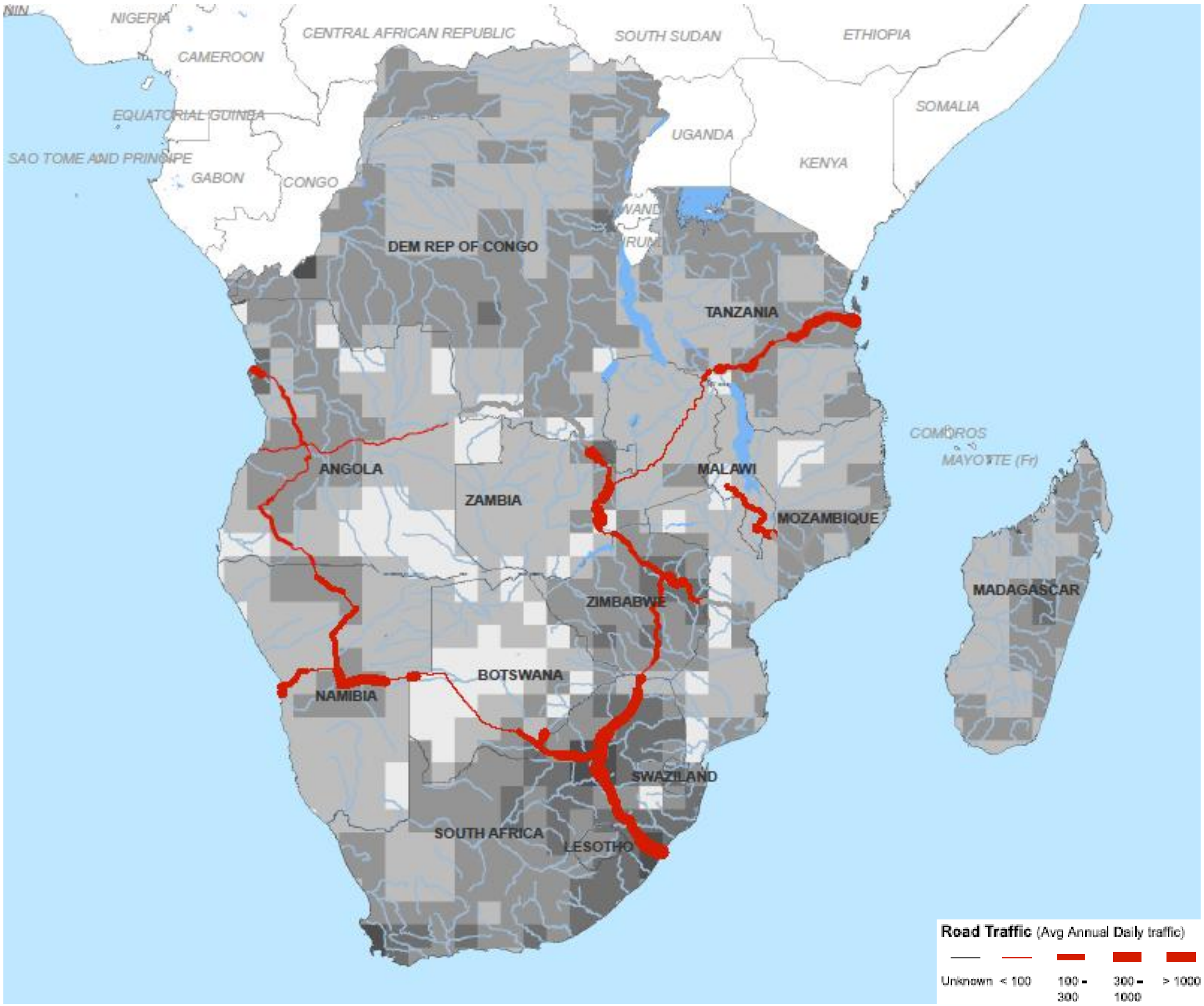
Figure 2.1 The SADC's seven main regional road corridors

a. Road condition



Source: AICD.

b. Traffic volumes



Source: AICD.

Note: Background shows gross domestic product (GDP) per 100 square kilometers on gray scale.

Box 2.1 The north-south corridor

Corridor anatomy. The north-south corridor is the main artery supporting international and intraregional trade in southern Africa and extends from the southern Democratic Republic of Congo to the Cape. The corridor comprises both road and rail arteries, connecting with ports. The core road artery covers a distance of 7,500 km from Dar es Salaam to Durban, spanning Zambia and Zimbabwe. There are subarteries connecting the Democratic Republic of Congo, Malawi, and Zimbabwe. National rail systems form a railway network of approximately 6,000 km. Zambia (RSZ), Zimbabwe (NRZ), Tanzania (Tazara), and South Africa (Spoornet) compose the network. Railway volumes are generally low for all systems except Spoornet. At current traffic levels, all the rail operators along the corridor (with the exception of Spoornet) are running at barely 10 percent of the capacity of the infrastructure. The corridor connects landlocked countries with the port of Durban and Dar es Salam. Subarteries of the corridor link landlocked countries with smaller ports in Mozambique.

Corridor and rail condition. Only around 10 percent of the roads in the corridor are in poor condition. This is because of poor road maintenance in Zimbabwe and to a lesser extent in Tanzania and Zambia. Among the corridor's sub-arteries, roads in Mozambique and to some extent in the Democratic Republic of Congo also need to be rehabilitated. Meanwhile, approximately 30 percent of the length of the rail corridor (outside South Africa), nearly 2,000 km in all, is currently in poor condition and requires rehabilitation. This condition is fairly evenly spread along the network, with most countries facing significant rehabilitation requirements. Existing traffic volumes are too low to cover the high costs associated with infrastructure rehabilitation and track maintenance. With the current traffic volumes, it is not possible for all of the examined railway systems to cover infrastructure rehabilitation needs as well as ongoing track and rolling-stock maintenance costs with their own revenues.

Trade facilitation along the corridor. Lengthy and inefficient administrative processes cause major problems for freight moving along the corridor. Some of the border crossings are notorious for delays to both road and rail freight. For road freight, the journey from Lusaka to Durban takes over eight days to complete, with as many as four days spent at border crossings. While trucks can operate at 50–60 kmph, the effective speed along the route averages a little over 12 kmph. The costs of delays for an eight-axle interlink truck has been estimated to be around $300 per day; given traffic volumes, this represents a loss of more than $50 million annually. For rail freight, a journey of 3,000 km from Kolowezi (along the Democratic Republic of Congo border) to Durban has taken up to 38 days to complete, 29 days of which are associated with customs processes and interchange. Even though trains run at 25–30 kmph, their effective speed along the route is 4 kmph—more or less the pace that a horse and buggy moves. Simulations suggest that these delays cost over $200 a day and represent a loss of $120 million per year, given traffic volumes.

The culprits are the border posts of Beit Bridge (Zimbabwe to South Africa) and Chirundu (Zambia into Zimbabwe). The delays at these borders are reputed to be among the longest in the continent. For railways, the major obstacles to trade facilitation have been a lack of reciprocal access rights among operators, inadequate operational planning, and an overall deficit in traction capacity. As it stands now, either access from one rail system to another is restricted for technical reasons (locomotives from one network are not allowed on another due to inability to provide technical assistance to broken locomotives belonging to another operator) or connecting rail operators simply do not have the necessary traction capacity to service existing traffic (mainly because of the low dispatch reliability of aging and badly maintained locomotives). In addition, poor traffic planning often causes undue delays, as operators have not signed binding contractual commitments that incentivize them to provide reliable interconnection services.

Source: Curtis 2009; AICD various.

Table 2.2 Road conditions along major transit corridors in the SADC

	Condition (%)				Type (%)			Percentage in traffic bands (AADT)			
Corridors	Good	Fair	Poor	Unknown	Paved	Unpaved	Unknown	<300	300–1,000	>1,000	Unknown
Gaborone to Durban*	***97.1***	***0.5***	***0***	***2***	***99.5***	***0***	***0.5***	***0***	***0***	***96.5***	***3.5***
Botswana	90.5	0	0	10	100	0	0	0	0	100	0
South Africa	97.4	0.5	0	2	99.5	0	0.5	0	0	96.3	3.7
Harare to Durban *	***72.9***	***25.3***	***0.5***	***1***	***100***	***0***	***0***	0.8	***3.3***	***94.7***	***1.2***
Zimbabwe	0	100	0	0	100	0	0	3.3	13.9	82.8	0
South Africa	95.8	2	0.7	2	100	0	0	0	0	98.4	1.6
Lusaka to Durban*	***62***	***34.6***	***2.4***	***1***	***100***	***0***	***0***	***1.3***	***5.5***	***92.1***	***1***
Zambia	26.1	31.3	42.5	0	100	0	0	0	59	41	0
Zimbabwe	0	100	0	0	100	0	0	4.2	8.7	87.1	0
South Africa	95.8	2	0.7	2	100	0	0	0	0	98.4	1.6
Lubumbashi to Durban	***59***	***35.3***	***4.9***	***1***	***100***	***0***	***0***	***1.1***	***6.4***	***89***	***3.4***
Congo DR	0	100	0	0	100	0	0	0	0	0	100
Zambia	46.2	28.4	25.4	0	100	0	0	0	23	77	0
Zimbabwe	0	100	0	0	100	0	0	4.2	8.7	87.1	0
South Africa	95.8	2	0.7	2	100	0	0	0	0	98.4	1.6
Lilongwe to Nacala	***27.2***	***60.2***	***12.5***	***0***	***61***	***39***	***0***	***0***	***0***	***34.7***	***65.3***
Malawi	78.4	18.5	3	0	100	0	0	0	0	100	0
Mozambique	0	82.4	17.6	0	40.2	59.8	0	0	0	0	100
Harare to Beira*	***0***	***72.4***	***0***	***28***	***100***	***0***	***0***	***4.2***	***0***	***44.3***	***51.5***
Zimbabwe	0	100	0	0	100	0	0	8.7	0	91.3	0
Mozambique	0	46.4	0	54	100	0	0	0	0	0	100
Gaborone to Walvis Bay	***59.2***	***17.3***	***0.1***	***23***	***100***	***0***	***0***	***11.5***	***44.3***	***44.2***	***0***
Botswana	50.7	5.1	0	44	100	0	0	8.2	65.4	26.4	0
Namibia	68.8	31	0.2	0	100	0	0	15.3	20.6	64.1	0
Lusaka to Dar Es Salaam*	***68.9***	***19.1***	***9.8***	***2***	***100***	***0***	***0***	***34.2***	***23.6***	***42.2***	***0***
Zambia	70.1	19.3	10.6	0	100	0	0	63.7	26.1	10.2	0
Tanzania	67.5	19	8.9	5	100	0	0	0	20.7	79.3	0

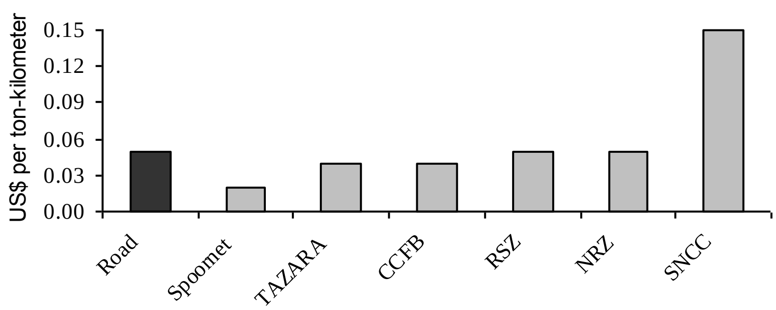
Source: AICD calculations.
Note: AADT = annual average daily traffic.
* Denotes portions of the TransAfrica Highway in the SADC.

Traffic patterns for the SADC region are heavily concentrated along the north-south corridor, with much lower volumes on the east-west branches. For example, the route connecting Harare and Durban is used by over a 1,000 vehicles a day along 94 percent of its length, whereas the route connecting Harare to Beira reaches this traffic level along only 44 percent of its length. The same observation can be made for traffic between Gaborone to Durban versus Walvis Bay, even though Walvis Bay is slightly closer to Gaborone than Durban. Another route that records low traffic is that between Malawi and Nacala.

The competitiveness of each corridor can be gauged by aggregating the time and costs associated with transport, administrative processes (customs), and long waits incurred along the route, whether at ports or otherwise. The cost of moving imports along each of these key arteries and the time taken for this movement are key elements of the competitiveness of both international and intraregional trade. The time taken can be broken down into four components: the travel time of goods, based on velocity along each corridor; the administrative time required to import goods into a country; the time taken to clear ports; and the delay incurred in crossing borders. Transport costs are based on the unit costs of moving freight along specific corridors and administrative costs are based on charges levied for bringing imports into a country. Port delays and border delays are quantified using the assumption that delays cost $5 per day per ton of imports.

Comparing the prices of road and rail freight that run parallel to each other in the SADC region suggests that railways have a slight competitive edge in terms of price per tonne-km. The north-south corridor has a competing railway system in southern Africa composed of several national railway systems that form a network (see box 2.1). Road freight tariffs along the north-south corridor are, on average, $0.05 per tonne-km (one of the lowest in Africa) due to widespread direct contracting between shippers and transporters. Overall prices vary along the corridor depending on the average traffic volumes of different segments. Meanwhile, rail tariffs are around $0.05 per tonne-km or even lower (figure 2.2). The only notable exception is the SNCC (in the Democratic Republic of Congo), whose average tariff is three times as much as that of roads ($0.15 per tonne-km), primarily because the state of the road system in the southern Democratic Republic of Congo is so poor that intermodal competition is rare. Assuming that there are no additional delays due to disrepair or other service disruptions, railways have a competitive edge in terms of average tariffs.

Figure 2.2 Comparison of road and rail freight tariffs



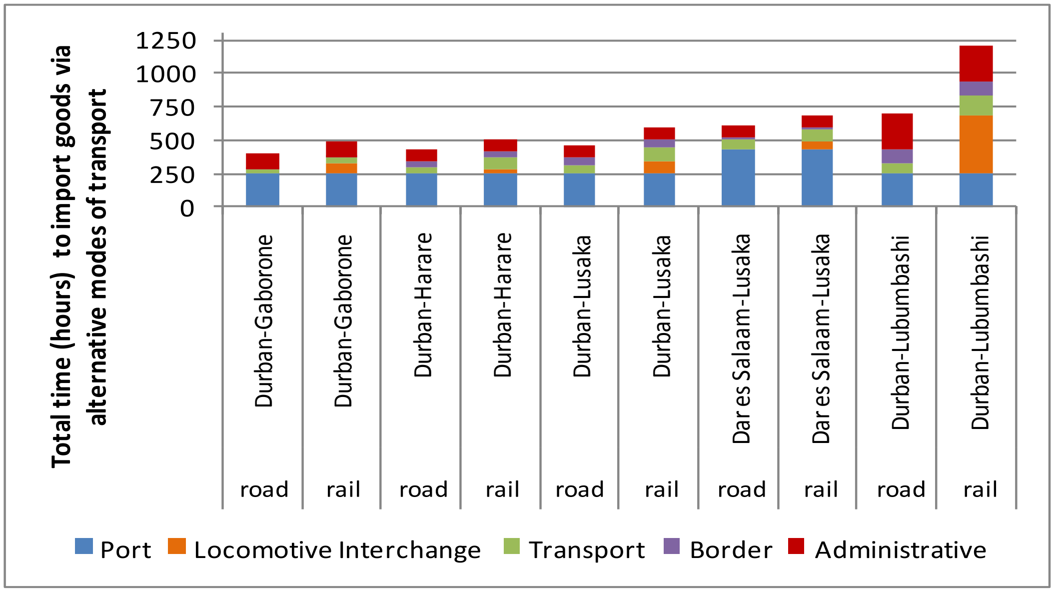
Source: AICD railway database; Teravaninthorn and Raballand 2009.

A comparison of the time required to move a given volume of imports from port of entry to destination revealed that road freight moving over the interregional corridors was faster than rail freight. The trains in southern Africa have rather low implicit velocities. Additionally, delays occur when cargo must be transferred from one national railway network to the other. (The average dwell time for imports at the frontier between two national rail networks is about three days.) On average, it takes between 400 hours (16 days) and 690 hours (28 days) to move freight along the southern African road network. By rail it takes 490 hours (20 days) to 1,200 hours (50 days) (figure 2.3). The slowest times recorded are for moving rail freight from Durban to Lubumbashi (in the Democratic Republic of Congo), with much of the delay occurring on the border between Zambia and the

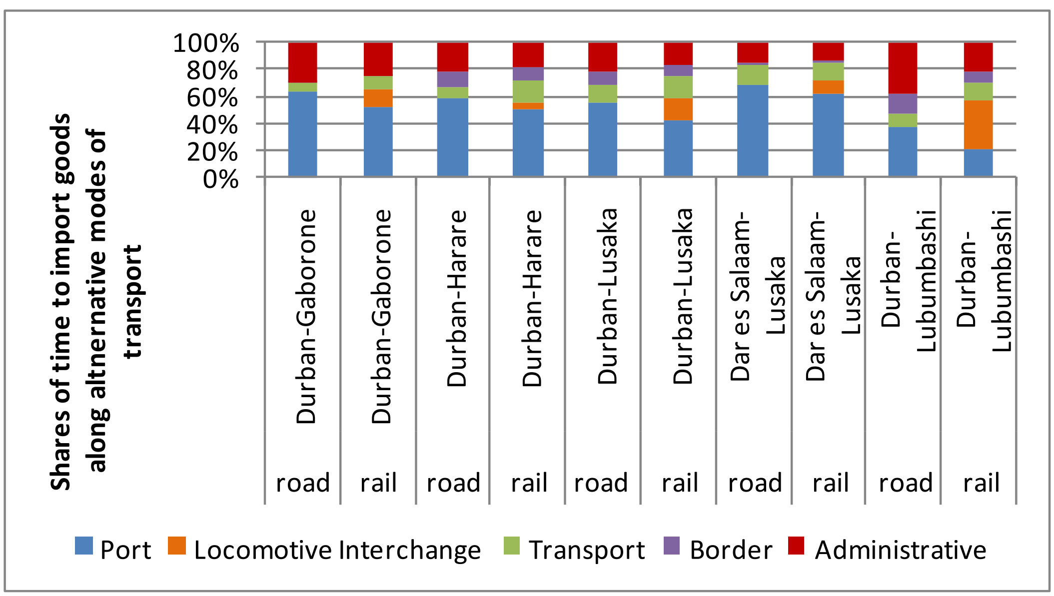
Democratic Republic of Congo, where freight often sits for 16 days (World Bank 2010c).[3] In this corridor, transit time accounts for more than 30 percent of the total time required to move imports from ports to landlocked capitals. Along most other corridors, dwell times at ports account for between 40 and 70 percent of the total time, followed by lengthy administrative processes.

Figure 2.3 Time required to import goods: Road versus rail routes

a. Total time (hours)



b. By step (% of total time)



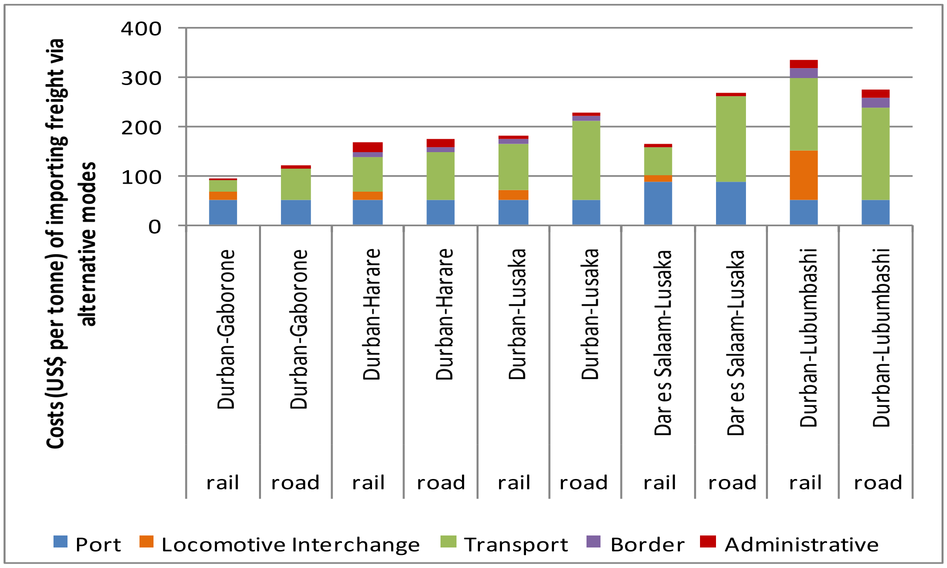
Source: Based on data collected from World Bank 2009; AICD ports and railway databases; Nathan Associates 2010; Teravaninthorn and Raballand 2009; and World Bank 2010.

[3] The baseline for transit times at the border of the Democratic Republic of Congo and Zambia was reported to be 16 days for mining freight.

