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ECCAS's Infrastructure

A Continental Perspective

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Abstract

Sound infrastructure is fundamental for growth across the Economic Community of Central African States (ECCAS). During 1995–2005, improvements in infrastructure boosted growth in Central Africa by 1 percentage point per capita annually, primarily due to the introduction and expansion of mobile telephony. Improved roads also made a small contribution. Conversely, inadequate power deterred growth to a greater degree than elsewhere in Africa.

ECCAS must address a complex set of challenges. Economic activity takes place in isolated pockets separated by vast distances. Two countries are landlocked and dependent on regional corridors; seven countries have populations of under 10 million; and eight have economies that are smaller than $10 billion/year. This difficult economic geography demands a regional approach to developing infrastructure. Yet Central Africa's infrastructure has the poorest performance record in all of Africa on most aggregate indicators.

Transportation is slow and the most expensive in Sub-Saharan Africa, with poor road conditions, border delays, port delays, time-consuming administrative processes, no integrated railway network, and inefficient air transport. The ICT backbone is still in its early stages; access rates are low and the prices of critical services are the highest in Africa. ECCAS has the least-developed power sector on the continent despite significant hydropower resources.

If Central Africa's infrastructure could be improved to the level of Mauritius, regional growth performance would be boosted by some 5 percentage points, with power making the strongest contribution. The cost of such an improvement is estimated at $1.8 billion/year for a decade and will require external assistance.

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ECCAS's Infrastructure: A Regional Perspective

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Synopsis

Sound infrastructure is a critical prerequisite for growth in Central Africa. Over the period 1995–2005, improvements in infrastructure boosted growth in Central Africa by 1 percentage point per capita annually. Almost the entire contribution to growth was due to the introduction of mobile telephony, while improvements in road infrastructure made a small contribution. Inadequate power deterred growth to a greater degree in Central Africa than in other regions in the continent. If Central Africa's infrastructure can be improved to the level of the strongest-performing country in Africa (Mauritius), regional growth performance would be boosted by some 5 percentage points, with power making the strongest contribution.

Central Africa's infrastructure has the poorest performance record in all of Africa on most aggregate indicators. The gap between southern Africa (the regional leader) and Central Africa is quite dramatic, indicating that Central Africa has to make a significant effort to catch up with other parts of Africa—let alone the rest of the developing world. Paved road density is a fraction of the low levels in West Africa. Central Africa does, however, outperform East Africa on power and information and communication technology (ICT) indicators.

The Economic Community of Central African States (ECCAS) must address a complex set of factors: economic activity takes place in isolated pockets separated by vast distances and environmentally sensitive areas. Two countries are landlocked and are entirely dependent on regional corridors. Seven countries have populations below 10 million and eight have economies that are smaller than $10 billion per year. This difficult economic geography makes it critical to take a regional approach to developing infrastructure. Inland waterways are prominent yet grossly underutilized.

A third of ECCAS's regional road network is unpaved, with substantial shares in poor condition. Meanwhile, coastal countries are not devoting sufficient attention to sea corridors. There is only one significant regional transport corridor linking the Port of Douala to the Central African Republic and Chad. A second potential corridor running inland from the Port of Pointe Noire fell into neglect during a recent conflict but is in the process of being revitalized. There is a tendency for coastal countries to neglect the hinterland portions of their regional corridors to the detriment of their landlocked neighbors. Traffic volumes along the region's corridors are exceedingly low and in many cases below the economic threshold for paving. Regional integration is a challenge because there is limited road connectivity between countries in the Economic and Monetary Community of Central Africa (CEMAC) and other ECCAS member states.

Surface transport in Central Africa is the most expensive in Sub-Saharan Africa due to cartelization and restrictive regulations on the trucking industry. In Central Africa road transport tariffs are on the order of $0.13 per tonne-kilometer (tonne-km) or even higher, compared with $0.05 per tonne-km in southern Africa and well below $0.04 per tonne-km in much of the developing world. High freight charges do not reflect high transport costs so much as high trucking profits that can be traced to the lack of competition in the industry. In addition, the regulatory framework is based on market sharing and centralized allocation of freight, which limits vehicle mileage and undermines incentives to invest in improving service quality.

Surface transport in Central Africa moves slower than most other parts of Africa because of poor road conditions, border delays, and time-consuming administrative processes. The average effective velocity of freight movement in Central Africa is around 6 kilometers per hour, about half the effective velocity of surface transport in southern Africa and not much faster than a horse and buggy. This slow speed is largely attributed to poor road infrastructure and also to administrative barriers such as border and customs clearance, as well as formal and informal checkpoints and road blocks that keep trucks stationary for extended periods of time.

The time taken to move freight from ports to landlocked countries has ranged from 26 to 71 days, among the longest on the continent. Between 50 to 80 percent of these delays are caused by the long dwell times at ports. Time required for administrative processes also accounts for a smaller yet significant share of the long delays that contribute to lengthening transit times along ECCAS's corridors.

The overall cost of moving goods along Central Africa's key trade routes is on the order of $230–$650 per tonne. These are the highest costs found in any African region. The main culprits are the extensive delays at ports and the high unit costs of road freight transportation.

Central African railway systems do not form a network, and existing rail lines are lightly used. These factors—coupled with the lack of performance required to retain competiveness with road transport—complicate the regional integration of the railways. The productivity performance of the railways in Cameroon and Gabon are encouraging. But the performance of railways in the Democratic Republic of Congo, the Republic of Congo, and some lines in Angola remains very poor.