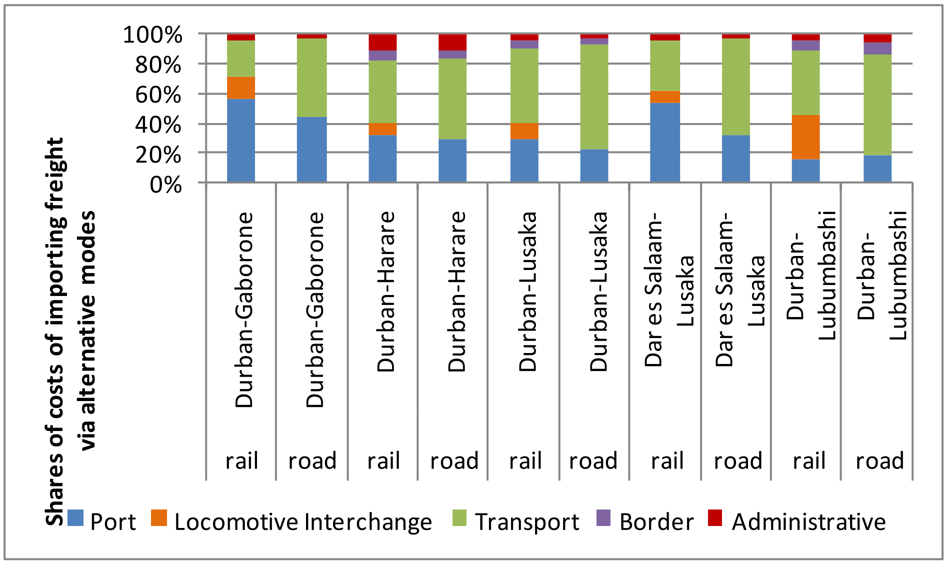
Despite lengthy transit times for imports, it is less expensive in most cases to move freight by rail than by road, giving rail the competitive edge. On average, it costs between $100 and $320 per tonne to move imports by rail and between $120 and $280 per tonne to move them by road. The only case where rail is more expensive than roads is in transporting freight to Lubumbashi. This is in part because of the large economic cost of long waits for locomotives at the border between Zambia and the Democratic Republic of Congo. Of the various factors (including delays at borders, long dwell times for railway-bound freight, and lengthy administrative processes), dwell times at ports and high transport costs compose the largest share of the total cost of moving freight (figure 2.4).

Figure 2.4 Cost of importing goods: Road versus rail routes

a. Total cost (US$ per tonne)



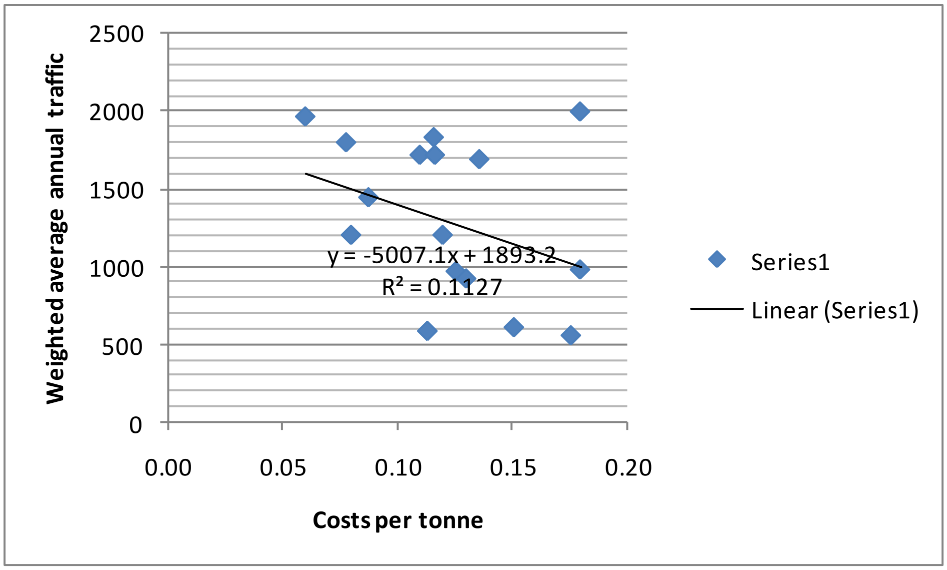
b. Composition of cost (% of total cost)



Source: Based on data collected from World Bank 2009; AICD ports and railway databases; Nathan Associates 2010; Teravaninthorn and Raballand 2009; and World Bank 2010.

Among the road corridors that serve landlocked countries, one finds significant cost differences. There is a strong negative correlation between lower traffic volumes and cost. As traffic increases, the unit cost of transport (per tonne) decreases (figure 2.5). Indeed, unit costs can vary by a factor of one to three—from $0.05 to $0.15 per tonne-km—depending on the level of traffic along different segments of the corridor. Freight tariffs start to fall once traffic volume exceeds 1,000 vehicles per day.

Figure 2.5 Relationship between traffic volumes and unit costs of transport

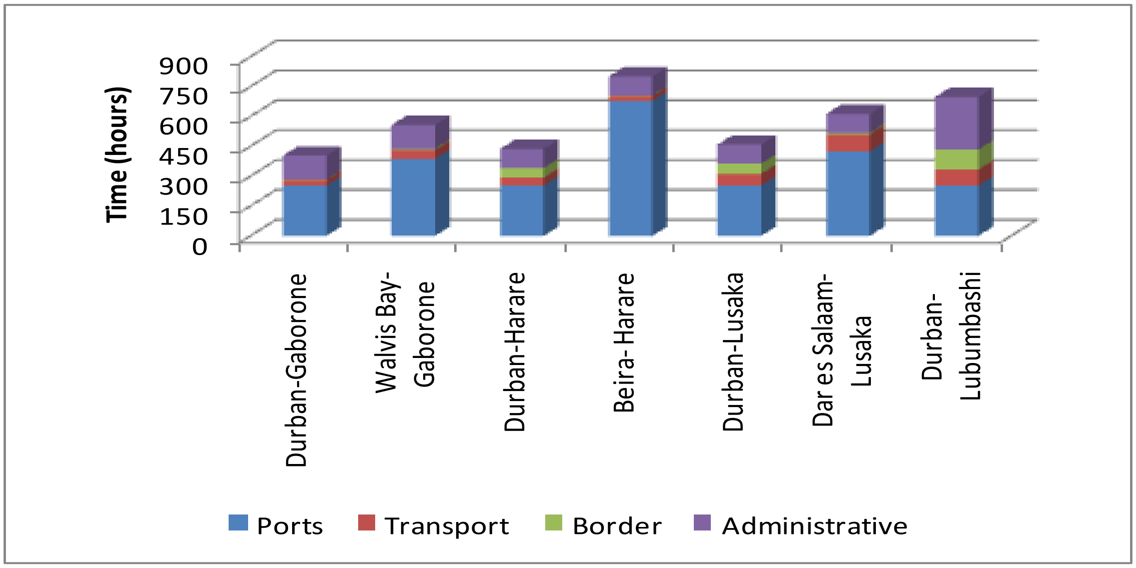


Source: Derived from preliminary data in Nathan 2010. The analysis is based on data from East and southern Africa.

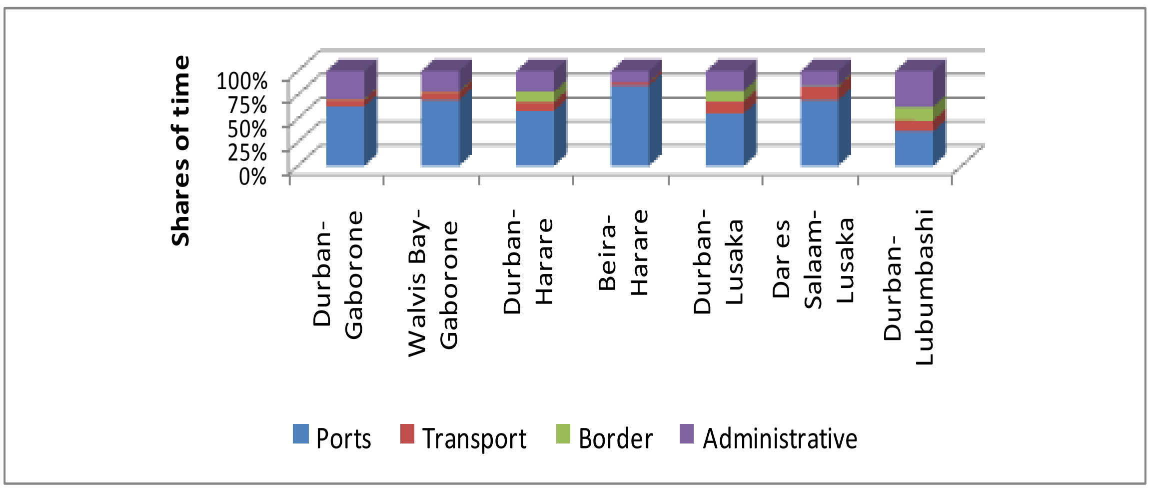
The costs and times of moving imported goods along various corridors in southern Africa are well aligned with observed traffic patterns. An analysis of the time required for imports to reach a landlocked capital ranged from 400 hours to more than 800 hours (figure 2.6a). Around 50 to 80 percent of the time required can be attributed to inefficient operations at ports (based on information from 2006–07; figure 2.6b). In the cases of Durban and Dar es Salaam, some of the inefficiency can be traced to excessive demand for port services, which slows freight clearance. Imports encounter long dwell times, and ships endure long waits for berths. Beira is a smaller port that has been a victim of poor operations. In both Beira and Walvis Bay, significant efforts are under way to improve standards. Regulatory processes in southern Africa (customs clearance and technical control) also add significant times to moving imports into landlocked capitals.

Figure 2.6 Time required to import goods by road through alternate gateways*

a. Total time (hours)



b. By step (% of total time)



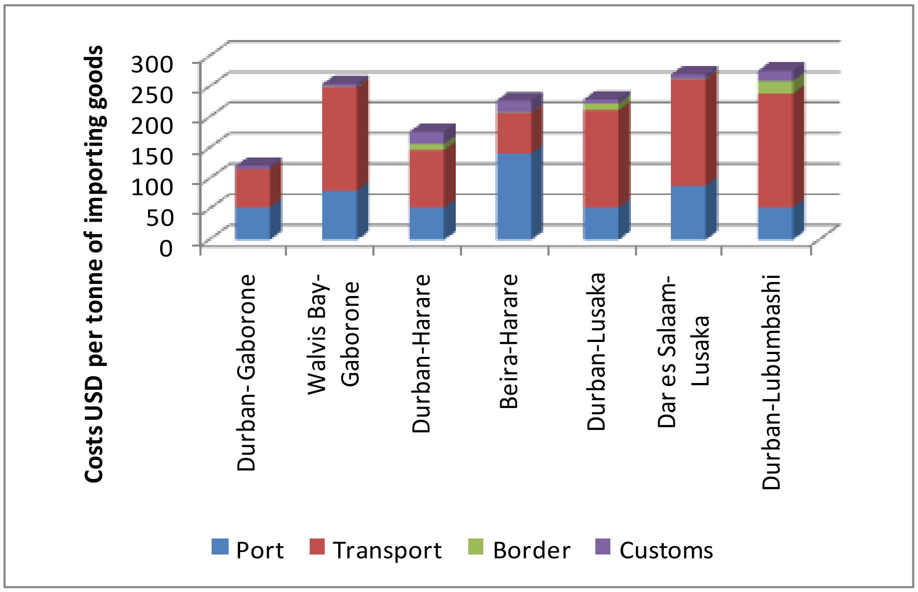
Source: Based on data collected from World Bank 2009; AICD ports database; preliminary estimates from Nathan Associates 2010.
Note: Ports data are based on indicators from 2006–07.

Recent evidence suggests that, overall, the time required to import a given volume of freight to a landlocked country has dropped substantially since 2006–07. Port performance—including time spent waiting for a berth, container dwell times, and vessel turnaround times—has improved dramatically. For example, at the port of Durban, times associated with moving out of the port have decreased from approximately 250 hours to around 150 hours. Despite improvements, however, moving imports from southern African ports to landlocked countries is still a lengthy and costly ordeal—more so than almost anywhere else in the world.

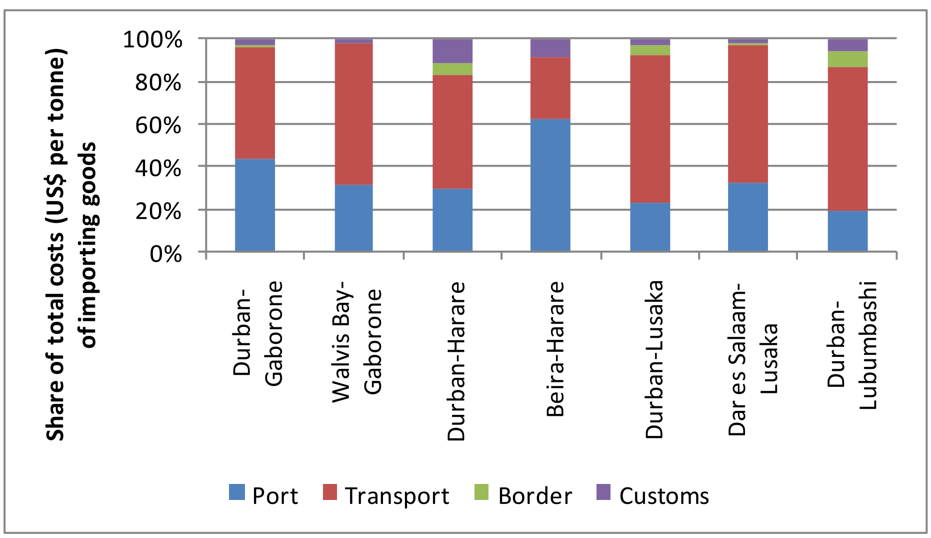
The corridors in which it takes the longest to import goods are those in which the total costs for importing freight are highest. It costs between $120 and $270 per tonne to import freight along intraregional corridors (figure 2.7a). In most cases, transport costs account for the largest share of total costs, with port costs a close second (figure 2.7b).

Figure 2.7 Cost of importing goods by road through alternate gateways

a. Total cost (US$ per tonne)



b. Composition of cost (% of total cost)



Source: Based on data collected from World Bank 2009; AICD ports database; and preliminary estimates from Nathan Associates 2010.

In order to understand overall corridor performance, it is helpful to examine the national performance of the various modal components. The performance of the corridor can only be as good as the performance of the national transport system of which it is a part. To this end, the performance of the national road, rail, and ports sectors is briefly reviewed in the remainder of the section, with the aim of identifying national weaknesses that may have serious repercussions at the regional level.

Roads

This section looks at the national segments of the regional road network. To this end, the regional road network is defined as the network needed to interconnect all national capitals with one another and with the major deep seaports. Overall, 75 percent of the SADC's regional network is paved, compared with over 90 percent in the Economic Community of West African States (ECOWAS) region. While several countries have made sizable investments in upgrading their portion of the regional road network, still more need to make additional investments. Most notably, less than 20 percent of the Democratic Republic of Congo's regional road network is paved, and surprisingly, only 60 percent of the road network in Tanzania is paved. Angola and Mozambique also have to upgrade their regional road network.

The SADC members vary substantially in their track record on the maintenance of the regional road network. Overall, 71 percent of the regional network is in good or fair condition (table 2.3). As a general rule, most member countries maintain their portions of the network in good or fair condition. But there are three important exceptions to this pattern. Countries such as Botswana, the Democratic Republic of Congo, and Zambia have allowed 30–60 percent of their portions to fall into poor condition. This may be symptomatic of wider deficiencies in the funding and implementation of road maintenance works in these countries, and/or denote that regional routes are not being prioritized in their national road plans.

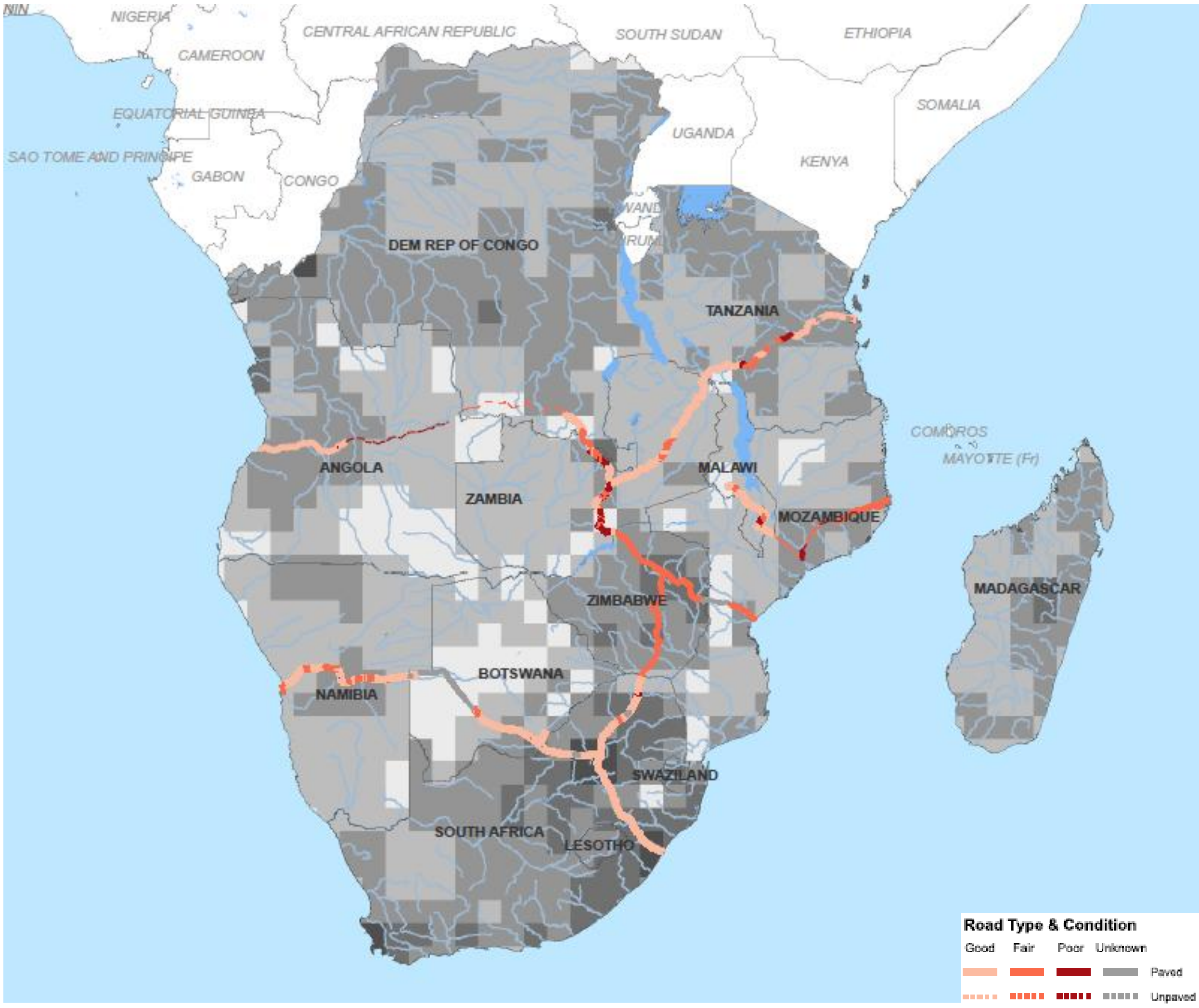
Table 2.3 Condition of the SADC's regional road network, by member country (%)

	Condition				Type		
	Good	Fair	Poor	Unknown	Paved	Unpaved	Unknown
Angola	71.4	5.5	23.2	0	71.4	28.6	0.0
Botswana	40.5	8.1	51.3	0	100.0	0.0	0.0
Congo, Dem. Rep. of	14.2	12.6	61.5	11.7	17.7	82.1	0.2
Madagascar	59.5	24.9	15.2	0.3	77.6	22.4	0.0
Mozambique	12.5	59.2	15.1	13.2	77.9	21.1	1.0
Malawi	61.8	32.7	5.5	0.0	95.5	4.5	0.0
Namibia	49.5	41.0	7.8	1.7	100.0	0.0	0.0
Swaziland	58.0	42.0	0.0	0.0	100.0	0.0	0.0
Tanzania	44.9	35.7	3.7	15.7	60.0	40.0	0.0
South Africa	88.2	4.3	0.2	7.2	99.4	0.0	0.6
Zambia	51.9	14.5	33.6	0.0	99.3	0.7	0.0
Zimbabwe	0.0	100.0	0.0	0.0	100.0	0.0	0.0
SADC	**46.7**	**24.1**	**22.8**	**6.4**	**74.0**	**25.8**	**0.2**
East Africa (EAC+)	**29.8**	**26.5**	**11.7**	**32.0**	**57.2**	**25.4**	**17.4**
EAC	**38.0**	**38.7**	**13.2**	**10.2**	**73.3**	**25.3**	**1.3**
ECCAS	**29.1**	**18.4**	**39.3**	**13.2**	**42.6**	**56.7**	**0.7**
ECOWAS	**45.1**	**28.4**	**22.5**	**4**	**91.9**	**8**	**0.1**

Source: AICD various sources.