Two ports in Central Africa—Douala and Pointe Noire—serve as transshipment hubs for the region, but the performance of these ports significantly lags global standards. In Doula and Luanda the volume of general cargo handled significantly exceeds design capacity. Prices in Central African ports are double that of global benchmarks on some parameters, and efficiency indicators are far from meeting global benchmarks. These inefficiencies and the excess capacities handled result in congestion problems at the ports, leading to extensive dwell times.

The air transport sector in ECCAS is striking for the absence of an air transport hub and the lack of connectivity between the CEMAC region and other ECCAS members. The CEMAC region is among the most liberalized in Africa and has made significant progress in allowing airlines to fly the so-called fifth freedom routes, flights flown under fifth-freedom arrangements (that is, by carriers that are not registered either in the origin or destination country) by instituting free pricing and lifting capacity and frequency restraints. Nevertheless, the number of seats flown fell dramatically between 2001 and 2007 due to the collapse of Cameroon Airlines and Air Gabon, as well as Air Afrique. Air safety standards are rather low; no ECCAS country has yet made significant progress toward achieving international safety standards.

Despite major hydropower resources, Central Africa has the least developed power sector on the continent. Generation capacity is inadequate and average historic costs of power in the region have been extremely high—on the order of $0.49 per kilowatt-hour. Notwithstanding this, power access is better than in some other regions. With power demand likely to double over the next decade, expanding the power supply infrastructure is critical to the region's economic future.

Regional power trade through the Central African Power Pool (CAPP) could substantially reduce power sector costs and the long-run marginal cost of energy in the region. In addition to the Democratic

Republic of Congo, Cameroon could potentially emerge as a significant exporter if it could develop an additional 1,300 megawatts of hydropower. Chad and Equatorial Guinea would find it economically attractive to import their entire power needs from the CAPP, while Congo and Gabon could import between 25 to 50 percent of their demand. Regional power trade would reduce overall energy costs in the region by $160 million annually, and would facilitate a shift to cleaner energy that would reduce regional carbon emissions by around 4 million tonnes annually. Importing countries would save significantly on their national power development costs and substantially reduce their long-run marginal cost of power. Given the region's underdeveloped transmission networks, significant investments in interconnectors are needed to make trade a reality. Overall, investments in regional interconnection yield an average rate of return of 28 percent.

Compared with other regional economic communities in Africa, ECCAS's ICT backbone is still in its incipient stages; access rates are low and the prices of critical services are the highest on the continent. It is cheaper to call outside of ECCAS than it is to call within the regional economic community. The roaming arrangements in the region are the least developed in Africa. Only three countries have roaming arrangements with other regional economic community members, and the special roaming plans (prepaid, no charge for incoming calls, preferential outgoing call rates) found in other regional economic communities are absent in Central Africa. A few large operators are beginning to develop a regional presence in ECCAS, and all countries now have two or three foreign operators. The region has very low connectivity to submarine cables: only three countries are connected and none of the landlocked countries have access to the cables despite their proximity. Completing the ICT backbone in ECCAS would require adding over 4,900 km of cable that would cost $140 million.

Completing and preserving ECCAS's regional infrastructure backbone would require an investment of $1.8 billion per year over the course of a decade. Of this, around $1.4 billion a year is needed for the creation of new regional infrastructure assets, while the balance of $222 million is needed to maintain the regional network in perpetuity once established, most of it for road maintenance. By far the largest item on the budget is the power sector, with regional power assets demanding $1.1 billion per year over the next decade. Of the total for ECCAS, 28 percent, or $680 million per year, is needed to complete CEMAC's infrastructure backbone—$470 million for new infrastructure investments and the rest for maintenance.

While this amounts to only 2 percent of regional gross domestic product (GDP) for ECCAS (and 1 percent for CEMAC), for some small countries the burden is insurmountable. In absolute terms, the largest burden falls on the Democratic Republic of Congo, which would have to spend $960 million a year over the next decade to deliver the infrastructure assets (chiefly power) needed by the region. Cameroon comes in a distant second, with a spending requirement of $350 million a year (also largely associated with power). If one looks at regional spending requirements relative to the size of each country's economy, the burden appears even more uneven. Congo's regional spending requirement, in particular, translates to almost 14 percent of GDP, manifestly beyond what the national economy could plausibly deliver without external assistance. The rest of the countries would need to spend between 1 and 5 percent of their GDP on regional spending—a stretch, even if the absolute sums involved do not look so large.

1 Introduction

The Africa Infrastructure Country Diagnostic (AICD) has conducted extensive data collection and analysis of the infrastructure situation in Africa, including in the countries of the Economic Community of Central African States (ECCAS) region. 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 economic community is to present the key AICD findings for ECCAS. The main value in doing so is that it allows ECCAS's infrastructure situation to be benchmarked against that of other African peers, the main gaps in the regional infrastructure backbones to be identified, and the costs and benefits of regional integration (as well as their distribution across member states) to be quantified.

A number of methodological issues need to be borne in mind.

First, owing to the cross-country nature of the data collection, there is inevitably a time lag involved in the data. The period covered by AICD runs from 2001 to 2006. Most 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 was 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. This is because 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.

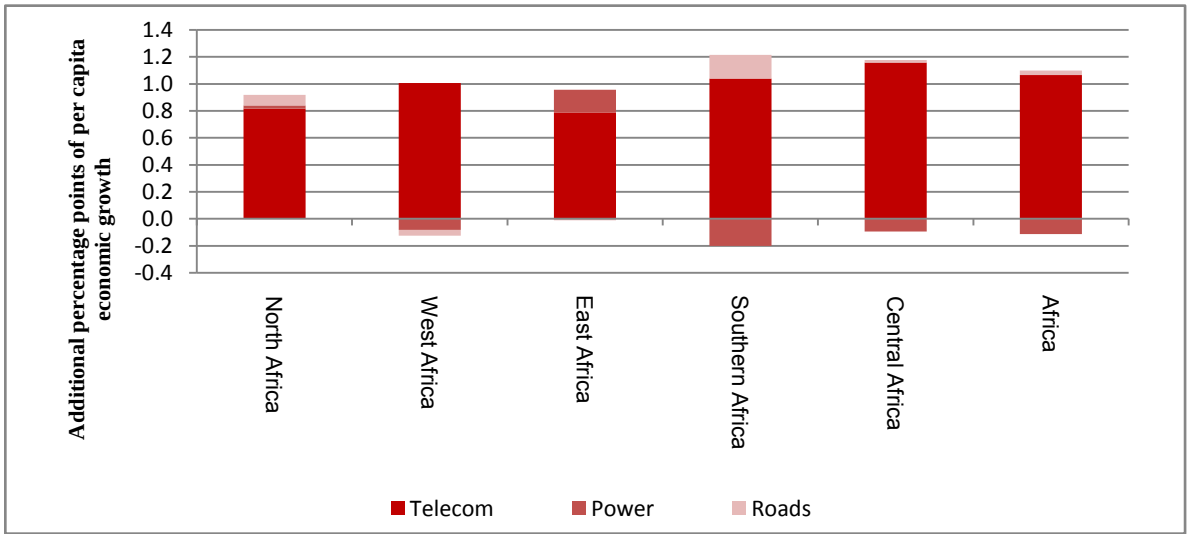
Why infrastructure matters

ECCAS has 10 member states: Angola, Burundi, Cameroon, Chad, the Democratic Republic of Congo, the Republic of Congo, the Central African Republic, Equatorial Guinea, Gabon, and São Tomé and Príncipe. A subgroup of these countries—Cameroon, the Central African Republic, Chad, the Republic of Congo, Equatorial Guinea, and Gabon—forms the Economic and Monetary Community of

Central Africa (CEMAC). Where relevant, separate aggregate results will be presented for the ECCAS and CEMAC countries.

For the period 2003–08, all countries for which data are available registered economic growth, albeit at varying rates. Average annual growth in purchasing power parity (PPP) terms was above 1 percent for all countries. Burundi, Cameroon, the Central African Republic, and Gabon grew at an average rate of 1 percent annually during this period. The Democratic Republic of Congo, the Republic of Congo, Chad, Rwanda, and São Tomé and Príncipe grew between 2 and 5 percent on average for the same period, and Equatorial Guinea had outstanding growth of over 10 percent annually. Infrastructure has contributed approximately 1 percentage point to the per capita growth rate in Central Africa (figure 1.1a). Almost the entirety of this was due to the growth of mobile telephony, as was the case in all other regions. Improvements in road infrastructure made a small contribution to overall growth. The lack of adequate power infrastructure eroded growth by 0.1 percentage point, more in Central Africa than in other parts.

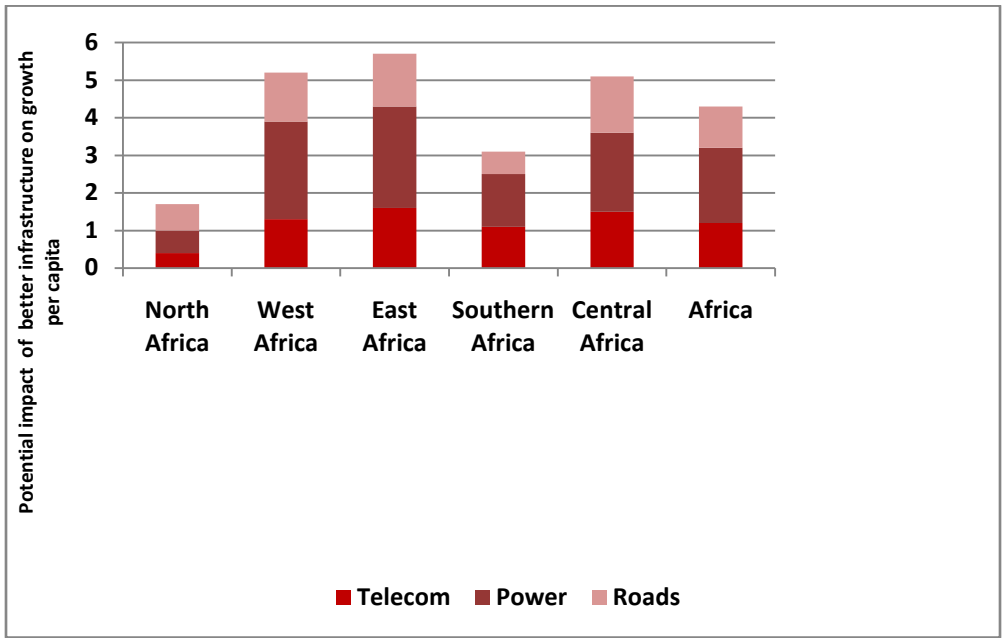
Figure 1.1a. Infrastructure's historic contribution to economic growth, 1995–2005



Source: Calderón 2009.