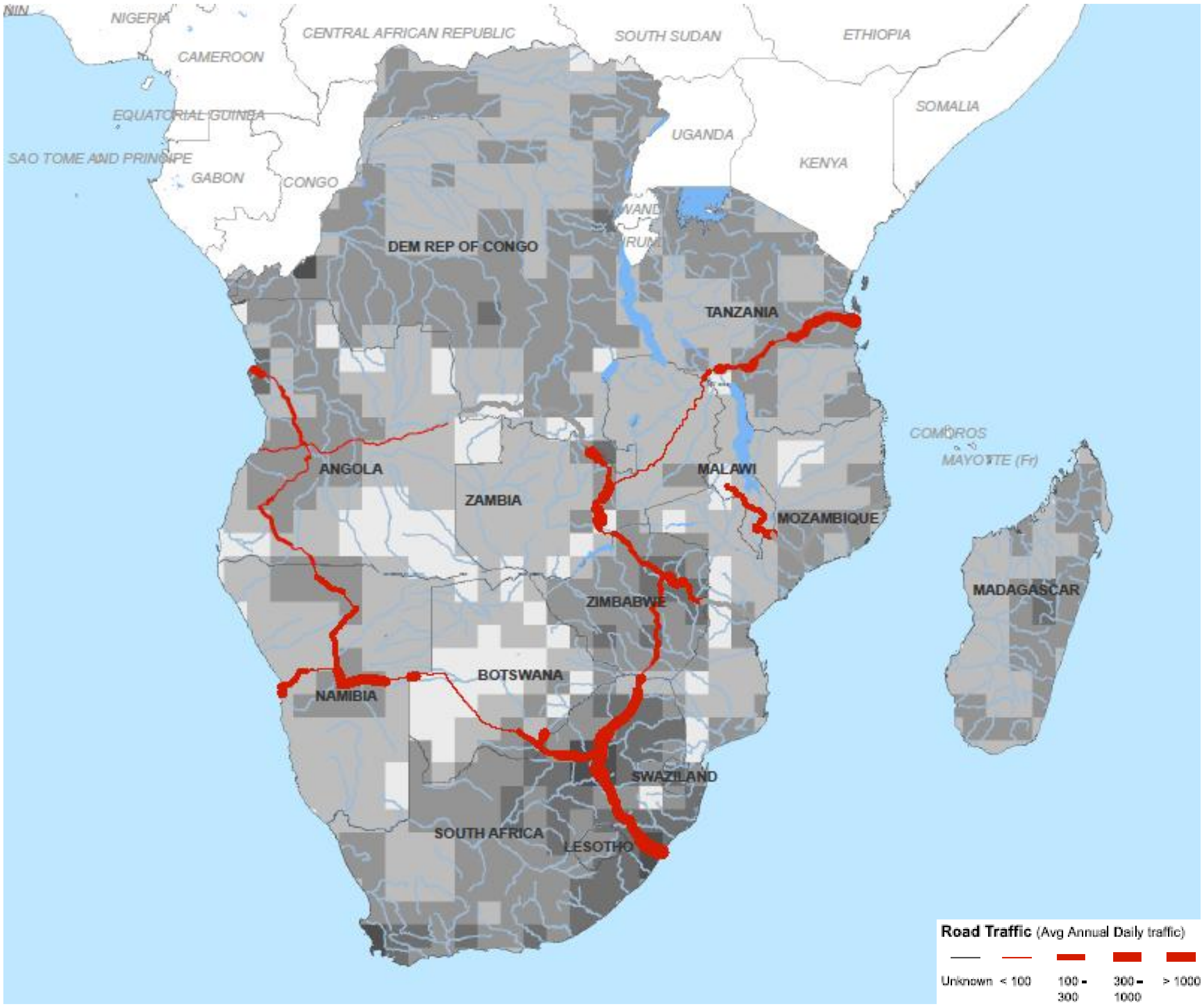
Note: ECCAS = Economic Community of Central African States; ECOWAS = Economic Community of West African States; EAC = East African Community.

Figure 2.8a Condition of the SADC's regional road network



Source: AICD.

Figure 2.8b Traffic on the SADC's regional road network

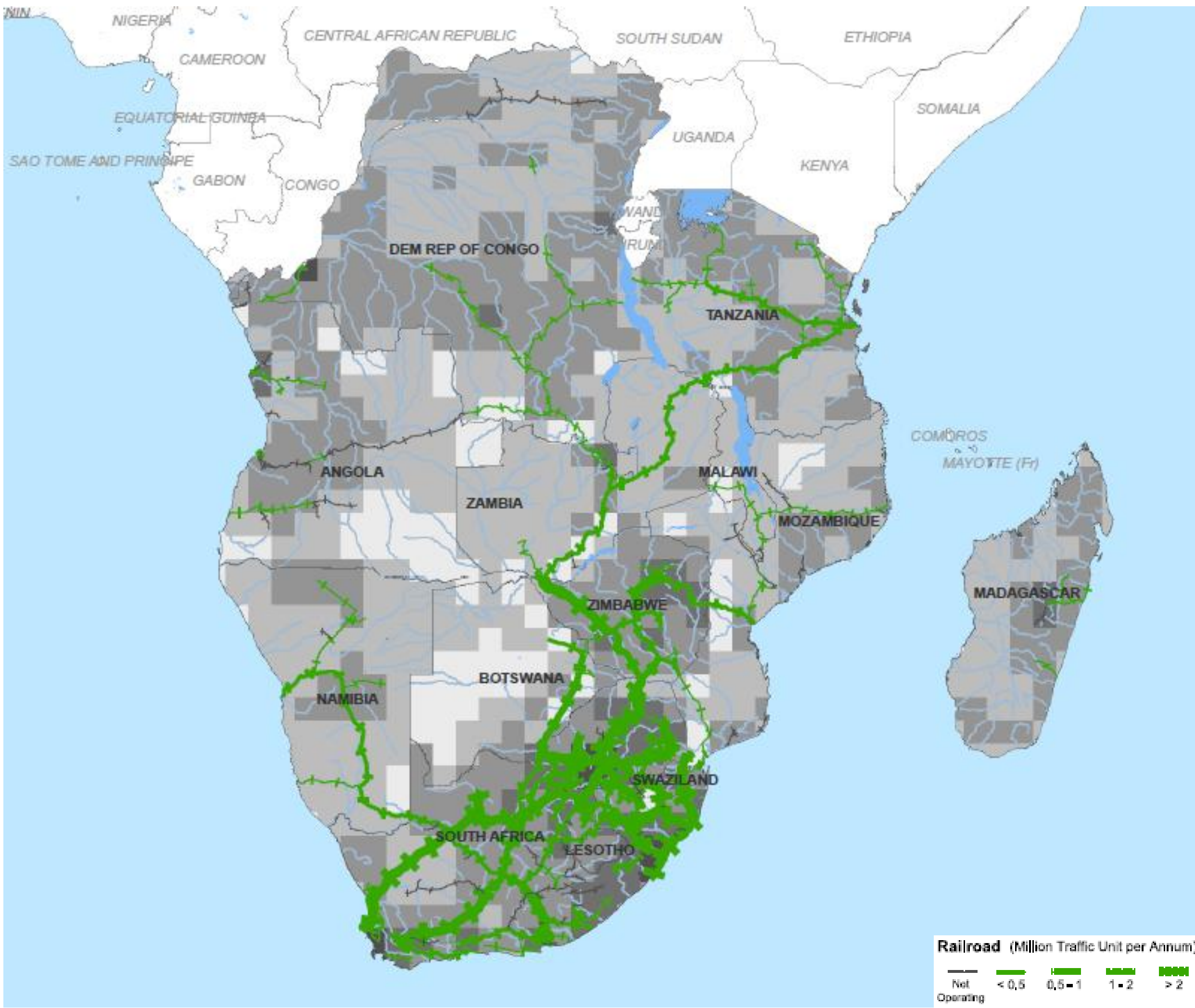


Source: AICD.

Railways

Seven interconnected national railways form an extensive and well-developed regional rail network in southern Africa, spanning half a dozen countries and extending from the Democratic Republic of Congo all the way to Durban in southern Africa (figure 2.9). This represents a far higher level of regional rail interconnection than has been achieved elsewhere in Africa, where a few binational railways exist but systems are otherwise disconnected. Unlike in other parts of Africa, the rail network in southern Africa is integrated with the use of a uniform gauge.

Figure 2.9 The SADC's regional railways

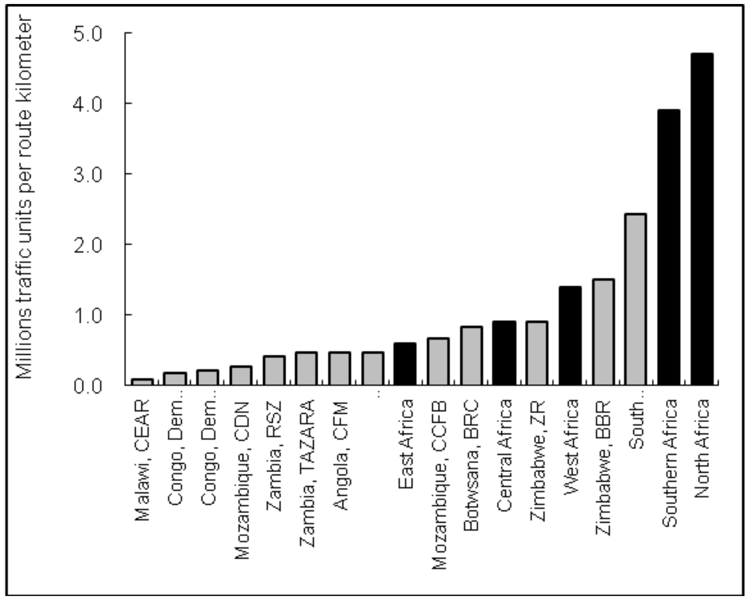


Source: AICD.

Of the total 55,000 km of track in Sub-Saharan Africa, 40 percent of the operating network and 70 percent of the traffic are captured by Spoornet in South Africa. Railways in southern Africa carry much more freight than in all the other regions of Africa put together. Overall, southern Africa handles around 74 percent of Sub-Saharan Africa's freight traffic (including coal and minerals) and more than 80 percent of the total net tonne-kilometers. Southern Africa also dominates the passenger business, carrying more than 70 percent of total passenger-kilometers, largely because of its heavy commuter passenger business.

Southern Africa has the highest traffic density in Sub-Saharan Africa. Nevertheless, outside of South Africa and Zimbabwe, rails are lightly used (figure 2.10). With the exception of these two cases, most southern African railways are serving well under 1 million traffic units per year. By global standards, this is little more than what might be carried by a moderately busy branch line. Moreover, such low traffic volumes do not generate the revenue needed to finance track rehabilitation and upgrading. The only railways to see any significant growth in their traffic over the period 2000–05 were those of Malawi and Namibia. In general, rail services struggle to compete with interurban bus services for passengers (box 2.2), and with the trucking industry for freight.

Figure 2.10 Traffic density on African railways



Source: Bullock 2009.

Note: Density is normally expressed as traffic units per route-km. The traffic units carried by a railway are the sum of the passenger-km and the net tonne-km.

Box 2.2 Road-rail competition for interurban passenger services: The case of Botswana

In Botswana in 2002 there were two trains (one day, one overnight) between Gabarone and Francistown; each took about 8 to 9 hours for the 435-km trip. The connecting road was a two-lane sealed road in generally fair-to-good condition, with moderate traffic levels. There were 35 to 40 buses traveling in each direction every day. By bus the trip took 4 to 5 hours, and buses left at regular intervals during the day but offered no overnight services. The day rail service charged Pula 19 (economy) and Pula 37 (business); the night service charged Pula 28 (economy), Pula 107 (business), and Pula 125 (sleeper). The competing bus fare ranged from Pula 30 to Pula 38, depending on the type of vehicle and speed. (The exchange rate at the time was Pula 5.5 = $1). Both rail and bus provided reasonable links to the local urban bus services at either end of their journey. In spite of the much cheaper rail fares, the bus services had about 70 percent of the market at the time. The day train was subsequently taken off line in 2006 and the night train in 2009.

Source: Bullock 2009.

Before contemplating further extensions to the rail network, a turnaround in the performance of existing railways is sorely needed to regain competitiveness with road transport. The poor quality of service provided by southern Africa's railways makes it increasingly difficult for them to compete with road vehicles, even for freight. Most railways in southern Africa operate at the standard at which they were originally constructed and are now ill-equipped to face competing modes of transport. The railway lines can be characterized as low-axle-load, low-speed, and small-scale undercapitalized networks ill-suited to modern requirements. Poor maintenance over extended periods of time has caused the deterioration of many sections of the track beyond repair, and resulted in a loss of competitiveness and rolling-stock productivity. While such inefficiencies can be tolerated on low-volume feeder lines, and may be the only way some can be viably operated, they are a major handicap when competing against the modern roads being constructed along major corridors. In addition, countries that have suffered recent conflict (for example, Mozambique and Angola) have found it difficult to rehabilitate damaged rail lines.

Table 2.4 Performance compared across southern African railways, 2005

	Labor productivity	Locomotive productivity	Carriage productivity	Wagon productivity	Freight yield	Passenger yield
Angola, CFM	580	30	4,046	950		
Botswana, BR	722	41	2,391	987		
Congo, Dem. Rep., SNCC	38	4	275	317	13	3
Malawi, CEAR	131	3	1,176	82	6	1
Mozambique, CCFB	281	13	750	476	3	1
Mozambique, CDN	710	25	3,333	260	5	1
Namibia, Transnamib	484	25		805		
South Africa, Spoornet	3,308	33		913		
Zambia, RSZ	502	25	3,286	377	4	1
Zimbabwe, NRZ	390	8		195		
Railway concessions	**350**	**23**	**2,945**	**491**	**5**	**2**

Source: AICD railways database.

Note: Labor productivity = '000s traffic units per employee; locomotive productivity = millions of traffic units per locomotive; carriage productivity = '000s passenger-km per carriage; wagon productivity = '000s net tonne-km per wagon.

There is a high degree of variability in the performance of southern African rail operators. At one end of the spectrum, Spoornet has by far the highest levels of productivity of any railway in Sub-Saharan Africa, in part due to the large coal and mineral volumes that it handles. In a second category come the networks in Angola, Botswana, Mozambique (CDN), Namibia, and Zambia, which perform moderately well on productivity. In a third category come the networks in the Democratic Republic of Congo, Malawi, Mozambique (CCFB), and Zimbabwe, which have very poor performance indicators.

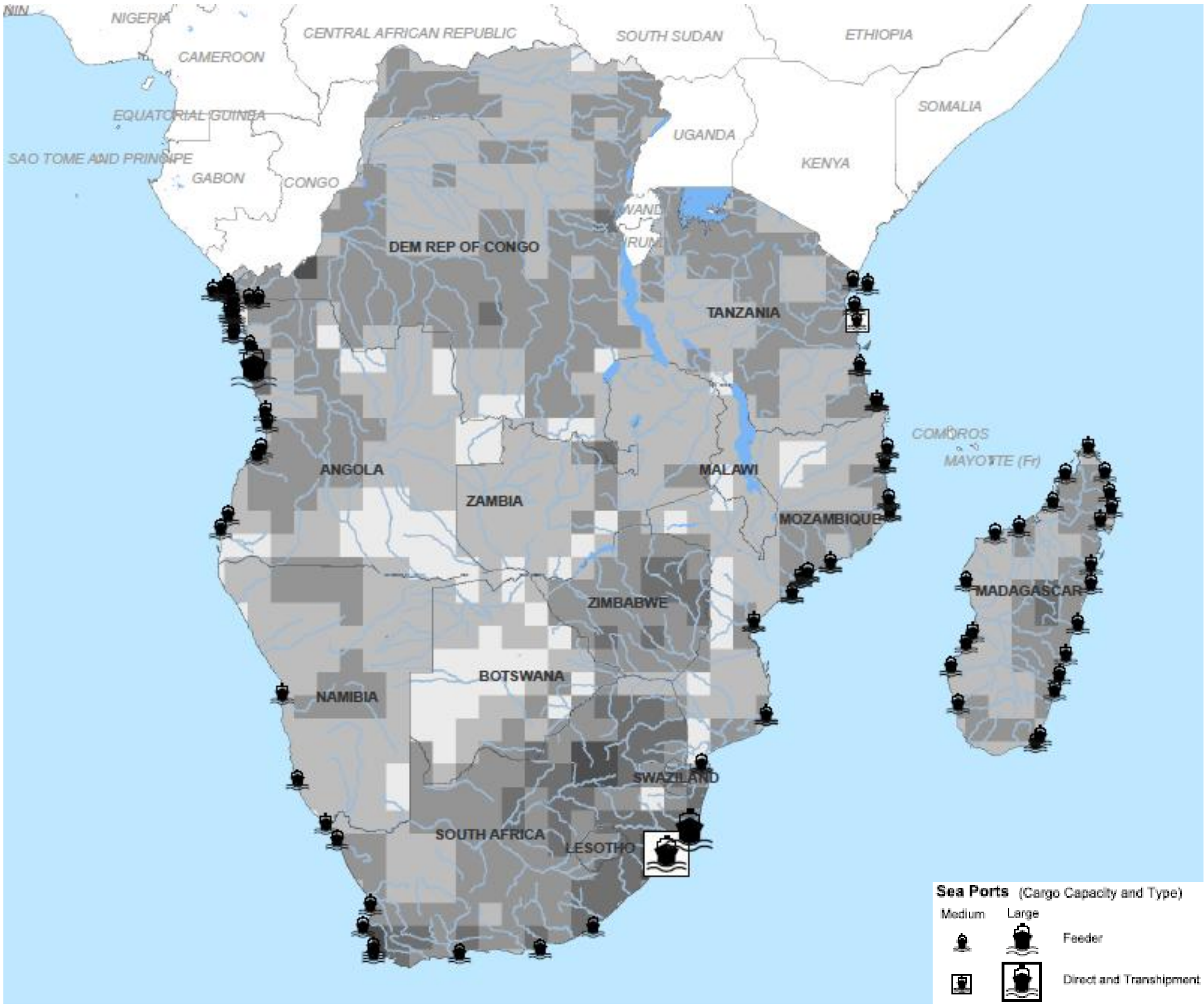
As noted above, rail freight faces huge delays while crossing national borders. For example, along the north-south corridor, rail transit times from Lubumbashi to Durban have been reported to be as high as 38 days at an effective velocity of around 4 km per hour. Travel accounted for only 9 days, and interchange and border crossing for the remainder (an astounding 29 days!). The delays can mainly be attributed to the time taken to unload and interchange freight across different locomotives as the cargo passes from one national network to another, as well as lengthy administrative processes at borders. These delays cost as much as $200 per railcar. For railways to be a competitive mode for the movement of freight, issues pertaining to trade facilitation and cross-border coordination need to be tackled (see box 2.1).

Railway operators in southern Africa are often unregulated and have, in some instances, adopted anticompetitive pricing policies. This is in direct contrast to the efficiently organized trucking sector in southern Africa, where direct contracting between shippers and transporters has provided incentives to keep road transport freight prices reasonably competitive (on average, $0.05 per tonne-km for the north-south corridor). Anticompetitive pricing in the railway sector has been observed in Zambia and the Democratic Republic of Congo. Particularly noteworthy are the rail freight tariffs charged by the Zambian operator RSZ. For transit cargo from the Democratic Republic of Congo to Dar es Salaam, tariffs stand at more than $2.00 per tonne-kilometer, or 40 times the region's average. These tariffs reflect an abuse of monopoly power, motivated in part by vertical integration, with the same concessionaire operating the Zambian rail network and the Beit Bridge border crossing from Zimbabwe into South Africa. The high level of these tariffs is distorting traffic flows and investment decisions along the entire corridor. For example, copper exports from the Democratic Republic of Congo go by road to avoid these charges, whereas they would be more naturally suited to rail transport.

Ports

Southern African ports have registered a substantial increase in container and general-cargo traffic between 1995 and 2005. Annual average growth in general cargo in southern Africa has been by far the highest of any region in Africa (table 2.5). Overall growth in containerized traffic has been propelled by rapid economic growth in Sub-Saharan Africa, a rising tide of global trade, the privatization of ports, and the advent of modern container vessels.

Figure 2.11 The SADC's ports



Source: AICD.

Table 2.5 Growth in containerized and general-cargo traffic between 1995 and 2005

	Container traffic				General-cargo traffic			
	TEUs		Percentage		'000s tonnes		Percentage	
	1995	2005	Overall growth	Average annual growth	1995	2005	Overall growth	Average annual growth
East Africa	505.1	1,395.0	+276	+10.7	13.8	38.4	+278	+10.8
North Africa	1,637.3	5,267.9	+322	+12.4	12.3	16.5	+134	+3.0
Southern Africa	**1,356.0**	**3,091.8**	**+228**	**+8.6**	**2.7**	**14.5**	**+532**	**+18.2**
West Africa	1,035.4	4,082.0	+394	+14.7	23.1	61.2	+265	+10.2
Total	4,533.8	13,836.7	+305	+11.8	52.0	130.7	+251	+9.7

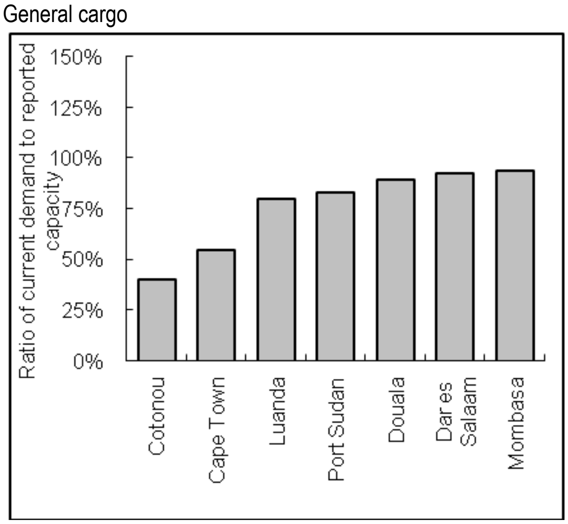
Source: Ocean Shipping Consultants Limited 2010.
Note: TEU = twenty-foot equivalent unit.

Although southern Africa is endowed with several port options, Durban and Dar es Salaam are by far the most intensively utilized. Overall, due to rapid expansion of traffic, a few of the region's ports are beginning to experience capacity constraints (figure 2.12). This is most notable in the case of Luanda (Angola) and Dar es Salam, where the general-cargo traffic handled significantly exceeds design capacity. Luanda, which is at almost 80 percent capacity, is on the threshold of facing a gridlock that would significantly undermine the efficiency of the port. Container traffic in Durban and Dar es Salaam exceeds 100 percent of their capacity. Cape Town also experiences challenges due to excess handling relative to design capacity, albeit on a smaller scale.

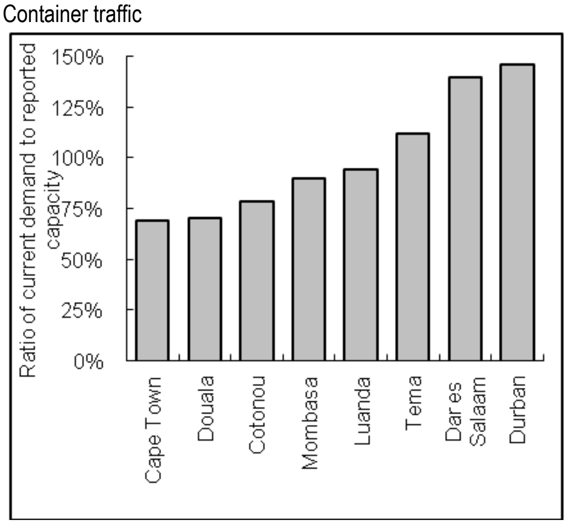
Durban struggles with handling South Africa's own traffic and has experienced recurring berth congestion during the peak season. Shipping lines are threatening to reintroduce a surcharge for berthing delays that existed between 2002 and 2005. Although there are plans to bring significant additional capacity on stream, such as the new Pier One scheme, demand is strong and in the short and medium term could outstrip any additional planned capacity. Carriers are seeking additional new locations in the Indian Ocean (such as Mauritius), compounding Durban's challenges.

Figure 2.12 Ratio of current demand to reported capacity

a. General cargo



b. Container traffic



Source: AICD Ports Database,2008

Southern African ports tend to perform somewhat better than those in other African regions across a range of parameters. But, when compared to global best practices, even southern African ports are expensive to use and subject to extensive delays (table 2.6). The services provided by these ports generally cost 75 percent more than other global ports. Crane productivity for containers, while better than some global benchmarks, shows wide variability across ports in southern Africa. Crane productivity for cargo and dwell time for containers is comparable for some ports. The truck-processing time is double that of global ports. Southern African terminals, unlike most other African ports, offer free storage—typically for up to seven days—and thereafter apply a daily storage charge, sometimes on a sliding scale that increases with the number of days.

Table 2.6 Port performance compared across African regions

Performance	East Africa	**Southern Africa**	West Africa	Global best practice
Container dwell time (days)	5–28	**4–8**	11–30	<7
Truck-processing time (hours)	4–24	**2–12**	6–24	1
Crane productivity (containers per hour)	8–20	**8–22**	7–20	20–30
Crane productivity (tonnes per hour)	8–25	**10–25**	7–15	>30
Charges				
Container handling (US$ per TEU)	135–275	**110–243**	100–320	80–150
General-cargo handling charge (US$ per tonne)	6–15	**11–15**	8–15	7–9

Source: AICD ports database.
Note: TEU = twenty-foot equivalent unit.

Individual port performance varies significantly across southern Africa. Some ports are almost as good as the best international ports; others require significant improvement. The ports of Durban and Walvis Bay are among the most efficient in terms of key performance parameters and exceed the performance of all other ports by a large margin (table 2.7). Container dwell time in Beira—a port that could serve northern Zimbabwe and even Malawi—records container dwell times of almost 3 weeks, as does Maputo—which could serve Zambia and Zimbabwe. Crane productivity in Luanda is half that of Durban. Even though prices in Durban are very high and exceed global averages, Durban remains competitive as a transshipment hub. Walvis Bay, which charges half as much as Durban and which is undergoing significant improvements, seeks to claim a growing share of the region's traffic.

Table 2.7 Port performance compared across southern Africa

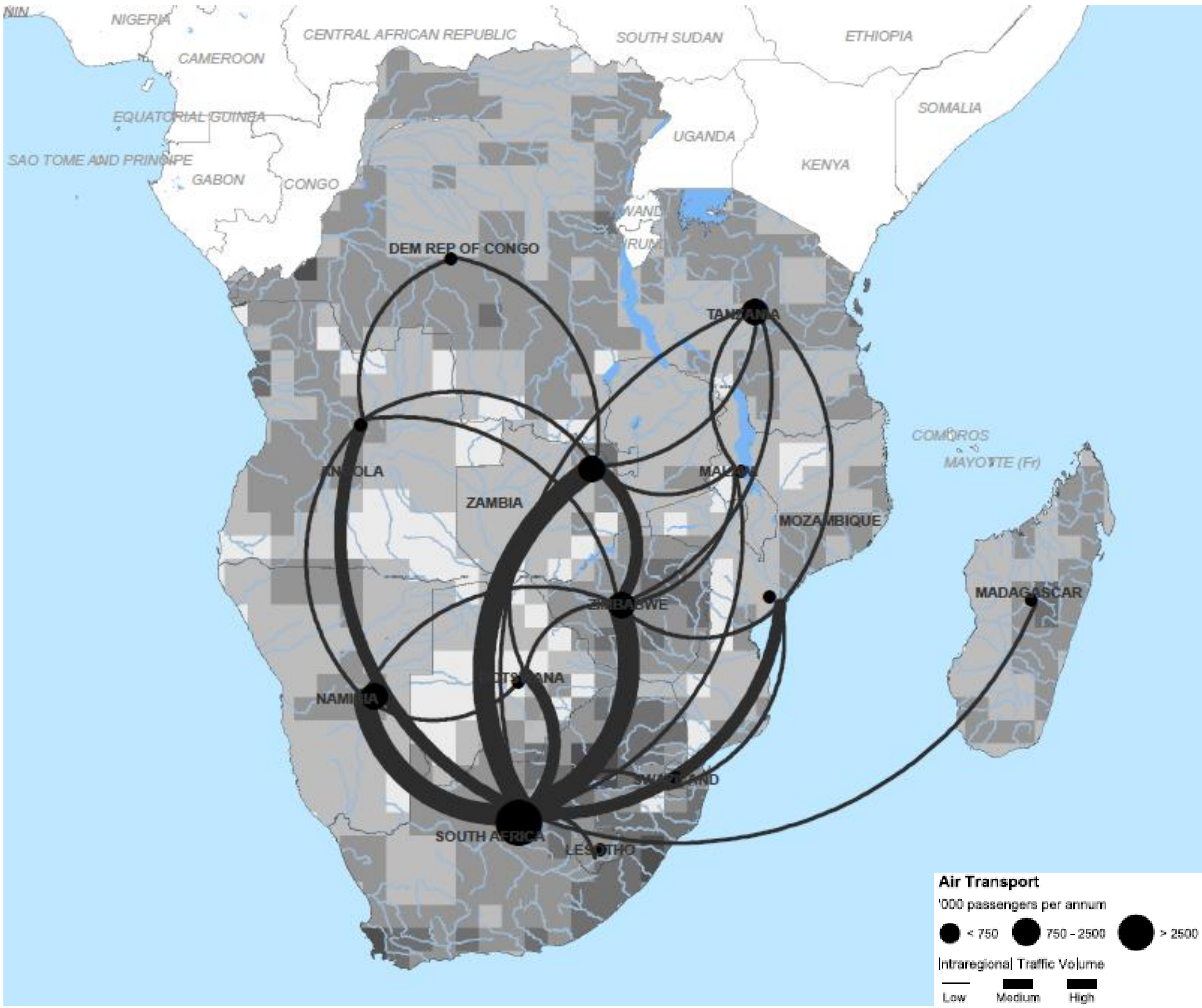
Performance and price	Cape Town, South Africa	Durban, South Africa	East London, South Africa	Port Elizabeth, South Africa	Walvis Bay, Namibia	Luanda, Angola	Beira, Mozambique	Maputo, Mozambique
Container dwell time—average (days)	6	4	7	6	8	12	20	22
Truck-processing time, cargo receipt and delivery (hours)	5	5	2	5	3	14	7	4
Container crane productivity (container per hour)	18	15	8	15		7	10	11
Container-cargo-handling charge (US$ per TEU)	258	258	258	258	110	320	125	155
General-cargo-handling charge (US$ per tonne)		8	8	8	15	9	7	6

Source: AICD ports database. *Note:* TEU = twenty-foot equivalent unit.

Air transport

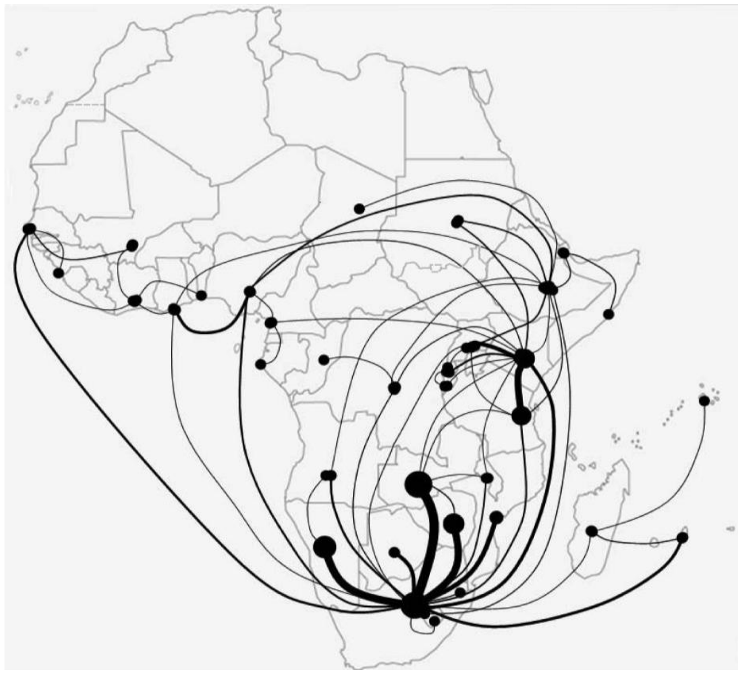
A map of the top 60 intracontinental routes in Africa serves to highlight the main traffic patterns across the continent (figure 2.13). While none of Africa's Sub-Saharan airports (with the possible exception of Johannesburg) move enough traffic to be considered global air transport hubs, a number of regional air transport hubs have emerged over the past decade. On the eastern and southern side of the continent, a strong hub-and-spoke structure is centered on Johannesburg, and, to a lesser extent, Nairobi and Addis Ababa. Lusaka is also emerging as a minor hub in the region.

Figure 2.13 The SADC's regional airports and air traffic flows



Source: AICD.

Figure 2.14 International routes within Sub-Saharan Africa for 2007



Source: Bofinger 2009.

The SADC has the largest and most advanced air transport market in Africa, with South Africa considered to be the most important intercontinental gateway. The SADC also has the largest domestic air transport market in the continent, mainly because of South Africa, Tanzania, and Mozambique (table 2.8). The number of intraregional seats is several times larger than for other parts of Africa. On average, within the regional economic community there are 17 pairs of domestic cities and 26 international city pairs. The market is also the most competitive in the continent, as defined by the Herfindahl Index. The seat-kilometers flown on older aircrafts is 11 percent of the total, better than other parts of Africa.

Table 2.8 Benchmarking air transport in the SADC and other regional economic communities

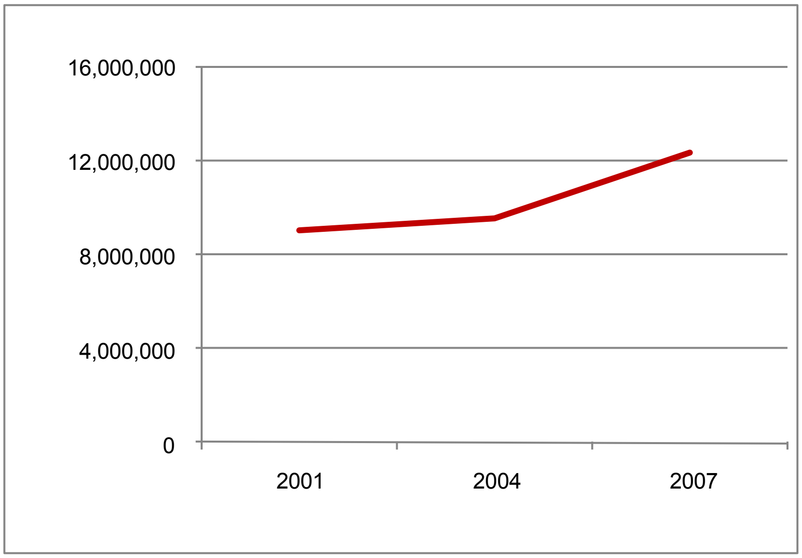
	SADC	ECOWAS	CEMAC	EAC
Annual seats, domestic (number)	**3,075,808**	2,034,272	235,305	1,345,217
Annual seats, international within Sub-Saharan Africa (number)	**964,210**	362,392	187,287	1,195,775
Domestic city pairs served (number)	**17**	8	4	13
International city pairs served (number)	**26**	20	15	29
Seat-km in old aircraft (% of total)	**11**	12	5	13
Seat-km in recent aircraft (% of total)	**80**	87	94	83
Domestic market Herfindahl Index	**0.73**	0.84	0.83	0.64
International market Herfindahl Index	**0.34**	0.19	0.24	0.25
Overall market Herfindahl Index	**0.42**	0.21	0.3	0.27

Source: AICD database.

Note: ECOWAS = Economic Community of West African States; CEMAC = Economic and Monetary Community of Central Africa; EAC = East African Community.

Air transport connectivity within the SADC has grown steadily since 2001, when the intraregional air transport market amounted to about 8 million seats. There was a steady increase in capacity to just over 10 million in 2004, and a further increase to 12 million in 2007 (figure 2.15).

Figure 2.15 Seats for intra-REC travel within the SADC



Source: Derived from Bofinger 2009.
Note: REC = regional economic community.

In examining regional air transport markets and patterns within the SADC (figure 2.14), it is clear that Johannesburg is a major hub. Regional air traffic is heavily concentrated on routes from South Africa to Namibia, Zambia, and Zimbabwe. The connectivity matrix in table 2.9 shows how most countries in the region have at least two daily flights to South Africa (and as many as 70–80 in the cases of Mozambique and Zimbabwe). Even though bilateral connections to countries in the SADC region are largely absent, Johannesburg facilitates connectivity throughout the region. On the other hand, island nations such as Madagascar and Seychelles have a much lower level of air connectivity (though Mauritius is an exception to this pattern).

Flights in the SADC region operate between a varying number of city pairs. South Africa serves 149 city pairs, of which 69 are international city pairs within the SADC and 44 are intercontinental flights. The large number of city pairs served in the SADC is due to the dominance of South African Airlines. At least one international city pair is served in all countries. This reflects the strong hub-and-spoke structure of the SADC market, in which all SADC countries are connected to one another through Johannesburg (and possibly by other links). Angola, the Democratic Republic of Congo, Madagascar, Mozambique, South Africa, and Tanzania all have moderate domestic connectivity. In the other countries, the absence of domestic city pairs reflects small size, low traffic volumes, and limited purchasing power. These factors make it difficult for air transport to compete with surface transport alternatives, such as road transport services (table 2.10).

Table 2.9 All flights within the SADC, one week in November 2007

		Destination														
		Angola	**Botswana**	**Congo DRC**	**Lesotho**	**Madagascar**	**Malawi**	**Mauritius**	**Mozambique**	**Namibia**	**Seychelles**	***South Africa***	**Swaziland**	**Tanzania**	**Zambia**	**Zimbabwe**
Origin	**Angola**			1						5		*7*			1	2
	Botswana											*57*				3
	Congo DRC											*7*				2
	Lesotho											*31*				
	Madagascar							8				*7*				
	Malawi											*8*		2	17	6
	Mauritius					8					3	*20*				
	Mozambique											*53*	2			2
	Namibia	5	3									*63*				3
	Seychelles							3				*2*				
	South Africa	*7*	*71*	*14*	*31*	*9*	*13*	*16*	*67*	*48*	*2*		*46*	*21*	*89*	*79*
	Swaziland								5			*51*				
	Tanzania						5		6			*14*			3	2
	Zambia			1			10					*45*		3		25
	Zimbabwe	2	3	8			7		2			*43*			29	

Source: Derived from Bofinger 2009.

Table 2.10 Domestic, international, and intercontinental city pairs, 2007 (number)

	Total city pairs	Intercontinental city pairs	International city pairs	Domestic city pairs
Angola	42	9	12	21
Botswana	12		8	4
Congo, Dem. Rep. of	49	3	21	25
Lesotho	1		1	
Madagascar	92	17	12	63
Malawi	15	1	11	3
Mauritius	34	27	6	1
Mozambique	62	1	31	30
Namibia	21	4	9	8
Seychelles	13	9	3	1
South Africa	149	44	69	36
Swaziland	4		4	
Tanzania	56	12	25	19
Zambia	24	2	13	9
Zimbabwe	27	5	17	5

Source: Bofinger 2009.

Beyond basic connectivity, it is important to evaluate the convenience and velocity of air travel. Most flights that originate from within the SADC countries are direct. The SADC members generally connect with one another by way of a direct flight to Johannesburg and another to their final destination (table 2.11a). The lower velocity of air travel is associated with lengthy travel time (table 2.11b). Flights from Malawi to Zambia and from Zambia to Zimbabwe have relatively low velocities compared with other flights in the region, indicating that passengers on these routes must travel to another destination before arriving at their final destination.

Table 2.11a Frequency of service

	Number of flights	
	All	Direct
Angola	14	14
Botswana	77	77
Congo, Dem. Rep.	16	23
Lesotho	31	31
Madagascar	17	17
Malawi	31	35
Mauritius	27	27
Mozambique	80	57
Namibia	53	48
Seychelles	5	5
South Africa	400	400
Swaziland	48	48
Tanzania	17	26
Zambia	138	129
Zimbabwe	122	107

Source: Bofinger 2009.

A recent assessment of progress toward implementing the Yamassoukro Decision ranks the SADC behind other regions of Africa, in particular West Africa (table 2.12). The indicator used to measure the degree of progress is the percentage of flights flown under fifth-freedom arrangements (that is, by carriers that are not registered either in the origin or destination country). The low prevalence of fifth-freedom flights in the region is precisely a reflection of the existence of a strong hub-and-spoke system based around a large carrier: South African Airlines. The emergence of strong hub airlines limits the scope for fifth-freedom flights. The low rating can be attributed to the presence of powerful airlines that are able to negotiate bilateral contracts in their own best interests rather than following regional initiatives. The SADC has not made significant progress toward instituting free pricing, lifting capacity and frequency restraints, and allowing airlines to fly so-called fifth-freedom routes.

There is ample evidence that southern Africa benefits from liberalization. For example, liberalizing the domestic market in South Africa in 1990 fueled passenger growth by 80 percent between 1994 and 2004 and eventually led to the establishment of domestic low-cost carriers. On the Johannesburg-Lusaka route for which South African Airways was the only carrier, designating a low-cost carrier, Kulula, as the Zambian carrier reduced fares by 33–38 percent and increased passengers by 38 percent.

Simulations also suggest that full liberalization of the air transport market in the SADC would have a significant impact. Airline fares would be reduced by 18–40 percent if a low-cost carrier were to enter the market and increase traffic volumes by 20 percent. Another half a million tourists would arrive by air each year, spending over $500 million. This multiplier effect would increase the SADC's GDP by approximately $1.5 billion or 0.5 percent.

Table 2.11b Velocity of flights (in kilometers per hour)

	Destination														
Origin	Angola	Botswana	Congo, Dem. Rep of	Lesotho	Madagascar	Malawi	Mauritius	Mozambique	Namibia	Seychelles	South Africa	Swaziland	Tanzania	Zambia	Zimbabwe
Angola			443						826		729			722	455
Botswana											270				460
Congo, Dem. Rep. of											585				700
Lesotho											290				
Madagascar							637				626				
Malawi											608		265	***73***	293
Mauritius					602					707	681				
Mozambique											312	286			516
Namibia	528	388									622				325
Seychelles							684				734				
South Africa	712	322	468	311	671	517	758	335	584	758		311	597	612	520
Swaziland								393			307				
Tanzania						361		315			665			668	504
Zambia			367			434					591		668		***123***
Zimbabwe	726	460	463			303		516			558			***119***	

Source: Bofinger 2009.