Infrastructure, however, could contribute much more to economic growth in the future than it has in the past (figure 1.1b). Simulations suggest that if Central 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 on the order of 5 percent. All areas of infrastructure—ICT, power, and transport—need to be upgraded. Improvements in power can impact growth by around 2 percentage points. Roads and telecommunications infrastructure upgrades could contribute 1.5 percentage points each to growth.

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



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

Why regional integration matters

With its large number of isolated economies, including island states, ECCAS's economic geography is particularly challenging. Of the member countries, two are landlocked and rely on regional corridors, seven have populations below 10 million people, and eight have economies smaller than $10 billion per year (figure 1.2a). Central Africa's economic geography stands out from the other regions for the considerable distances that exist between areas of economic agglomeration and vast environmentally sensitive areas. Inland waterways feature prominently in this region as an alternate cost-effective, but typically underutilized, mode of transport.

Levels of economic activity are very low throughout ECCAS, and exceed $5 million per 100 square kilometers only around Kinshasa-Brazzaville. A small area around Bujumbura in Burundi also records dense economic activity. There are patches of moderate economic activity around the capital cities of the regional economic community member states, but these taper off inland (figure 1.2b).

Regional integration is the only likely way to overcome these handicaps and to allow ECCAS 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 for deeper economic integration, thereby allowing countries to gain scale economies and harness regional public goods.

Table 1.1. Progress and challenges for regional integration in ECCAS

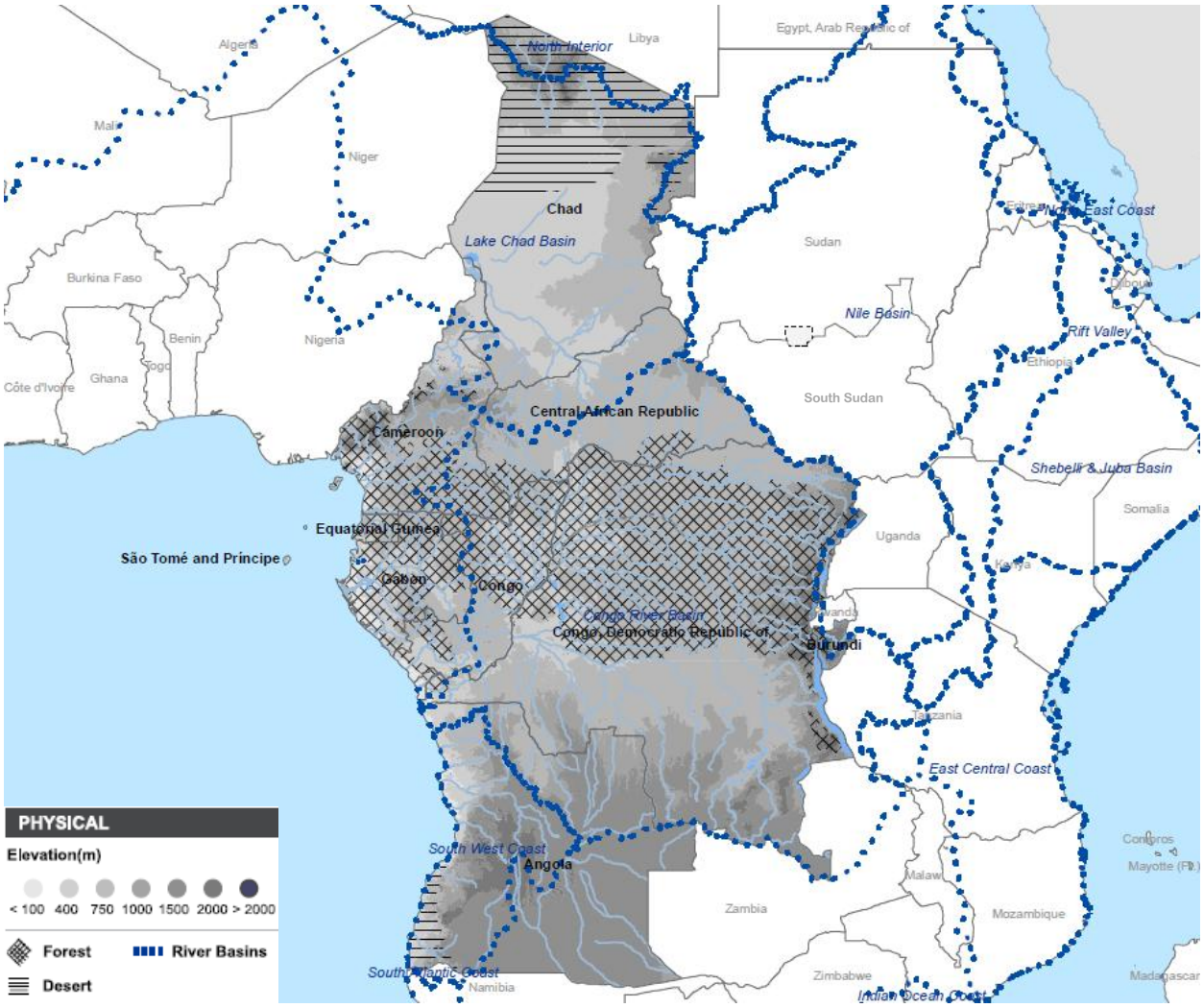
Sector	Achievements	Challenges	Promise of regional integration
Road transport		High trucking charges and lengthy delays due to trade facilitation issues. Traffic volumes on regional corridors are well below traffic thresholds and do not justify paving. Road quality is not very good, with patches of very poor roads along key corridors. No connectivity between the CEMAC countries and the Democratic Republic of Congo and Angola.	Reducing costs and delays associated with surface transportation of goods within the region.
Railways	Two relatively successful binational concessions. The concessions have improved productivity of individual railways.	Low levels of passenger and freight traffic. Poor operational performance of railways.	
Ports	Douala acts as the main gateway for landlocked countries. Pointe-Noire has good deep-water characteristics.	The two key ports used in the region are facing capacity constraints. Port charges are exceedingly high.	
Air transport	CEMAC has made good progress toward liberalization.	The air transport market has dwindled, and levels of air connectivity are very low. There is no connectivity between the CEMAC countries and the Democratic Republic of Congo and Angola. Air safety is among the worst in the world.	Collaborating on improvement of safety record. Improving efficiency of regional air transport through a better hub system.
Power	Significant availability of cost-effective hydropower resources.	Very low access and generation capacity. Utilities highly inefficient with regard to distribution losses and revenue collection.	Deepening regional integration would save the CAPP area US$160 million (10 percent of power costs) in energy costs and generate annual savings of some 4 million tonnes of carbon emissions. Long-term marginal cost of power in the CAPP would fall by US$0.02 per kilowatt-hour, the greatest savings in Africa. The overall rate of return on regional integration investments is 28%.
ICT	Some countries have been connected to the undersea fiber-optic cable, which has resulted in reduction of costs to ICT services. A few international operators are beginning to develop a regional presence.	Very low access to ICT services and very high prices in ECCAS. Roaming far less developed than other parts of Africa.	Achieving regional ICT integration would cost only US$14 million annually and bring large benefits. Benefits derive primarily from lower prices inducing higher rates of subscription to broadband services.

Source: Summary of analysis presented in the paper

Note: CEMAC = Economic and Monetary Community of Central Africa; CAPP = Central Africa Power Pool; ICT = information and communication technology.

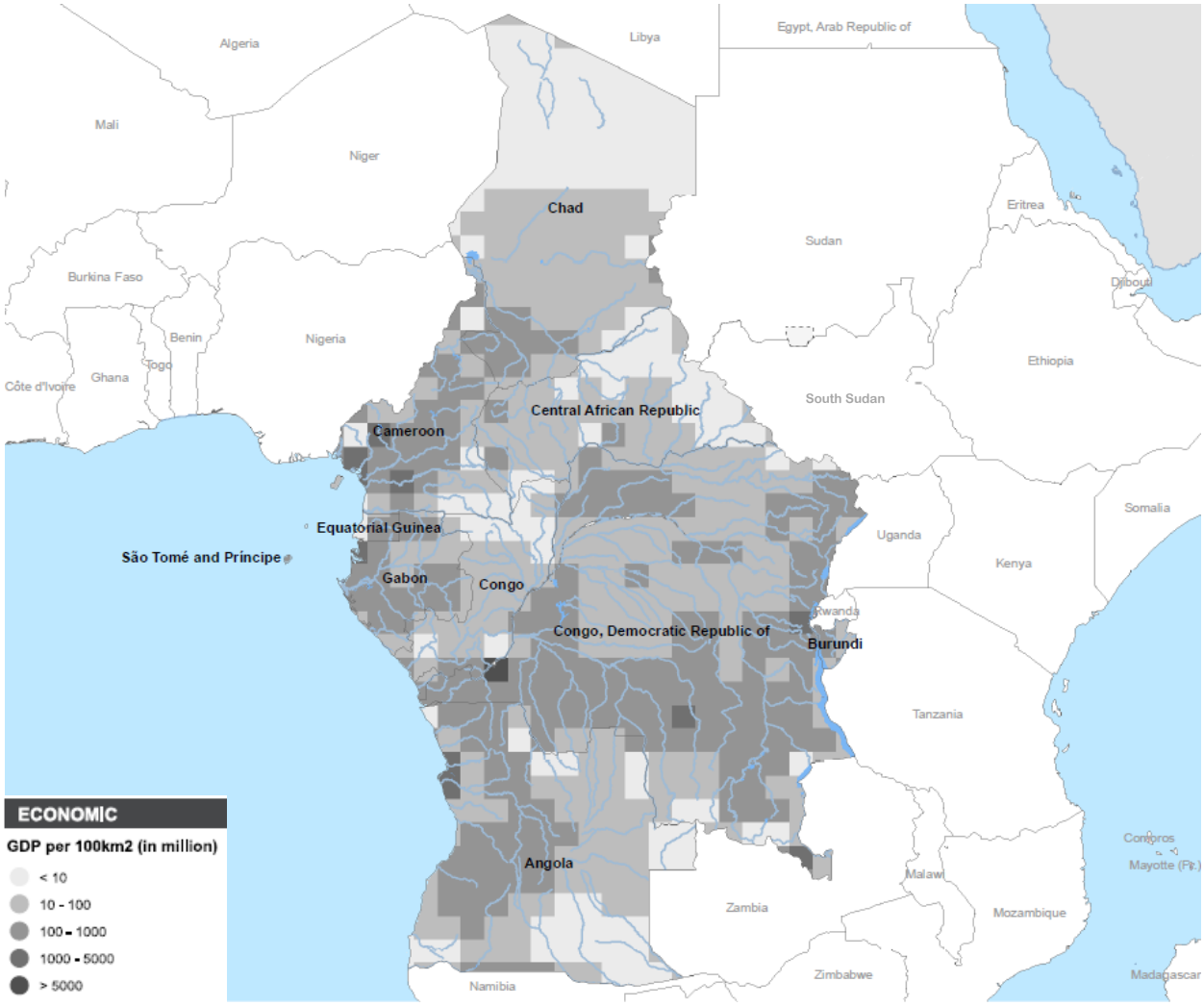
As well as assessing the current state of regional infrastructure, this report identifies the basic infrastructure needed to provide a minimum level of transport, power, and ICT interconnection. Basic needs include smooth land corridors between landlocked countries and ports, as well as between major 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 ECCAS region