Table 2.12 Measuring progress toward implementation of the Yamassoukro Declaration

Community	General status of YD implementation	Status of air services liberalization	Overall implementation score
Arab Maghreb Union	No implementation.	No liberalization within the Arab Maghreb Union initiated, but need is recognized.	1
Banjul Accord Group (West Africa)	Principles of the YD agreed upon in a multilateral air services agreement.	Up to fifth freedom granted, tariffs are free, and capacity/frequency is open.	4
Economic and Monetary Community of Central Africa	Principles of the YD agreed upon in an air transport program. Some minor restrictions remain.	Up to fifth freedom granted, tariffs are free, and capacity/frequency is open. Maximum two carriers per state may take part.	5
Common Market for Eastern and Southern Africa	Full liberalization agreed upon ("legal notice no. 2"), but application and implementation remain pending until a joint competition authority is established.	Pending. Operators will be able to serve any destination (all freedoms), and tariffs and capacity/frequency will be free.	3
East African Community	EAC council issued a directive to amend bilaterals among the EAC states to conform with the YD.	Air services are not liberalized, as the amendments of bilaterals remain pending.	3
Southern African Development Community	No steps taken toward implementation, although the civil aviation policy includes gradual liberalization of air services within the SADC.	No liberalization has been initiated.	2
West African Economic and Monetary Union	The YD is fully implemented.	All freedoms, including cabotage, granted. Tariffs have been liberalized.	5

Source: Bofinger 2009.

The structure of the regional air transport market has altered since 2001, with a transfer of the market share of South African Airlines to a number of the company's subsidiaries such as SA Airlink and South African Airways Express (table 2.13). Thus, while the market share of South African Airlines appears to have declined from 35 percent in 2001 to 25 percent in 2007, when the subsidiaries are added back, the market share actually increased slightly to 37 percent in 2007. Other key players in the air transport market in the SADC are international airlines such as Air Namibia, Air Mauritius, and Air Zimbabwe. Interestingly, Kenya Airways and Ethiopian Airlines, though major carriers for Africa as a whole, do not feature prominently in the SADC market. Previously significant European carriers, notably British Airways, had largely disappeared as of 2007.

Table 2.13 Changes in market share of major regional carriers, 2001–07 (%)

Airline	2001	2004	2007
South African Airways	34.7	28.6	24.1
British Airways P.L.C.	10.9	0	0
Air Zimbabwe (Pvt) Ltd.	7.5	3.6	7.9
Air Botswana Corporation	6.6	5.8	4.7
Air Namibia	6.4	9.6	7.7
Air Mauritius	4.7	4.1	4.5
TAAG Angola Airlines	4.2	3.6	2.5
Zambian Airways	1.6	0.8	7.3
SA Airlink d/b/a South African Airlink	0	6.3	8
Comair Ltd.	0	6.5	5.8
South African Express Airways (Pty) Ltd.	0	7.2	5.3
Other	1.9	2.5	5.2

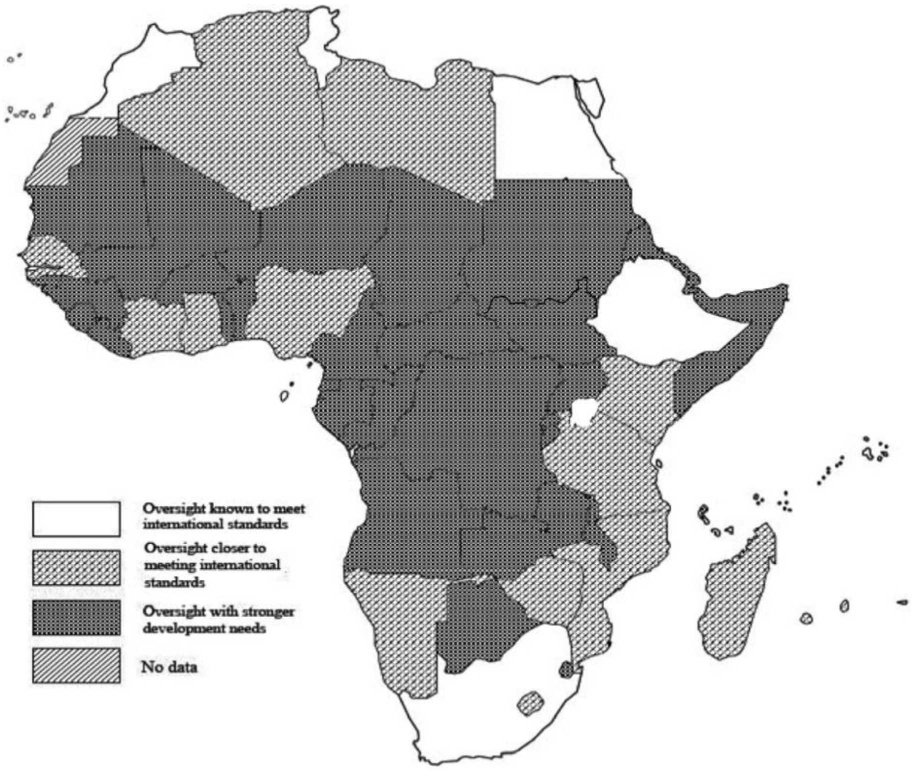
Source: Derived from Bofinger 2009.

Only a few countries in the SADC have made progress toward achieving international standards in air safety, making this an area ripe for further regional collaboration. South Africa's air safety has met all international standards. Several countries (Namibia, Mozambique, and Tanzania) have been moving toward achieving international standards in air safety oversight, but the remaining countries in the SADC are in need of significant development (figure 2.16). These deficiencies are highly correlated with national accident rates, suggesting that institutional failings can largely explain Africa's poor accident record. Air navigation services and air traffic control throughout Sub-Saharan Africa are spotty and concentrated in a few centers. South Africa, among the SADC countries, has several radar installations and is able to actively monitor traffic. Zimbabwe is also equipped with radar installations. In Malawi, some surveillance coverage existed in the past, but the aged equipment was too expensive to repair and is now no longer salvageable.

The notion that air safety is a regional problem and requires regional solutions is gaining widespread support and momentum. In the SADC, a project called the Cooperative Development of Operational Safety and Continuing Airworthiness Program is under way to address air safety by pooling regional resources.

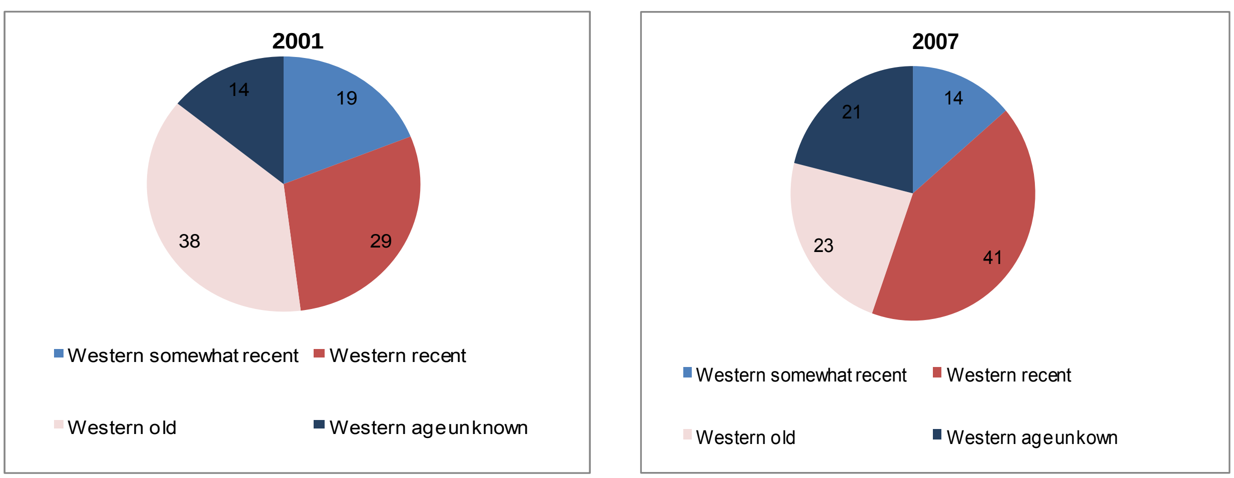
Another important factor in air safety is the vintage of the airline fleet. Southern Africa's aircraft fleet has been renewing since 2001, and as of 2007, 55 percent of seats flown were on newer aircraft (figure 2.17).

Figure 2.16 Status of African safety oversight, using several criteria



Source: Bofinger 2009.

Figure 2.17 Age distribution of airline fleet in the SADC region, 2001 and 2007

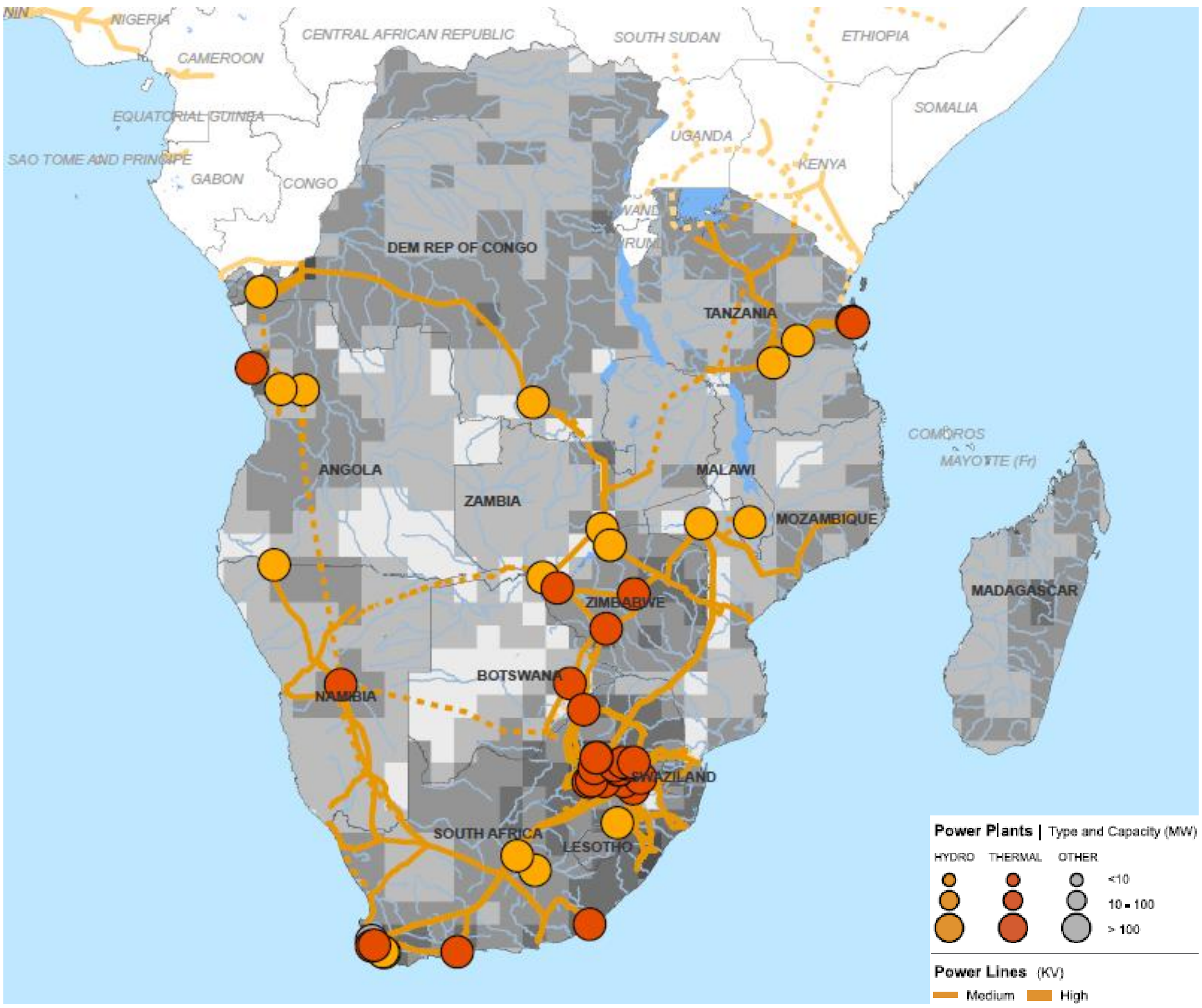


Source: Bofinger 2009.

3 Power

The regional power transmission network in southern Africa is relatively well advanced (figure 3.1). The Southern African Development Community (SADC) has the highest generation capacity of all regions but performs relatively poorly in terms of access to power. Generation, at almost 9,900 megawatts (MW), is about three times greater than the next highest region, the Economic Community of West African States (ECOWAS). Annual per capita generation of power is seven times that of ECOWAS (with the second-highest level) and 15 times that of the EAC (with the smallest level).

Figure 3.1 The SADC's regional power network and infrastructure



Source: AICD.

At least up until 2006, and before the advent of the power supply crisis in South Africa, outages have been less severe than in other regions in Africa. As a consequence, the value lost due to outages has been smaller. Given these factors, however, access to power in the SADC region is surprisingly low, at only 35 percent on average (versus 50 percent in ECOWAS). Utilities in southern Africa perform relatively well: system losses are only 12 percent of generation, and hidden costs are relatively low. The overall collection rate in the SADC, though relatively good at 89 percent, trails most other regional economic communities but by a small margin. Utilities in southern Africa, however, have to focus on cost recovery, which at only 68 percent is lower than most other regional economic communities (table 3.1).

Strikingly, the SADC has historically had the lowest-cost power in Africa, at $0.14 per kilowatt-hour on average. Moreover, the region's long-run marginal cost of power, at $0.07 per kilowatt-hour, is less than half the equivalent figure for ECOWAS. In this sense, southern Africa has a competitive advantage vis-à-vis other regions of Africa for energy-intensive industry.

Table 3.1 Benchmarking power infrastructure and capacity, access, and utility performance

	ECOWAS	CEMAC	COMESA	EAC	SADC	Low-income countries	Middle-income countries
Installed generation capacity (MW)	**3,912**	583	1,085	774	9,855	2,110	36,971
Generation, net, per capita, annual (KWh/capita/year)	**171**	147	114	82	1,214	165	4,479
Outages, number, annually (number/year)	**165**	152	119	132	91	134	71
Outages, value lost, annually (% of sales)	**7**	5	7	8	2	5	2
Firms with own generator (% of firms)	**54**	51	43	56	19	33	18
Access (urban, % of population)	**50**	31	34	23	35	43	50
Growth in access of population to electricity, annual (%)	**2**	1	1	1	1	3	2
System losses (% of generation)	**29**	31	32	23	12		10
Cost-recovery ratio, historical (%)	**79**	45	73	69	68	100	87
Total hidden costs (% of revenue)	**159**	107	102	65	4	544	0
Collection rate, reported by utility, electricity (% of billing)	**71**	93	93	94	89		91
Prices ($/kWh)	**WAPP**		**CAPP**		**EAPP**		**SAPP**
Average historic cost		0.21		0.49		0.19	0.14
Long-run marginal cost		0.18		0.09		0.12	0.07

Source: Eberhard and others 2008.

Note: CEMAC = Economic and Monetary Community of Central Africa; COMESA = Common Market for Eastern and Southern Africa; EAC = East African Community; ECOWAS = Economic Community of West African States; kWh = kilowatt-hour; MW = megawatt; WAPP = West African Power Pool; EAPP = East African Power Pool (EAPP is expanded to include key Nile Basin trading partners Egypt, Ethiopia, and Sudan); CAPP = Central Africa Power Pool; SAPP = Southern African Power Pool.

For the remainder of this section, attention will focus on the SAPP countries. This is because power sector issues in southern Africa can only really be analyzed in the context of this regional trading arrangement. The analysis necessarily excludes the island nations Madagascar, Mauritius, and Seychelles. Also, for the purposes of this analysis, Tanzania is considered part of the East African Power Pool (EAPP) as opposed to the Southern African Power Pool (SAPP). Similarly, the benchmarks will be the other regional power pools: namely, the Central African Power Pool (CAPP); the EAPP—expanded to include important trading partners in the Nile Basin (notably Egypt); Ethiopia; Sudan (EAPP–Nile Basin); and the West African Power Pool (WAPP).

As of the baseline year, 2006, almost all of the power demand was being met. But this situation deteriorated considerably in the years that followed due to South Africa's power supply crisis. The baseline total net demand for power in the SAPP was 259 terawatt-hours (TWh) in 2005, making it the largest power market in Sub-Saharan Africa. In the island states (all members of the SADC), about 95 percent of demand for power was being met.

Table 3.2 Demand and suppressed demand in the Southern African Power Pool

	Total net demand in 2005	% suppressed demand as a share of net demand (2005)	Market demand 2015	Social demand with national targets 2015	Total net demand 2015
Angola	2.1	21	6	1.9	7.9
Botswana	2.4	0	4	0.2	4.2
Congo, Dem. Rep. of	4.7	7	7.4	6.2	13.6
Lesotho	0.4	2	0.8	0.1	0.9
Malawi	1.3	4	1.9	0.4	2.3
Mozambique	11.2	4	15.7	0.7	16.4
Namibia	2.6	1	4.2	0.1	4.3
South Africa	215	0	316	3.2	319.2
Zambia	6.3	2	9	0.4	9.3
Zimbabwe	12.8	4	18	0.8	18.7
SAPP	**258.8**	**1**	**383**	**14**	**396.9**
WAPP	31.3	42	69.6	24.8	94.3
EAPP	100.6	1	144.8	24.2	169
CAPP	10.7	9	17.1	3.1	20.2
Island states	1.1	5	1.6	1.5	3

Source: Rosnes and Vennemo 2009.

Note: WAPP = West African Power Pool; EAPP-NB = East African Power Pool–Nile Basin (EAPP is expanded to include key Nile Basin trading partners Egypt, Ethiopia, and Sudan); CAPP = Central Africa Power Pool; SAPP = Southern African Power Pool; TWh = terawatt-hour. All figures are in TWh unless noted otherwise.

Power demand in the SAPP area is expected to increase by 40 percent over the next decade, a pace that is lower than power pools starting from a lower base. Taking into account the need to satisfy existing demand for power—plus the anticipated expansion in market demands driven by economic growth in commerce and industry, plus the need to provide additional power to support the planned expansion in electrification from 26 percent to 51 percent of households across the region—it is estimated that power demand as of 2015 could reach 397 TWh. This requires the development of 31,300 MW of new generation capacity (table 3.2). (These projections are based on economic growth forecasts prior to the onset of the global financial crisis of 2008. On the assumption that the economic crisis could halve anticipated economic growth rates over this region, the estimate of demand for 2015 would fall to 397 TWh.)

Future power demand can either be met through expanding national production or expanding cross-border power trade within the SAPP. Two alternative scenarios will be considered in this report. The *trade stagnation* scenario assumes that no additional cross-border interconnectors will be built, so that trade is constrained at the levels observed today, and countries are thus obliged to meet incremental power demands solely through the development of their own domestic power sectors. For many SAPP countries that lack significant energy resources of their own, this entails increased reliance on thermal generation fueled by oil imports. Alternatively, under the *trade expansion* scenario, future regional power demand is met by the most cost-effective energy resources available to the region as a whole, and additional cross-border transmission capacity is added wherever required to allow power to flow from production to consumption locations. Essentially, this scenario takes regional power trade to its fullest economic potential, assuming that there are no restrictions to cross-border exchange and that the necessary infrastructure can be built wherever it is required. Reality is likely to lie somewhere in between the trade stagnation and trade expansion scenarios, and in this sense the two scenarios serve to frame the range of possible outcomes.

Deepening regional integration would save the SAPP area $1.1 billion in annual energy costs. Table 3.3 compares the cost of meeting growing regional power demand over the next decade, depending on whether the trade stagnation or trade expansion scenarios are adopted. Overall, trade expansion reduces the total annual cost of producing and distributing power from $19.5 billion to $18.4 billion, saving the region $1.1 billion each year. Under the trade expansion scenario, countries would have to divert $0.4 billion of their investment budget from generation to regional interconnectors. This would allow the SAPP area to tap into large-scale hydropower, reducing variable costs by $1 billion annually.

Table 3.3 Annualized costs of system expansion in the SAPP, 2015

($ billion)	Trade expansion	Trade stagnation
New investment	7.5	7.5
Generation	4.5	4.9
Interconnectors	0.4	0
Distribution	2.6	2.6
Refurbishment	2.6	2.6
Variable cost	8.4	9.4
SAPP total cost	18.4	19.5
CAPP	1.38	1.54
EAPP-NB total cost	15	16
WAPP total cost	12.2	12.7
Island states	0.6	0.6

Source: Rosnes and Vennemo 2009.

Note: WAPP = West African Power Pool; EAPP-NB = East African Power Pool–Nile Basin (EAPP is expanded to include key Nile Basin trading partners Egypt, Ethiopia, and Sudan); CAPP = Central Africa Power Pool; SAPP = Southern African Power Pool.

To make trade expansion possible, significant additional investments would be required. In particular, the Democratic Republic of Congo would need to develop 7,640 MW of additional hydropower capacity to be dedicated to supplying export markets in neighboring countries. Mozambique would have to develop 900 MW of power generation capacity for export, and Tanzania and Zimbabwe would have to develop less-daunting capacities of 279 MW and 93 MW, respectively, to meet export demands under trade expansion. Almost all countries in the SAPP region would need to invest in developing a total of 23,839 MW of new cross-border interconnectors to allow power to flow more readily around the region (table 3.4). The heaviest transmission investments would need to be made in Zambia (7,526 MW), the Democratic Republic of Congo (5,984 MW), and Zimbabwe (3,072 MW). These three countries have the onus of developing 70 percent of the total required interconnection capacity for the power pool.