Source: AICD.

Figure 1.2b. Spatial distribution of economic activity within ECCAS



Source: AICD.

The state of ECCAS's infrastructure

ECCAS's infrastructure ranks consistently below other parts of Africa on almost all aggregate infrastructure indicators (table 1.2). Paved road density, at 4 km per 100 sq km of land, is barely a fraction of the density in West Africa, which is the next-worst performer on this indicator. In terms of electricity generation capacity and coverage and mainline and mobile density, Central Africa has better access than East Africa. In fact, the mobile revolution seems to have taken off in Central Africa, where the mobile density, at 84 subscribers

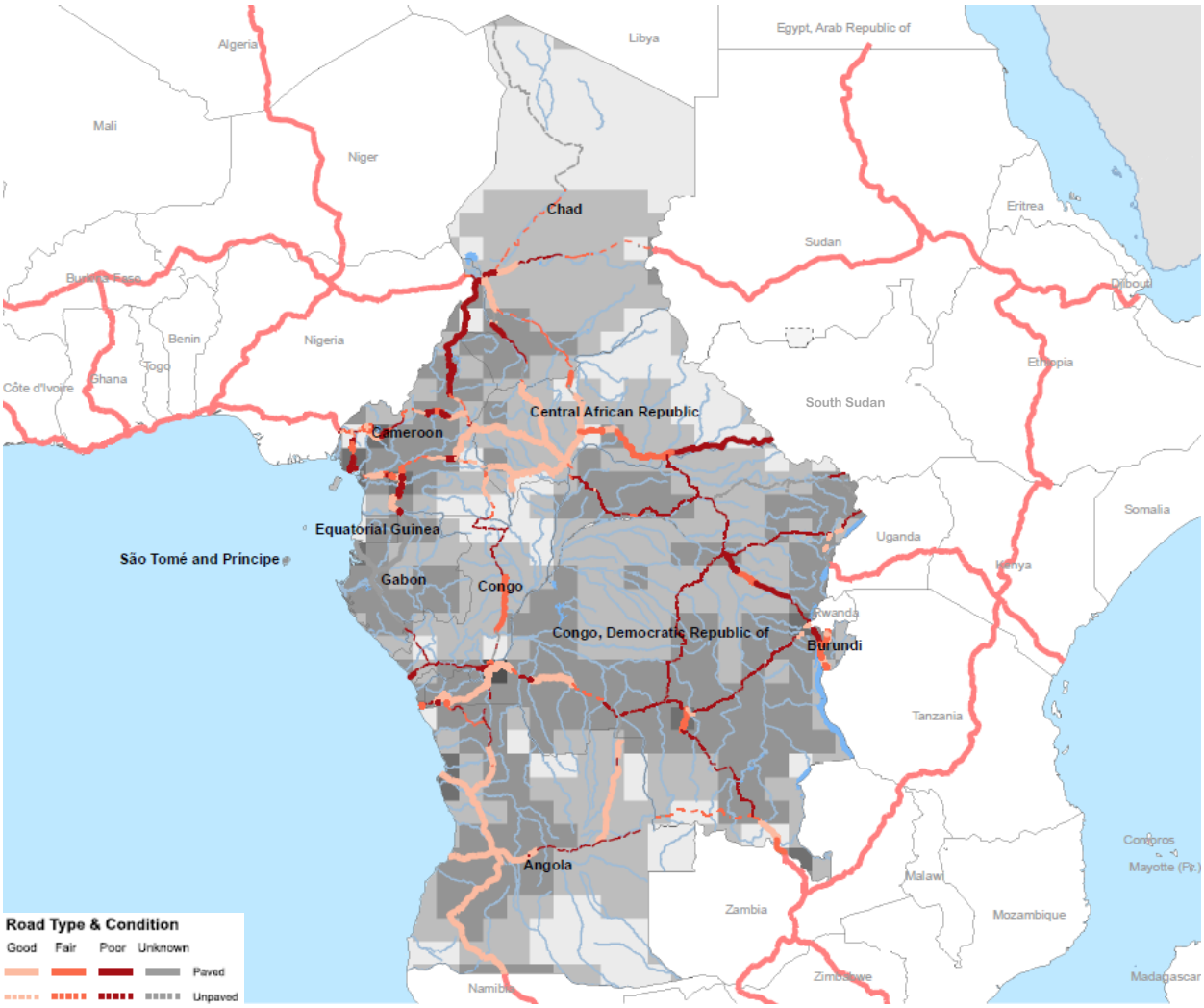
Table 1.2 Benchmarking Central Africa against other regions

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

out of 100 people, is second only to southern Africa. The gap between southern Africa (the regional leader) and Central Africa on most indicators, however, is quite dramatic, indicating that Central Africa has to make a significant effort to catch up with other parts of Africa, let alone the rest of the developing world.