The spending needs identified in figure 3.2 would absorb between 3.9 and 3.7 percent of the SAPP region's gross domestic product (GDP), depending on whether the trade stagnation or trade expansion scenario is adopted (figure 3.2). For individual countries, the impact of adopting trade can substantially influence the burden of power sector development needs on their national economies. Under trade stagnation, six SAPP countries (Namibia, Zambia, Malawi, the Democratic Republic of Congo, Mozambique, and Zimbabwe) would need to spend over 5 percent of their GDP for a decade to meet their power sector needs, which is an extremely tall order. In the most extreme case, Zimbabwe would need to spend over 25 percent of its GDP to satisfy power demand.

Under trade expansion, the pattern of spending shifts markedly for some countries. Zimbabwe under trade expansion would also have to spend around a quarter of its GDP—a large part on interconnectors. Other countries such as Botswana, Namibia, and Malawi would have to spend significantly less than that under the trade stagnation scenario to meet power sector needs. Only the Democratic Republic of Congo would have to spend almost 15 percent of its GDP under trade stagnation and Mozambique less. The expenditure burden for the Democratic Republic of Congo would rise dramatically from around 5 percent of its GDP under trade stagnation to 15 percent of its GDP under trade expansion, reflecting the critical role that the Democratic Republic of Congo would play as an exporter of cheap hydropower for the region.

Table 3.4 Additional infrastructure requirements for trade expansion (MW)

MW	Interconnectors	Additional hydropower capacity
SAPP	**23,839**	**8,912**
Angola	2,120	0
Botswana	2,141	0
Congo, Dem. Rep. of	5,984	7,640
Lesotho	0	0
Madagascar	0	0
Malawi	227	0
Mozambique	1,400	900
Namibia	556	0
South Africa	547	0
Swaziland	—	—
Tanzania	266	279
Zambia	7,526	0
Zimbabwe	3,072	93

Source: Rosnes and Vennemo 2009.
Note: MW = megawatt.

As of 2005, power trade flows in the SAPP were the largest of all power pools. Exports amounted to 25.8 TWh and imports to 22.7 TWh in total. Several countries participated in trade. The main flows involved Tanzania, Zambia, Swaziland, Namibia, Botswana, and Zimbabwe, all of which import power from South Africa and Mozambique and a minimal amount from the Democratic Republic of Congo (figure 3.3a).

Under trade stagnation, future trade volumes would increase to 46 TWh per year up to 2015, and the pattern of trade would shift somewhat. With trade stagnation, the Democratic Republic of Congo's exports are reduced from 52 TWh per year to 2.3 TWh per year. Reduced import possibilities in South Africa and Botswana are replaced by more coal-fired power plants. In Botswana the expansion of the Morupule plant becomes relevant. Gas-fired power plants and hydropower are built in Angola and Namibia to meet domestic demand in the trade stagnation scenario (figures 3.3b, 3.4). Under trade stagnation, north-south power flows are replaced by more power exchange—that is, power would flow in different directions in peak and off-peak hours. For instance, in off-peak hours South Africa exports to Mozambique, Namibia, and Zimbabwe.

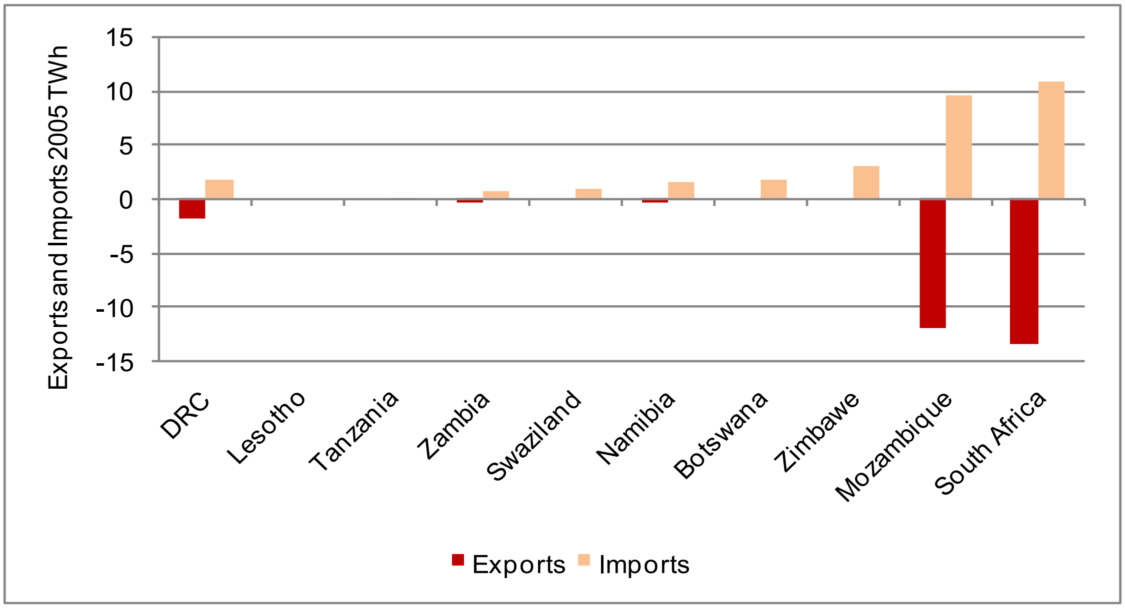
Under trade expansion, the volume of power traded in the SAPP could increase substantially to 146 TWh by 2015. The key change under trade expansion is that the Democratic Republic of Congo would fully develop its hydropower potential and become the major power exporter of the region, sending 60 TWh annually into neighboring countries and exporting more than 350 percent of its domestic consumption (figure 3.3b, 3.4). Mozambique would also increase its power exports, although on a scale significantly smaller than the Democratic Republic of Congo. As a result Angola, Botswana, Namibia, and Zambia—all of which do not now import any power—would become significant power importers. Botswana's power imports would expand considerably as it would move to import most of its demand. Zambia and Malawi, both power exporters under trade stagnation, would become importers: Malawi would import more than half of its demand and Zambia less than a quarter.

Figure 3.2 Regional spending needs as a percentage of GDP

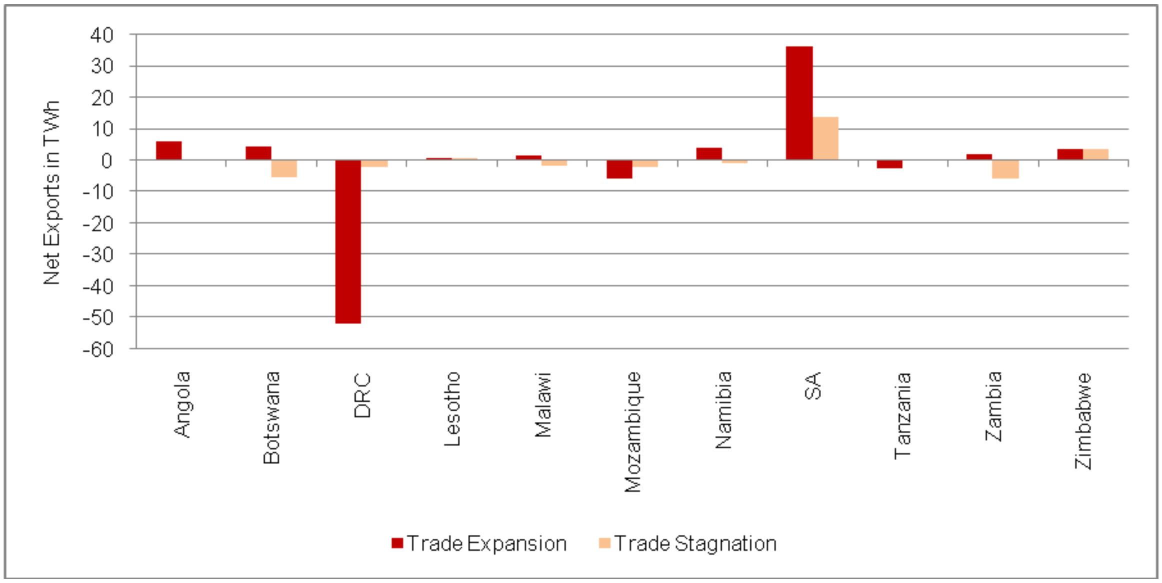
Source: Derived from Rosnes and Vennemo 2009.
Note: GDP = gross domestic product.

Figure 3.3 Existing and simulated power trade patterns in the SAPP, 2005 (TWh)

a. Existing trade patterns, 2005 (TWh)



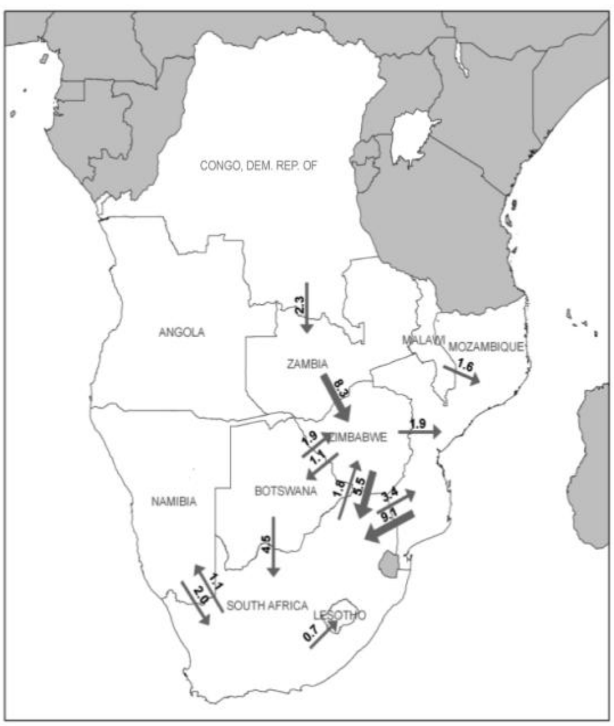
b. Simulated trade patterns, 2015 (TWh)



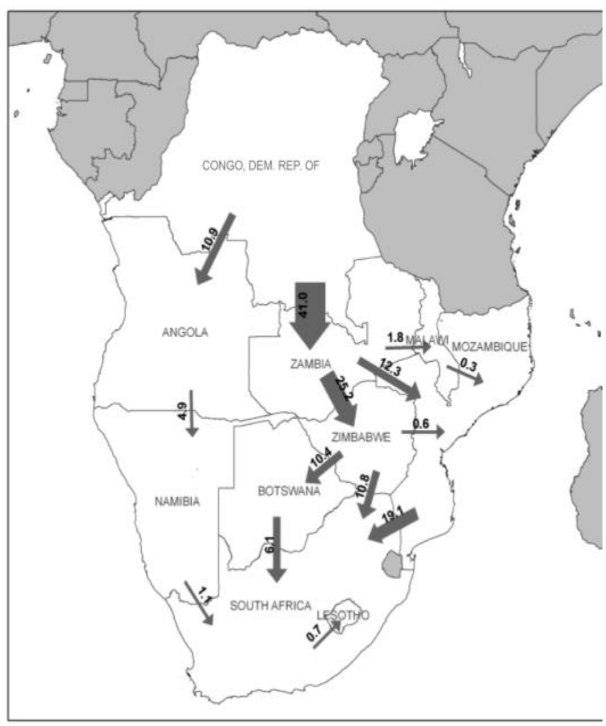
Source: Derived from Rosnes and Vennemo 2009.
Note: SAPP = Southern African Power Pool; TWh = terawatt hour.

Figure 3.4 Projected trade flows in the SAPP, 2015 (TWh)

a. Trade stagnation



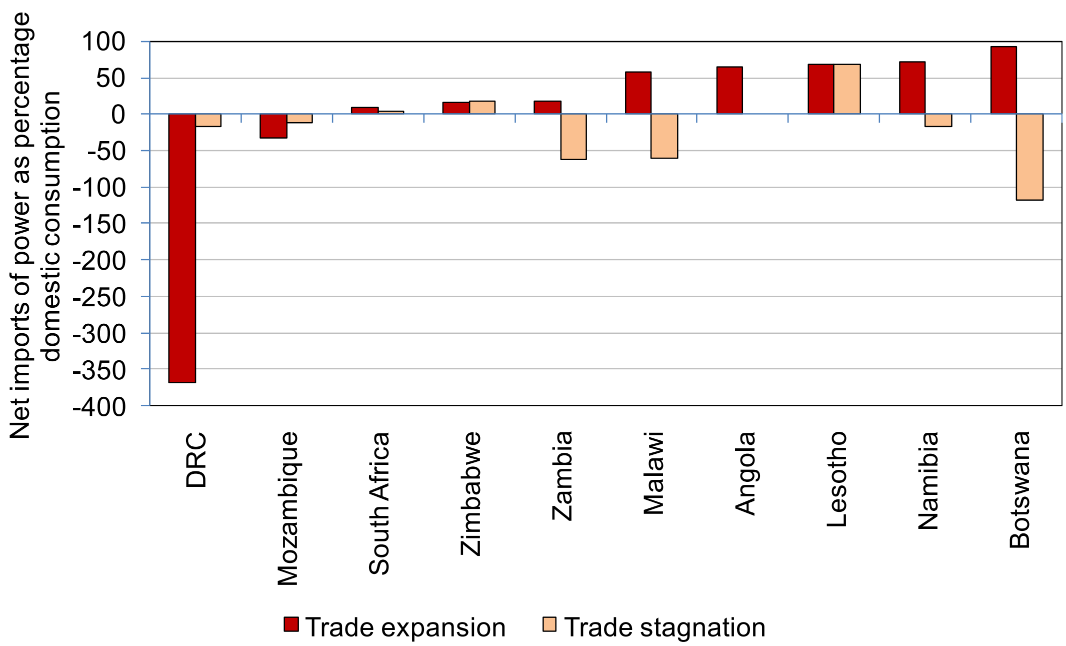
b. Trade expansion



Source: Rosnes and Vennemo 2009.
Note: SAPP = Southern African Power Pool; TWh = terawatt hour.

Under the trade expansion scenario, several SAPP countries would end up importing more than half their power needs (figure 3.5). At one extreme, Botswana would import almost all its power from neighbors. A second group comprising Namibia, Angola, and Malawi would import around half their power consumption. A third set of countries, including Zimbabwe and Lesotho, would not see a significant shift in their pattern of power imports as a result of trade. South Africa's power imports, though large in absolute terms at 36 TWh annually, would cover no more than 10 percent of domestic consumption. Most of these importing countries would be reliant on the Democratic Republic of Congo and (to a far lesser extent) Mozambique to meet their power sector needs.

Figure 3.5 Net imports as a share of domestic demand (percentage)



Source: Rosnes and Vennemo 2009.

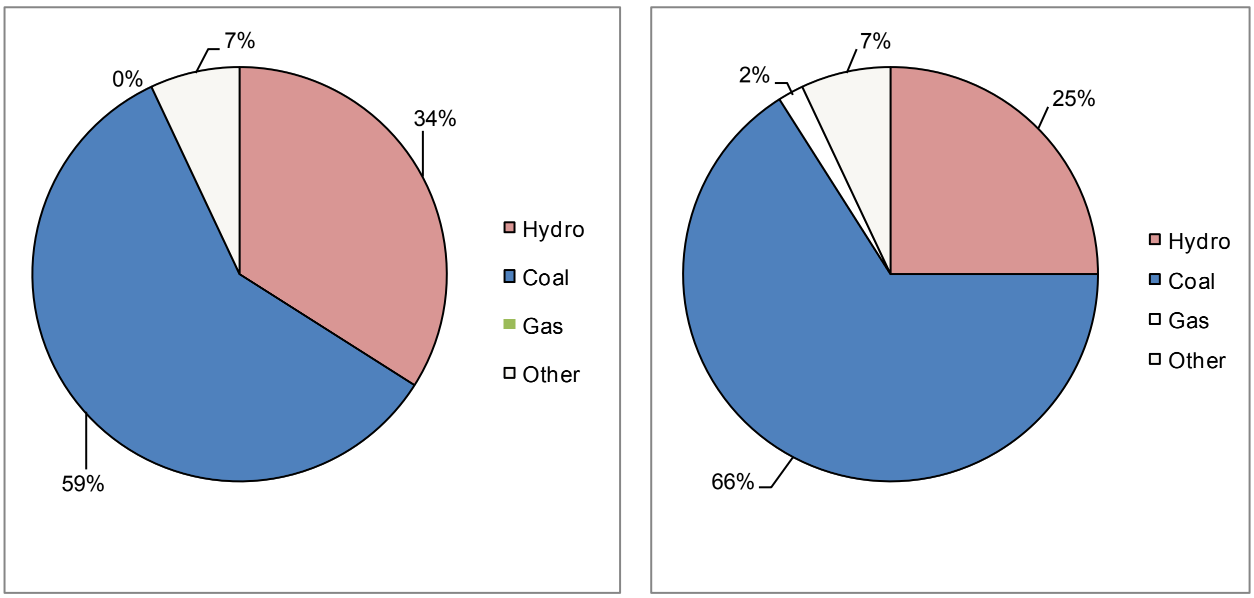
The possibility of accelerating regional power trade in the SAPP hinges entirely on the ability of the Democratic Republic of Congo to deliver the massive investments in hydropower that would be needed. The implementation of the trade expansion scenario described here depends on the rapid development of 7,640 MW of additional hydropower resources in the Democratic Republic of Congo. There are a host of technical, financial, and political challenges that make this a difficult prospect. First, from a technical perspective, the envisaged scale-up is more than three times the country's existing installed generation capacity, which amounts to little more than 2,450 MW, making this a huge technical challenge for the country. Second, the cost of developing these hydropower schemes would be $892 million annually for a decade, which is equivalent to almost 15 percent of the Democratic Republic of Congo's GDP, and would not be financially tenable without massive capital contributions from those countries that would ultimately import the power. Third, for many years the Democratic Republic of Congo has suffered from political instability and weak governance, a fact that does not make it an attractive destination for investments of this magnitude.

By increasing hydropower's share of the regional generation portfolio, the trade expansion scenario would lead to substantial savings in carbon emissions. The main impact of trade expansion would be to enable a shift away from thermal generation and relatively dispersed small-scale hydropower toward larger and more cost-effective hydropower resources. Overall, the share of hydropower in the regional generation portfolio would increase from 25 to 34 percent, displacing coal and other thermal options (figure 3.6). Some 47.5 TWh of additional hydropower generation would reduce carbon emissions by 41 million tonnes (table 3.5). The savings in carbon emissions would be the highest among regional power pools, indicating that regional trade permits a much larger volume of hydropower to be harnessed.

Figure 3.6 Power generation mix

a. Trade expansion

b. Trade stagnation



Source: Derived from Rosnes and Vennemo 2009.

Table 3.5 Differences in electricity production and carbon dioxide emissions under power trade scenarios

	WAPP	SAPP	EAPP	CAPP	Total	WAPP	SAPP	EAPP	CAPP	Total
	Production difference (TWh)					*Emissions savings (millions of tonnes)*				
Coal		–41.5	0.7		–40.8		–37.8	0.6		–37.2
Diesel	–0.8	–0.3	0.3		–0.8	–0.6	–0.2	0.2		–0.6
Gas	–9.2	–5.3	–42.4		–56.8	–4.7	–2.7	–21.5		–28.9
HFO	0.2		0.4	–4.9	–4.3	0.1		0.3	–3.6	–3.2
Hydro	11.5	47.5	43.4	5.1	107					0
Total	**1.6**	**0.5**	**2.4**	**0.3**	**4.7**	**–5.2**	**–40.7**	**–20.4**	**–3.6**	**–69.9**

Source: Derived from Rosnes and Vennemo 2009.

Note: The East African Power Pool is expanded to include key Nile Basin trading partners Egypt, Ethiopia, and Sudan. CAPP = Central Africa Power Pool; SAPP = Southern African Power Pool; WAPP = West African Power Pool; EAPP = East African Power Pool; TWh = terawatt-hour; HFO = heavy fuel oil

Deepening regional power trade would bring substantial economic benefits to the region by reducing the long-run marginal cost of power. Given that power is a key production input to the economy, any reduction in the reference level of power costs spurs productivity and competitiveness. For the SAPP as a whole, trade expansion would reduce the long-run marginal cost of power from $0.07 to $0.06 per kilowatt-hour or by 5 percent overall. It should be noted that even without trade, the economic cost of power in southern Africa is the lowest on the continent (table 3.6).

Table 3.6 Long-run marginal costs of power in the SAPP and island states

(U.S. cents/kWh)	Trade expansion	Trade stagnation	Difference
CAPP	7	9	–2
EAPP	12	12	0
SAPP	**6**	**7**	**–1**
WAPP	18	19	–1
Angola	6	11	–5
Botswana	6	6	0
Congo, Dem. Rep. of	4	4	0
Lesotho	6	7	–1
Malawi	5	5	0
Mozambique	4	6	–2
Namibia	11	12	–1
South Africa	**6**	**7**	**–1**
Zambia	8	8	0
Zimbabwe	8	9	0
*Madagascar**	*14*	*14*	*0*
*Mauritius**	*18*	*18*	*0*

Source: Rosnes and Vennemo 2009.

Note: * Island-state members of the SADC; not a part of the SAPP. CAPP = Central Africa Power Pool; SAPP = Southern African Power Pool; WAPP = West African Power Pool; EAPP = East African Power Pool; kWh = kilowatt-hour.

The largest benefits are felt by small countries with thermal-based systems, which could save as much as $0.05 per kilowatt hour or more than 40 percent of power costs overall. The magnitude of power cost savings varies hugely across individual countries in the SAPP area (table 3.6). Countries that have traditionally relied on very expensive, oil-based generation have the most to gain from switching to hydropower imports from the Democratic Republic of Congo. Angola has by far the largest potential gain, at $0.05 cents per kilowatt-hour. South Africa would save $0.01 kilowatt-hour, which seems modest, but considering the large volumes of power involved, amounts to a sizable financial gain. Finally, the Democratic Republic of Congo, the major power exporter under the trade expansion scenario, would not see any reduction in the long-run marginal costs of power. This is due both to its great power demand and the expense of investing in schemes more ambitious than needed to meet domestic demand alone. The long-run marginal costs in the island states are relatively high: $0.14 per kilowatt-hour in Madagascar and $0.18 per kilowatt-hour in Mauritius.

One can think of regional power trade as a project entailing additional investments and delivering reduced operating costs. On this basis, a rate of return for regional power trade can be estimated at 167 percent for the SAPP region. Essentially, the additional investments associated with trade expansion are paid back in less than a year and individual countries stand to make higher returns.

For power importers, the decision to trade can be thought of as an investment in cross-border interconnection that yields an annual return in terms of access to lower-cost power. On this basis it is possible to calculate returns on trade for individual importers. South Africa, Zimbabwe, and Angola stand to make exceptionally high returns: 319, 51, and 45 percent per year, respectively. Nambia's rate of return, at 14 percent, is more modest. Angola benefits significantly because trade provides the country with access to cheap hydropower from the Democratic Republic of Congo. A one-time investment of $870 million saves Angola $0.05 per kilowatt-hour and yields a return of 45 percent annually. For a negligible one-time investment of $10 million, South Africa fulfills required power infrastructure backbone needs and benefits from the cheap hydropower generated in the Democratic Republic of Congo. Returns for other importers are much lower due to the high cost of interconnectors.

For power exporters, the decision to trade can be thought of as an investment in additional generation capacity and cross-border interconnection that yields an annual return. For example, the Democratic Republic of Congo could expect to earn annual export revenues of $623 million from a one-time investment of $7.4 billion, a rate of return of 8 percent. Mozambique could expect to generate $212 million in annual export revenues from a one-time investment of $2.1 billion.

Table 3.7 Rate of return on power trade at the country level

Country	Price gain ($/kWh)	Net power trade (TWh)	Annual benefits ($ millions per annum)	One-time investment (US$ million)	Rate of return (%)
Exporters					
Congo, Dem. Rep. of	0.01	49.6	622.8	7,480	8
Mozambique	0.03	3.1	212.4	2,156	10
Importers					
Angola	0.05	6	395	870	45
Botswana	<.01	4.3	0	100	0
Lesotho	0.01	0.7	90	0	n.a.
Malawi	<.01	1.5	0	10	0
Namibia	0.01	3.8	43	300	14
South Africa	0.01	36.4	3,192	10	319
Zambia	<.01	1.8	0	1,420	0
Zimbabwe	0.01	3.5	187	370	51

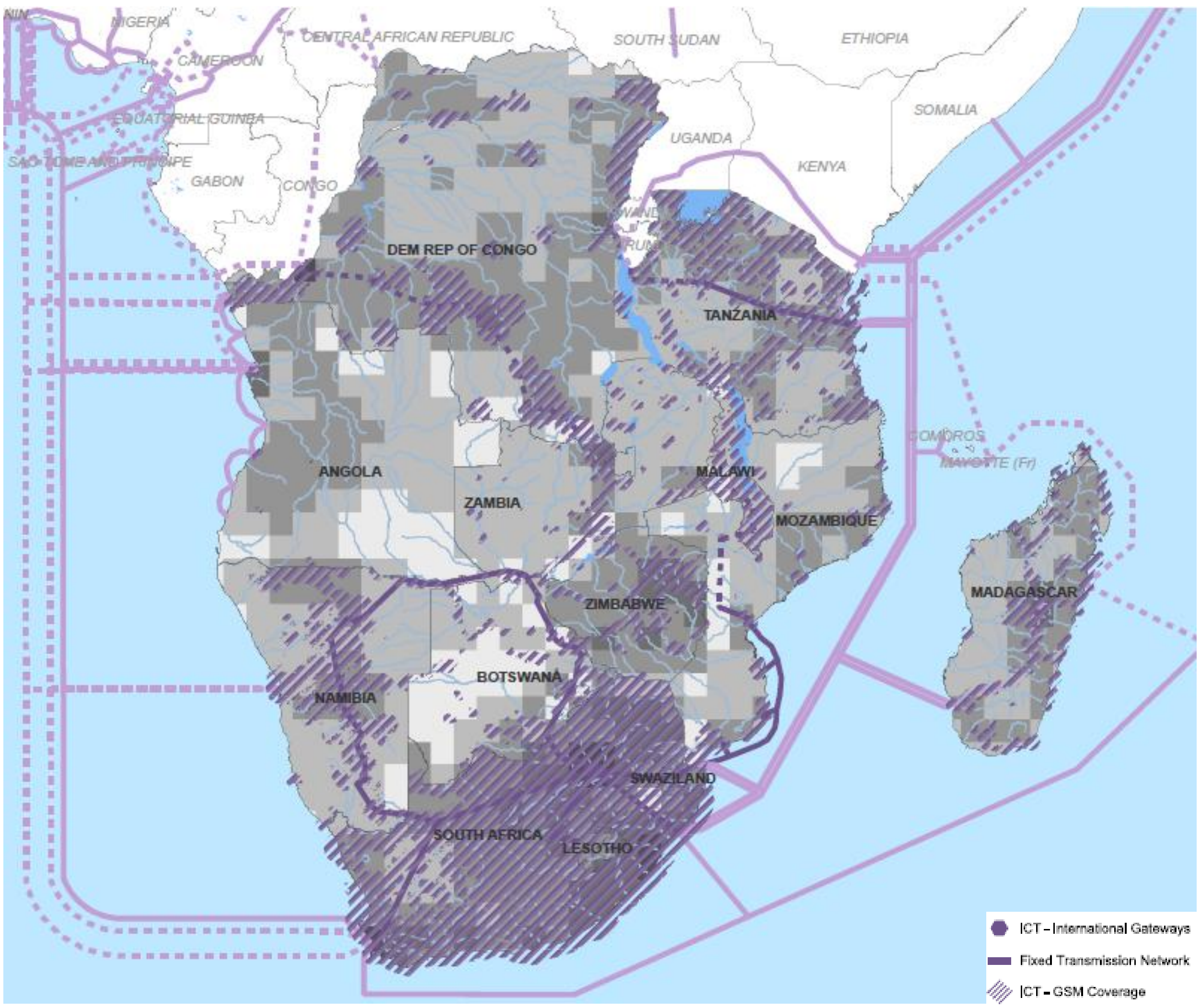
Source: AICD calculations.

n.a. = Not applicable.
Note: kWh = kilowatt-hour; TWh = terawatt-hour.

4 Information and communication technologies

Compared with the other regional economic communities, the Southern African Development Community (SADC) is the best performer in Sub-Saharan Africa in terms of ICT access, but critical information and communication technology (ICT) services are priced very high. The level of broadband subscribers, at 0.35 per 100 inhabitants, is higher than all other regional economic communities. International bandwidth (at 19 bits per capita) and mobile subscribers (at 31 out of 100 people) are higher than in other regions but not significantly so. Tariffs are toward the lower end of the range observed in other regions but are by no means the lowest. The price of a monthly prepaid mobile basket is $11, compared with $9 for the Common Market for Eastern and Southern Africa (COMESA) region. The price of monthly dial-up internet access is $76, compared with $50 in the COMESA region (table 4.1).

Figure 4.1 The SADC's regional ICT network



Source: AICD.
Note: ICT = information and communication technology.

Comparing performance across the SADC member countries, South Africa and Seychelles are far ahead of the others (table 4.2). Performance is mixed everywhere else, with the mobile footprint ranging from 23 percent in Madagascar to 93 percent in Malawi, mobile penetration ranging from 7 percent in Malawi to 39 percent in Namibia, and Internet subscribers ranging from less than 0.1 percent in Malawi to 1.8 percent in Swaziland. The price of a monthly mobile basket of services ranges from $4 in Zimbabwe to $15 in Zambia, while the price of a monthly Internet dial-up subscription ranges from $7 in Madagascar to $148 in Tanzania.

Perhaps more relevant than fixed-line international calls are regional roaming arrangements for mobile services—an area where the SADC is not as advanced as the Economic Community of West African States (ECOWAS). Given that fixed-line services have largely been overtaken by mobile services in southern Africa, the regional availability of roaming arrangements is in many ways a more relevant measure of the cost of internal communications. Although there are a number of roaming arrangements in the SADC (table 4.3), restrictions and limitations apply. Not every country has a roaming arrangement with all other SADC countries, and where roaming does exist, it may not be across all operators within a given country. In a number of cases, roaming is restricted to postpaid subscribers, which are a minority of total mobile subscribers in the region. Prepaid roaming requires real-time billing and is not always implemented. In some cases roaming is one way (subscribers in one country can use their mobile in another but not vice-versa) or subscribers cannot make international calls from the roamed country (except back to their home country).

Table 4.1 Benchmarking ICT infrastructure across Africa's regional communities

	ECOWAS	CEMAC	COMESA	EAC	SADC
Broadband subscribers (per 100 inhabitants)	0.03	0.01	0.04	0.02	**0.36**
International Internet bandwidth (per capita)	16	11	9	11	**19**
Internet subscribers (per 100 inhabitants)	0.24	0.06	0.09	0.05	**0.53**
Main telephone lines outside largest city (per 100 inhabitants)	0.39	0.20	0.53	0.24	**1.89**
Mobile telephone subscribers (per 100 inhabitants)	25	22	12	21	**31**
Prices					
Prepaid mobile price basket ($ per month)	14.04	15.11	9.09	12.18	**11.32**
Price of a 3-minute call to the United States ($ per 3 minutes)	0.83	5.68	2.20	1.37	**1.50**
Price of the 20-hour Internet basket ($ per month)	79.98	67.97	50.91	95.70	**75.60**
Price of fixed telephone price basket ($ per month)	9.35	12.59	6.85	13.33	**13.27**

Source: Ampah and others 2009.
Note: CEMAC = Economic and Monetary Community of Central Africa; COMESA = Common Market for Eastern and Southern Africa; EAC = East African Community; ECOWAS = Economic Community of West African States.

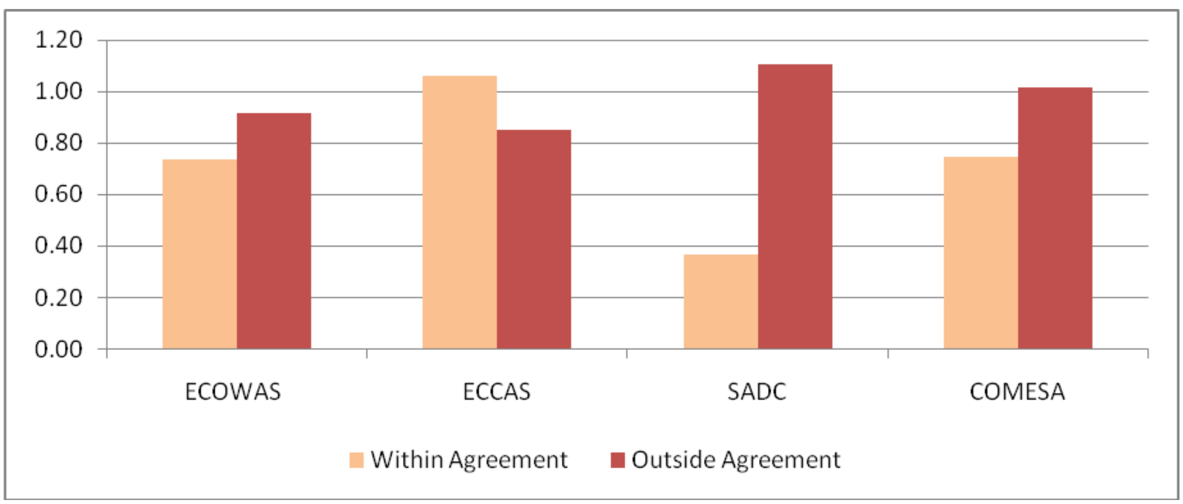
Table 4.2 Benchmarking ICT across the SADC member states

	Angola	Botswana	Congo, Dem. Rep. of	Lesotho	Madagascar	Malawi	Mozambique	Namibia	Seychelles	South Africa	Swaziland	Tanzania	Zambia	Zimbabwe
Broadband subscribers (per 100 inhabitants)	0.07	0.18	0	0	0.01	0.01	0.03	0.01	3.53	1.68	0	0	0.02	0.11
Internet subscribers (per 100 inhabitants)	0.28	0.43	0.04	0.11	0.06	0.13	0.15	0.99	4.58	2.01	1.78	0.09	0.1	0.81
Mobile telephone subscribers (per 100 inhabitants)	22	74	9	23	9	7	16	39	98	92	33	21	21	10
Coverage of mobile network (% of population)	35	85	53	55	23	93	80	95	97	98	90	60	60	59
International Internet bandwidth (Mbps)	250	200	10	1	250	2	150	56	42	3400	4	200	15	115
Prepaid mobile monthly basket (US$)	11.6	8.3	11.2	14	10.2	10.5	8.9	13.1	13.5	13.9	13	9.5	14.6	3.7
Price of a three-minute call to United States (US$)	3.7	0.9	1.2	1.8	1.4	3.5	1	2.3	2.9	0.4	2.4	0.7	5.5	4.4
Price of 20-hour Internet basket (US$)	63.1	29.7	93.2	78.4	6.7	52.7	66.9	61.4	50	36.2	51.7	148	81.5	29.6
Price of fixed-line monthly phone basket (US$)	20.5	14.4		14.5	2.6	1.7	13.9	13	15.5	20.8	5.7	11.3	8.9	1.3

Source: Ampah and others 2009.

Mbps = megabits per second; ICT = information and communication technology.

Figure 4.2 Price of one-minute peak-rate call within and outside regional economic communities (US$ per minute)



Source: Ampah and others 2009.

Note: COMESA = Common Market for Eastern and Southern Africa; ECOWAS = Economic Community of West African States; ECCAS = Economic Community of Central African States.

Table 4.3 GSM roaming in the SADC

	Operator	Angola	Botswana	Congo, Dem. Rep. of	Lesotho	Madagascar	Malawi	Mauritius	Mozambique	Namibia	Seychelles	South Africa	Swaziland	Tanzania	Zambia	Zimbabwe	Total
Angola	Unitel		O	O	O	O	O	O	O	O		O		O	O	O	**12**
Botswana	Orange			Θ	Θ	Θ	Θ	Θ	Θ	Θ	Θ	Θ	Θ	Θ	Θ	Θ	**13**
Congo, Dem. Rep. of	Vodacom	Θ	Θ		Θ	Θ	Θ	Θ	●	Θ	Θ	●		●			**11**
Lesotho	Vodacom	Θ	Θ	Θ			Θ	Θ	Θ	Θ		Θ	Θ	Θ		Θ	**11**
Madagascar	Orange	Θ	Θ				Θ	Θ	Θ		Θ	Θ		Θ			**8**
Malawi	Zain	O	O	O	O	O		O	O	O	O	O	O	O	O	O	**14**
Mauritius	EMTEL	●	●	●	●	●	●		●	●	●	●	●	●	●	●	**14**
Mozambique	Mcell	O	O	O	O	O	O	O		O		O	O	O	O	O	**13**
Namibia	MTC	O	O	O	O	O	O	O	O			O	O	O	O	O	**13**
Seychelles	C&W		Θ			Θ		Θ				Θ		Θ			**5**
South Africa	Vodacom	Θ	Θ	Θ	Θ	Θ	Θ	Θ	●	●	Θ		Θ	●	Θ	Θ	**14**
Swaziland	MTN	□	O		O	O	O	O	O	O		O		O	O	O	**11**
Tanzania	Vodacom	Θ	Θ	Θ	Θ	Θ	Θ	●	●	Θ	Θ	●	Θ		Θ	Θ	**14**
Zambia	Zain	O	O	O	O	O	O	O	O	O		O	O	O		O	**13**
Zimbabwe	Econet		Θ	Θ	Θ	Θ	Θ	Θ	Θ	Θ		Θ	Θ	Θ	Θ		**12**
Total		**10**	**14**	**11**	**12**	**13**	**13**	**14**	**13**	**12**	**7**	**14**	**10**	**14**	**10**	**11**	

Source: AICD, adapted from mobile operators and the GSM Association.

Note: ● = prepaid and postpaid roaming; Θ = only postpaid roaming; O = not specified; GSM = global system for mobile communications.

In other regional economic communities, some operators have attractive roaming agreements whereby users are not charged for incoming calls, and outgoing calls are charged at the local network rate without any markup. This type of arrangement is nonexistent in the SADC even though the same mobile groups operating in the SADC offer this option in other regional economic communities. In the absence of such arrangements, high costs accrue to the average customer, discouraging use or resulting in the purchase of multiple overseas SIM cards for travel.

The SADC has identified ICT as a key issue. The SADC's ICT regulatory agencies are grouped together in the Communications Regulators' Association of Southern Africa (CRASA, previously known as the Telecommunications Regulators' Association of Southern Africa).[4] It was established in 1997 in line with the SADC Protocol on Transport, Communications and Meteorology. CRASA's key goals include presenting a unified market to investors and coordinating telecommunications issues across member countries. To that end CRASA carries out activities such as the harmonization of laws and policies; spectrum coordination; training; and providing a forum for operators, regulators, equipment manufacturers, and other stakeholders to discuss regional telecommunications issues. In 2006 CRASA issued guidelines for wireless technologies policy and regulations that address roaming concerns.

Several large mobile groups with a multicountry presence dominate the regional telecommunications market. Across the board, the SADC member states have been very open to foreign investment in mobile telecommunications. All have at least one strategic foreign investor operating in their mobile industry (table 4.4). At least one of the "big three" pan-African mobile companies—Zain of Kuwait and MTN and Vodafone of South Africa—are present in the SADC countries (with the exception of Angola, Mauritius, Seychelles, and Zimbabwe). Other than South African strategic investors[5] and one Zimbabwe mobile operator in Lesotho, all foreign investors come from outside the region.

For fixed-line telephones, only Lesotho, Mauritius, Seychelles, South Africa, and Tanzania have privatized incumbent operators. Only the Seychelles has a fully privatized fixed-line provider. All except South Africa have foreign strategic investors in their fixed-line operators (the original strategic investors in South Africa's Telkom relinquished their shares on the local stock market). Angola, Mauritius, and South Africa have competitors to the incumbent operating in the fixed line market. Telecom Namibia is an investor in a greenfield Angolan operator; Indian investors are active among second national operators in Mauritius and South Africa. Although almost all of the strategic investors are publicly listed, only a few of the local subsidiaries are. These include TNM in Malawi, Telekom in South Africa, and Zain in Zambia. The percentage of foreign ownership varies throughout the SADC. In some cases, foreign investors own 100 percent of the operation whereas in others local investors play an important part. In several countries there are limits on the percentage of foreign ownership allowed.

[4] Madagascar and Seychelles are not listed as members on the CRASA Web site (http//:www.crasa.org), whereas Tanzania is also a member of the East African Regulatory Post and Telecommunications Organization (EARPTO).

[5] Vodacom is 65 percent held by Vodafone of the United Kingdom and 13.9 percent by the South African government, with the remainder of shares listed on the Johannesburg Stock Exchange. MTN is traded on the Johannesburg Stock Exchange.