2 Transport

Figure 2.1a. The condition of ECCAS's regional road network

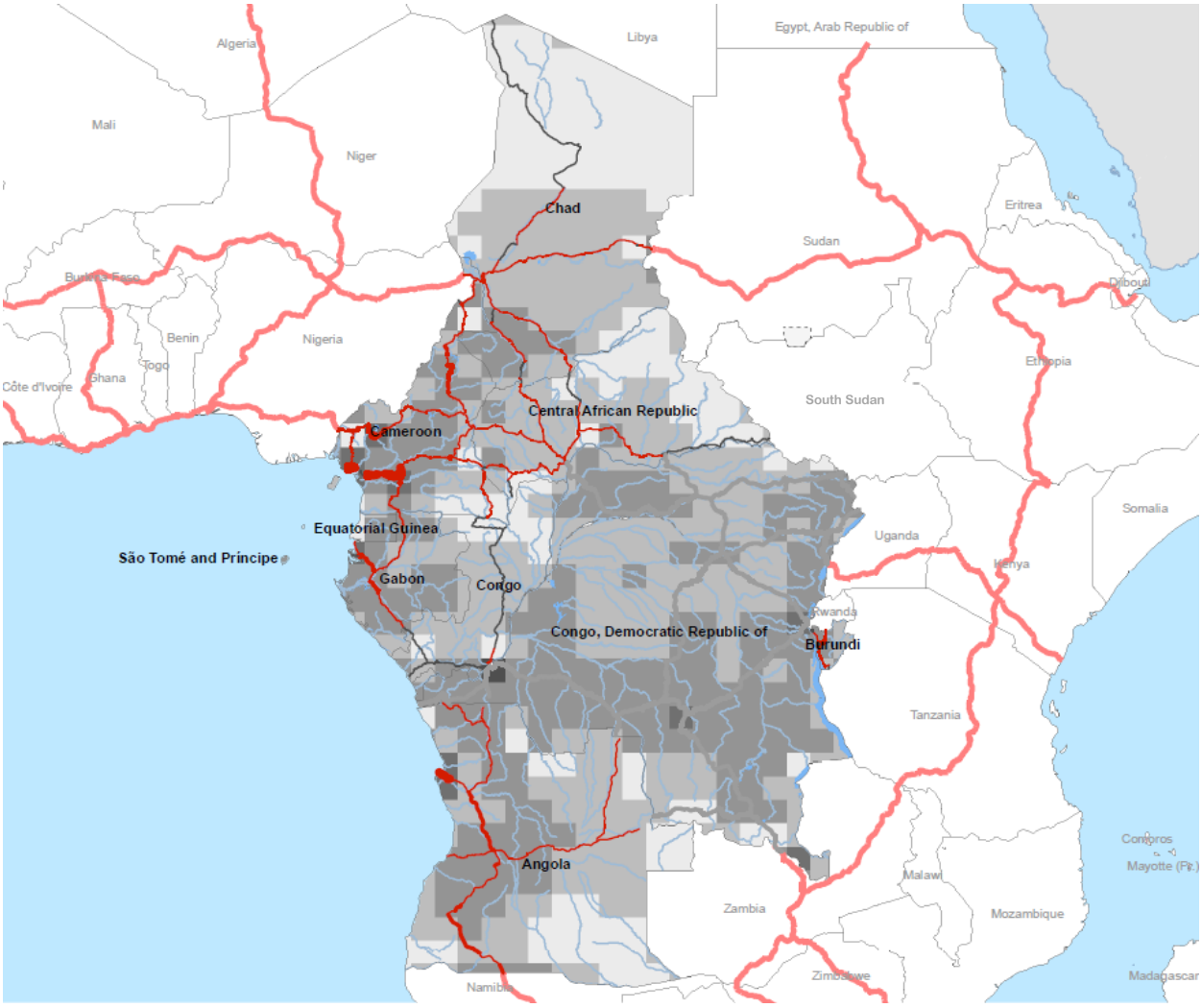


Source: AICD.

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 $0.05 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 fully into account. At an effective speed of 6–12 kilometers per hour (kmph), they did not move much faster than a horse and buggy (table 2.1).

Figure 2.1b. Traffic on ECCAS's regional road network



Source: AICD

Table 2.1. Relative performance of transport corridors in Africa

Corridor	Length (km)	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.