Table 4.4 Foreign investors in the SADC telecommunications sector

Country	France Telecom	Millicom (Luxembourg)	MTC (Zain, Kuwait)	MTN (South Africa)	Orascom (Egypt)	Vodafone (UK)	Portugal Telecom	Other	Total	Note
Angola							25%		**1**	Also has foreign investors in fixed-line market
Botswana	54%			53%					**2**	
Congo, Dem. Rep. of		100%	99%			51%		51%	**4**	Other = ZTE (China)
Lesotho						88%		70%	**1**	Other = Econet (Zimbabwe)
Madagascar	72%		100%					68%	**3**	Other = Distacom (Hong Kong)
Malawi			100%						**1**	
Mauritius	40%	50%							**2**	Also has foreign investment in second fixed-line operator
Mozambique						98%			**1**	
Namibia					100%		34%		**2**	
Seychelles								100%	**2**	Other(s) = Cable & Wireless (UK); Bharti (India)
South Africa				100%		65%		75%	**3**	Other = Oger (Saudi Arabia)
Swaziland				30%					**1**	
Tanzania		100%	60%			65%		51%	**4**	Other = Etisalat (UAE)
Zambia			79%	100%					**2**	Incumbent operator is currently undergoing privatization
Zimbabwe					60%				**1**	
Total	**3**	**3**	**5**	**4**	**2**	**5**	**2**	**6**		

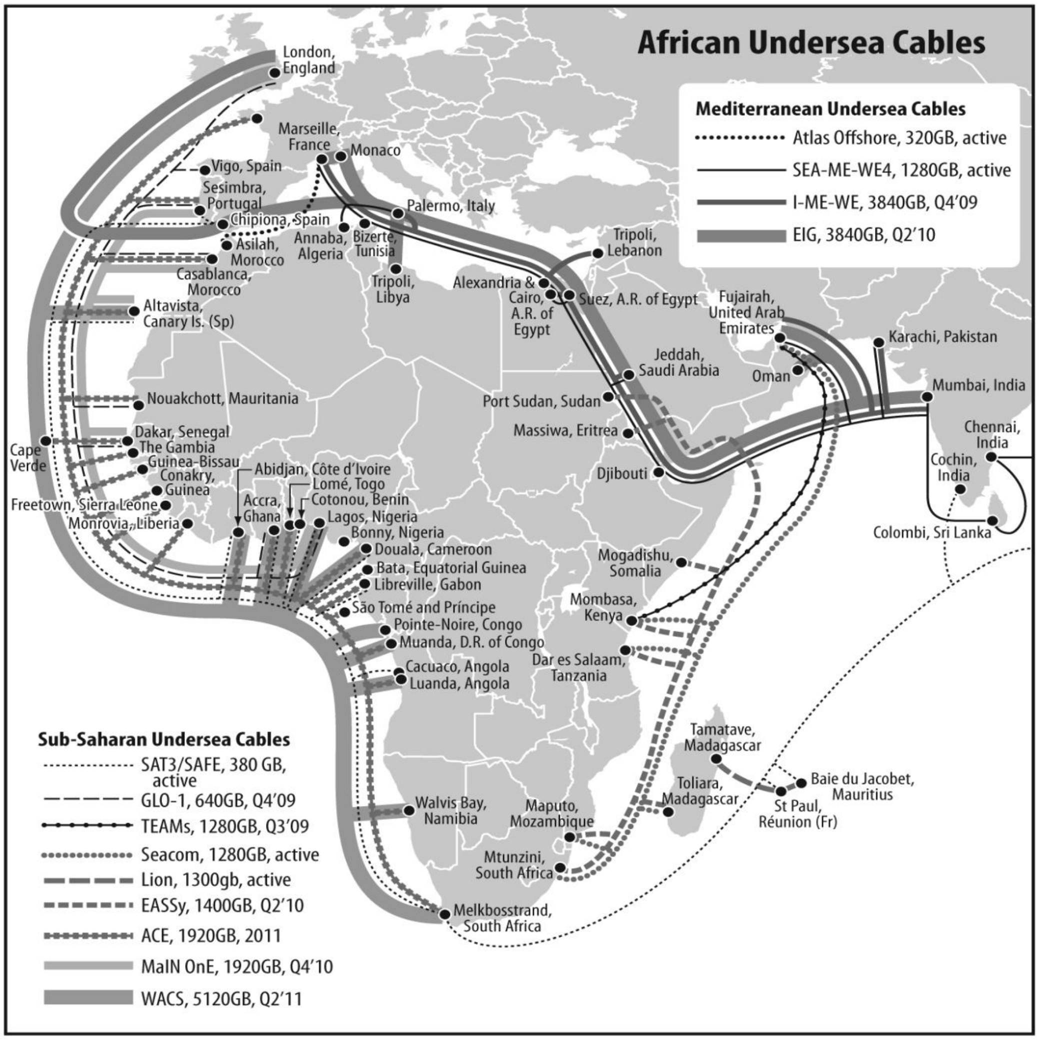
Source: Derived from Ampah and others 2009.
Note: UAE = United Arab Emirates.

Until recently, very few countries in the SADC region were connected to an undersea submarine cable. Connectivity to a submarine cable is critical to achieve seamless transmission of voice, text, data, and video communications traffic. Even though several transmission mediums are available, a fiber optic cable is preferred because of its ability to transmit large volumes of data rapidly, and to thus affect Internet access and speed. The main international cable in the region is the South Atlantic 3 (SAT-3)/West Africa Submarine Cable (WASC)/South Africa Far East (SAFE), which extends from Malaysia to South Africa and then up the west coast of Africa to Portugal and Spain (figures 4.3). Angola, Mauritius, and South Africa have access to the SAT-3 cable. As of July 2009, Mozambique and Tanzania have connected to SEACOM (the South Africa–East Africa–South Asia fiber optic cable).[6] Madagascar has connected to the LION cable (Lower Indian Ocean Network). Plans to connect the remaining

[6] http://www.seacom.mu. East Africa connected to the cable first.

countries with sea-based borders to submarine cables are under way. Several additional undersea cables are planned, so that by the year 2012 there will be other cables that will serve southern Africa (figure 4.3).

Figure 4.3 Proposed fiber optic connectivity in the SADC



Source: Mayer and others 2009.

Note: COMESA = Common Market for Eastern and Southern Africa; SAT-3 = South Atlantic 3; WACS = West African Cable System; SAFE = South Africa Far East; WACS = West African Cable System; GSM = global system of mobile communications; GLO1= Globalcom 1; SEACOM = South Africa–East Africa–South Asia fiber optic cable; LION = Lower Indian Ocean Network; ACE = Africa Coast to Europe; WACS= West Africa cable system

For example, the planned Africa Coast to Europe (ACE),[7] which will run from France to Gabon, is expected to be operational by 2011. The 14,000-km Main One cable system is expected to connect Africa with Europe, the Americas, and Asia in 2010. The initial deployment will connect Portugal to Nigeria, with a landing station in Ghana. After this is complete, the network will be expanded to connect South

[7] http://www.orange.com/en_EN/press/press_releases/cp090609en.jsp.

Africa, Angola, Gabon, Senegal, the Democratic Republic of Congo, Côte D'Ivoire, and Morocco.[8] The equally long ACE submarine cable system will connect all countries along the west coast of Africa (more than 25 countries in Africa and Western Europe), from Morocco to South Africa. Seventeen operators signed a memorandum of understanding in November 2008, and the cable is scheduled for launch in 2011.[9] The West African Cable System (WACS) will link Europe, West Africa, and South Africa.

Countries with access to submarine cables benefit from lower prices for ICT services, and those with *competitive* access benefit even more (table 4.5a). Mauritius and South Africa, after being connected to an undersea fiber optic cable, saw reduced prices for Internet services. Tanzania, which has recently obtained access to the cable, has seen a steady decline in prices (table 4.5b) for all critical ICT services.

Table 4.5a Prices of Internet access and phone calls in Sub-Saharan Africa, with and without access to submarine cables

	Price per minute for a call within Sub-Saharan (US$)	Price per minute for a call to United States (US$)	Price for 20 hours of dial-up Internet access per month ($)
No access to submarine cable	1.34	0.86	67.95
Access to submarine cable	0.57	0.48	47.28
Monopoly international gateway	0.7	0.72	37.36
Competitive international gateway	0.48	0.23	36.62

Source: AICD calculations.

Table 4.5b Time trend of prices for ICT services in Tanzania (US$)*

	2005	2006	2007	2008	2009	2010
Monthly prepaid mobile basket	13.46	10.40	9.54	—	9.32	9.28
Monthly postpaid fixed basket	12.43	10.82	11.28	11.73	—	9.65
ADSL monthly service charge		38.87	31.49	32.74	29.74	29.74

Source: AICD.

Note: *2010 values have been generated using 2009 annual average exchange rate. ADSL = Asymmetric Digital Subscriber Line; ICT = information and communications technology.

Access to a submarine cable is a necessary but not sufficient condition for lowering the prices of ICT services. Countries will have to ensure that the international segment of the market is competitive if customers are to see lower prices. In several SADC countries, prices remain high owing to lack of competition in the international gateways.

To attain full intraregional connectivity, the SADC member countries will have to add 5,158 km of new fiber optic links. Achieving the minimum levels of regional connectivity will require investments in several countries. The levels of investment required in each case are very modest in absolute terms (table 4.6). The region as a whole will need to spend a modest $139 million to meet the regional requirements.

The benefits of completing the regional integration of ICT networks would be substantial in relation to the modest costs involved. Experience from other African countries suggests that connecting a country to a submarine cable via a competitive arrangement for landing station can bring down the costs of broadband Internet by as much as 75 percent. Not only would this deliver substantial savings to existing users of broadband, but the price reduction could be expected to induce additional uptake of broadband

[8] http://www.mainonecable.com.

[9] http://www.orange.com/en_EN/press/press_releases/cp090609en.jsp.

services. Based on regional experience, every 10 percent reduction in broadband prices can be expected to bring about a significant increase in broadband penetration. Based on available information, the benefit of completing the SADC's regional is estimated to total $203 million per year, against costs of only $139 million—a rate of return of 150 percent. Most benefits derive from the addition of new broadband users, making regional integration a positive business prospect for broadband service providers, since the revenue lost from existing customers is more than compensated by the revenue gained from new customers.

Table 4.6 Gaps in intraregional connectivity, and total investment required to attain minimum levels of regional connectivity

	Gaps (km)	Necessary investment ($ million)
Angola	782	21
Congo, Dem. Rep. of	1,781	48
Lesotho	2	<1
Madagascar	637	17
Malawi	477	13
Mozambique	21	1
South Africa	12	<1
Tanzania	1,220	33
Zimbabwe	226	6
Total	**5,158**	**139**

Source: AICD calculations.

A number of greenfield investments have been made to develop the communications backbone in several countries. When the gaps in the backbone and connectivity are bridged, the rate of return will escalate. For example, in Malawi a $13 million one-time investment to address ICT gaps will lead to a 37 percent rate of return on this investment annually (table 4.7).

Table 4.7 Cost-benefit analysis of regional integration

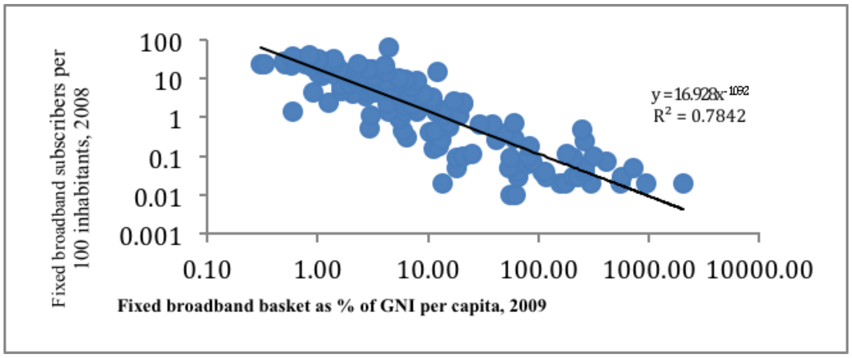
	Broadband price ($/mo.)		Broadband subscriptions ('000s)		Benefits ($ millions/yr)	Costs ($ millions)	Rate of return (%)
	Baseline 2008	Induced	Baseline 2008	Induced			
Angola	157	98	16	65	28.6	21	135
Lesotho	50	31	0.1	7	0.8	0.1	1,629
Madagascar	102	63	4	11	3.3	17	19
Malawi	493	308	3	1	4.9	13	37
Mozambique	80	50	10	14	4.4	1	443
South Africa	27	17	426	2,126	154.4	12	1,287
Tanzania	64	40	6	44	7.1	0.3	2,231

Source: AICD calculations.

Box 4.1 Methodology for calculating the benefits of ICT

Affordability significantly affects access to telecommunications services. As the price of broadband service rises, the number of fixed broadband subscribers per 100 inhabitants drops (see figure).

Relation between broadband penetration and broadband affordability, world



The cost of Internet access largely depends on the wholesale price paid for international Internet connectivity. At present, African countries rely heavily on satellite connections for Internet access. But fiber optic cables can lower the cost of Internet access, provided countries allow Internet service providers (ISPs) open access to the cable. For example, in Kenya, connectivity to a fiber optic cable prompted a 75 percent drop in international bandwidth prices.

Assuming Kenya's wholesale cost reduction is applicable to other countries and that international wholesale prices account for half of the ISPs' cost structure, the reduction in retail prices is assumed to be 37.5 percent. The potential savings for consumers in African countries, once they have open access to undersea fiber-optic networks, can then be estimated. The revised broadband tariff is used to estimate the number of new broadband subscriptions based on the equation shown in the figure. Based on these assumptions, it is estimated that a 37.5 percent reduction in retail broadband prices would result in a *consumer* savings of $159 million for existing subscribers. The lower broadband prices would trigger new subscriptions estimated at around 2.7 million (compared with 833,000 in 2008). These new subscriptions would generate an additional $800 million of new revenue.

Certain assumptions in the model should be noted. The model assumes a standard broadband tariff, even though there are a number of different packages with differing speeds. It assumes a scenario similar to Kenya's in terms of the degree of the price reduction, and that half of the wholesale price reduction will be passed through to retail prices. It also assumes that there is only a correlation between broadband pricing and take-up, even though other variables such as education and infrastructure availability will also have an impact. Finally, the model shows the one-year effect of a 37.5 percent reduction in retail tariffs. The timing of the full reduction is likely to spread over several years in some countries.

Source: AICD.

Note: ICT = information communication and technology; GNI = gross national income.

5 Regional infrastructure funding

Completing and maintaining the Southern African Development Community's (SADC's) regional infrastructure backbone would entail sustained spending of $2.1 billion a year over the course of a decade. The preceding sections identified a number of key gaps. The basic regional infrastructure package recommended would enable full regional power trade, a complete regional road network, and fiber-optic links connecting all countries to submarine cables. Meanwhile, the total spending needed in the SADC region to fulfill both regional and national infrastructure demands amounts to $30 billion a year. Hence, the regional portion—$2.1 billion—accounts for only 7 percent of the overall requirement.

The amount of spending needed varies widely across countries and sectors. The largest spending requirements in terms of investments and operations and maintenance (O&M) are in power ($1.4 billion per year), followed by transport ($728 million), and information and communication technology (ICT) (around $15 million). The Democratic Republic of Congo, followed by Mozambique, has the highest spending needs in the region in absolute terms. The Democratic Republic of Congo has to spend $961 annually to meet regional spending needs for infrastructure, mainly in the power sector. Mozambique needs to spend $265 million on regional integration, much of it also devoted to power-related investments.

Table 5.1 Regional spending needs by sector

	Transport		ICT		Power		Total		
	Inv	O&M	Inv	O&M	Inv	O&M	Inv	O&M	Total needs
Angola	34	36	2	0	88		125	36	160
Botswana	12	23			9		21	23	44
Congo, Dem. Rep. of	139	69	5	0	748		892	69	961
Lesotho	0	0	0	0			0	0	0
Madagascar	15	23	2	0			17	23	40
Malawi	2	11	1	0	1		5	11	16
Mozambique	14	36	0	0	216		229	36	265
Mauritius	0	0	0	0	0		0	0	0
Namibia	37	34			30		67	34	101
Seychelles	0	0	?	?	0				
South Africa	11	79	0	0	2		14	79	93
Swaziland	11	26	0	0	0		11	26	37
Tanzania	28	32	3	0	44		76	32	108
Zambia	10	34			141		151	34	185
Zimbabwe	4	7	1	0	73		77	7	84
SADC	**319**	**409**	**14**	**1**	**1,352**	**0**	**1,685**	**410**	**2,095**

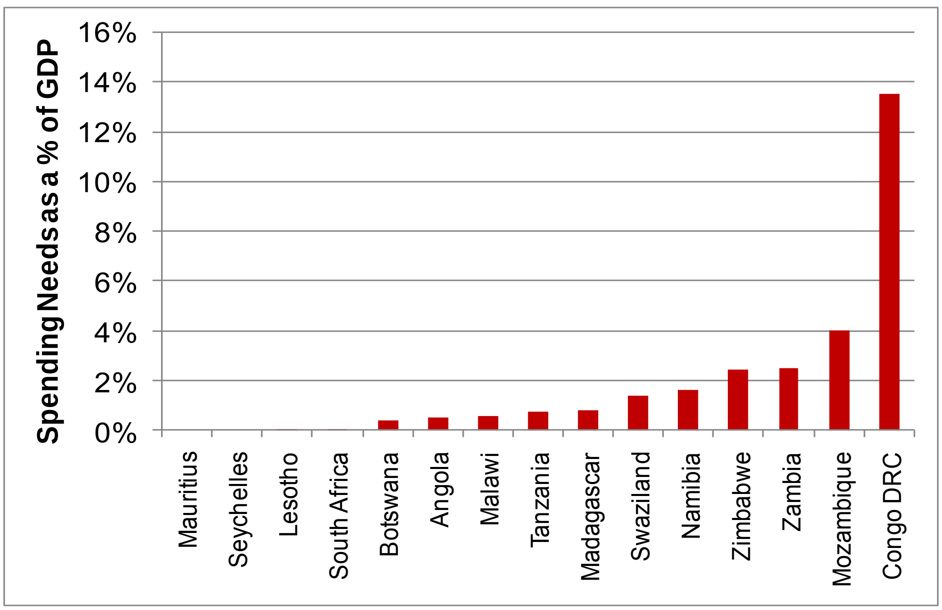
Source: Derived from Carruthers and others 2009, Rosnes and Vennamo 2009 and Mayer and others 2009

Note: O&M = operations and maintenance; ICT = information and communication technology.

Maintaining the SADC's regional backbone, once completed, would cost a significant amount. Although the bulk of the regional infrastructure spending needs relate to new investment, there is also a significant ongoing need for maintenance spending. This amounts to a total of $410 million per year—the lion's share for regional road networks.

Regional spending needs in the SADC, though only 0.6 percent of the regional gross domestic product (GDP), weigh heavily on some countries (figure 5.1). The Democratic Republic of Congo has the most daunting spending requirement at almost 14 percent, followed by Mozambique at around 4 percent. The requirements for the Democratic Republic of Congo, which is a relatively small and fragile economy, are untenable, making it unlikely that the country will be able to deliver its portion of the regional backbone without some external or cross-border funding arrangements. The spending needs in the Democratic Republic of Congo are driven by the large export-oriented hydropower projects that the country would need to develop before it could assume its natural role as a power exporter for the region. The spending needs of the remaining countries pale in comparison to those of the Democratic Republic of Congo, but even for a country like Zambia, devoting 2 percent of GDP to regional infrastructure would be a significant challenge.

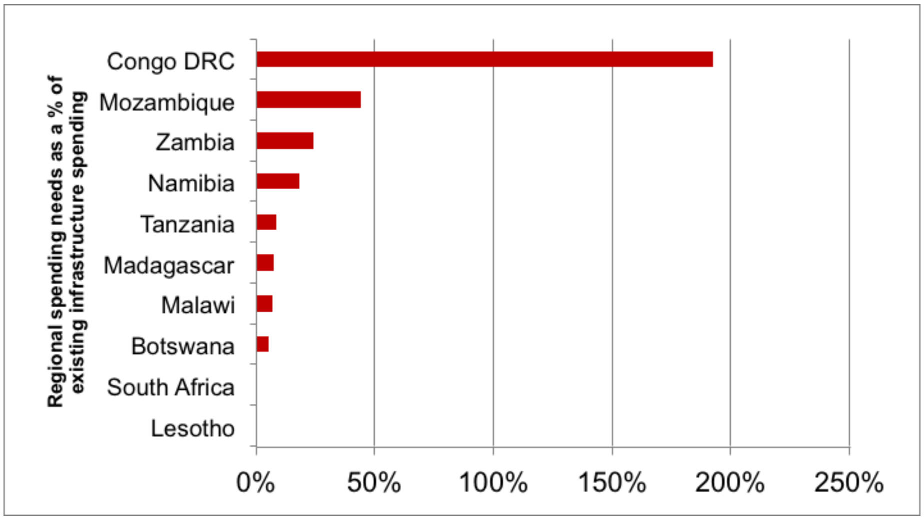
Figure 5.1 Spending on regional infrastructure as a share of GDP



Source: Derived from Carruthers and others 2009, Rosnes and Vennamo 2009 and Mayer and others 2009.
Note: GDP = gross domestic product.

Looking at regional spending needs as a percentage of historic spending on infrastructure presents an even more improbable picture for some countries. The SADC countries would have to devote between 1 and 192 percent of their existing infrastructure spending to meet regional needs. Figure 5.2 expresses each country's regional spending need as a percentage of existing infrastructure spending. (Information on existing spending is available for only a subset of countries.) This analysis identifies a group of countries (Lesotho, South Africa, Botswana, Malawi, Madagascar, and Tanzania) that could meet their regional spending needs by allocating less than 10 percent of their existing infrastructure spending for regional projects. A second group (Namibia, Zambia, and Mozambique) that would need to devote 10–50 percent of their infrastructure spending on regional projects faces a much tougher proposition. The Democratic Republic of Congo would have to spend 192 percent of its existing infrastructure spending to meet regional spending needs.

Figure 5.2 Spending for regional infrastructure as a percentage of national infrastructure spending



Source: Derived from Carruthers and others 2009, Rosnes and Vennamo 2009 and Mayer and others 2009.

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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 (AICD). All of these can be downloaded from the project Web site: 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 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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About AICD

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

Reports on Africa's for major regional economic communities (RECs) provide a snapshot of the state of integration of infrastructure networks at the regional level. The focus of these reports is on benchmarking infrastructure performance within and between RECs, gauging the benefits of regional integration, identifying missing links, and quantifying the main financing gaps and their distribution across countries. These reports are particularly relevant to national and regional policy makers and development partners working on regional integration programs.

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 as possible of the remaining African countries.

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, the Development Bank of Southern Africa, 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, the Public Private Infrastructure Advisory Facility, Agence Française de Développement, the European Commission, and Germany's KfW Entwicklungsbank. The Sub-Saharan Africa Transport Policy Program and the Water and Sanitation Program provided technical support on data collection and analysis pertaining to their respective sectors. A group of distinguished peer reviewers from policy-making and academic circles in Africa and beyond reviewed all of the major outputs of the study to ensure the technical quality of the work.

The data underlying 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.