Corridor performance varies across Africa (table 2.1). Teravaninthorn and Raballand (2009) found that transport corridors in Central Africa perform significantly worse than the rest of Africa and are well below global standards. Only half of the regional road corridors are in good condition—significantly less than other parts of Africa—and trade density is lower. The implicit velocity of freight (when stops and delays are factored in) is only 6.1 kmph, similar to what is found in West Africa. Road freight tariffs, at $0.13 per tonne-km, are among the highest in the world. For example, transport prices on the Douala to Ndjamena route are three times higher than in Brazil and almost two times the cost of moving from Lusaka to Durban.

The Logistics Performance Index (LPI) from 2010[1] indicated that West and Central Africa performed slightly better than East Africa, which as of 2010 had amongst the worst trade logistics record in the world.[2] The LPI results revealed that transporters on trade corridors in Central (and West) Africa operated under regulatory systems that negatively impacted productivity and imposed additional burdens on landlocked countries.

Similar to West Africa, high road freight charges and very poor transport quality are in large part due to the cartelization of a trucking industry that operates in a highly restrictive regulatory environment. The strong presence of freight bureaus and transport associations influences the market and prevents truck operators from contracting with customers directly. Analysis of cost information provided by trucking firms indicates that the high road freight charges in the region are not attributable to higher costs but rather to larger profit margins made possible by limited competition within industry cartels. In the United States, freight transport prices average around $0.04 per tonne-km, compared with $0.11 per tonne-km along the Douala- Ndjamena corridor (USITC 2009).

The regulatory framework is based on market sharing and the centralized allocation of freight. This limits vehicle mileage (to around 2,000 km per month versus 12,000 in the developed world) and undermines incentives for investing in service quality. Hence, the truck fleet is largely composed of poorly maintained secondhand trucks that are typically overloaded to obtain maximum revenue from their restricted usage. There is typically excess supply, with too many vehicles chasing modest freight volumes. In southern Africa, by contrast, a much larger share of freight traffic is allocated through competitive bilateral contracts between clients and shippers.

The cartelization of the Central African trucking industry is at an extremely high level. For example, the truckers surveyed indicated that they were compelled to join truckers' associations; without membership, getting a load would be far more difficult. In more deregulated environments such as those found in East Africa, being a part of a cartel or truckers' association counts for less than the individual professionalism of a trucking company.

These considerations make the liberalization of the trucking industry an important step toward improving surface transport in Central Africa. Indeed, until the regulatory framework for the trucking

[1] The LPI is an annual survey of international freight forwarders conducted in 155 countries. This survey aggregates the responses of survey participants to questions concerning several factors—such as transport, warehousing, and border clearance—into an index that is used to rank and rate global logistics for trade.

[2] Most countries aggregated as "West and Central Africa" by the LPI are countries that belong to the Economic Community of West African States (ECOWAS).

industry is modernized, there will be no real economic benefit from further improvements to the quality of road corridors.

The slow effective velocity of freight in Central Africa can be explained in terms of numerous road blocks, lengthy administrative delays at ports and border crossings, and corruption. Corruption levels are found to be as high as in West Africa. The landlocked countries in Central Africa (Chad and the Central African Republic) experience by far the most costly and lengthiest export times. A 2009 USITC report found that trucks often took two weeks to cross the border between the Central African Republic and Cameroon, losing more time at the border than in transit. Importing goods took between 4 to 6 weeks on average, including 2 to 4 weeks at the port (Arvis, Raballand, and Marteau 2009).

The uncertainty associated with delays on the road and at ports—in addition to high administrative costs—translates into an economic drain. Operators and businesses need to hedge against unreliable service delivery either by increasing inventories or taking alternate transport routes, which are often extremely expensive. *The Economist* reported in 2002 that a beer factory in Cameroon, for example, keeps 40 days of inventory to cope with poor road conditions, and a beer distributor stockpiles five months of inventory at the beginning of each rainy season. This creates additional business costs and reduces orders (USITC 2009).

The landlocked members of the Economic Community of Central African States (ECCAS) largely rely on Douala in Cameroon as a gateway to the sea. The landlocked Central African Republic and Chad use Douala as the main point of exit to the sea. Trade with the western Democratic Republic of Congo tends to go through Matadi. Pointe-Noire in the Republic of Congo could potentially play a greater role as a deepwater gateway to the sea for the Democratic Republic of Congo and the Central African Republic. But the neglect of surface transport corridors during these nations' recent conflicts has prevented this from taking place. Exports from the southeastern Democratic Republic of Congo have traditionally used Durban as a gateway to the sea because of its proximity to the north-south corridor in the Southern African Development Community (SADC) region.

A substantial share of regional corridors are unpaved and in poor condition. There are five major corridors in Central Africa (table 2.2).[3] In most cases, only around two-thirds of the total length is paved. The Central African Republic has paved just about the entirety of its sea corridors and keeps them in good condition. But much of the connecting routes in Cameroon and the Republic of Congo is unpaved and in poor condition. The same can be said of the Angolan portion of the Lobito corridor. These countries seem to be neglecting strategic hinterland routes that are critical to Chad, the Central African Republic, and the Democratic Republic of Congo. What is striking in each of these cases is that the problem seems to lie in the neglect of road quality by a coastal gateway country. The incentives for the coastal country to maintain hinterland road corridors do not appear to be strong, since the coastal countries' own economies are typically concentrated along the coast.

Traffic volumes on ECCAS's regional corridors are substantially lower than in other regions and make the case for paving questionable. The Douala to Ndjamena route is the only one recording a significant volume of traffic: above 300 vehicles per day over three-quarters of its length. In most other

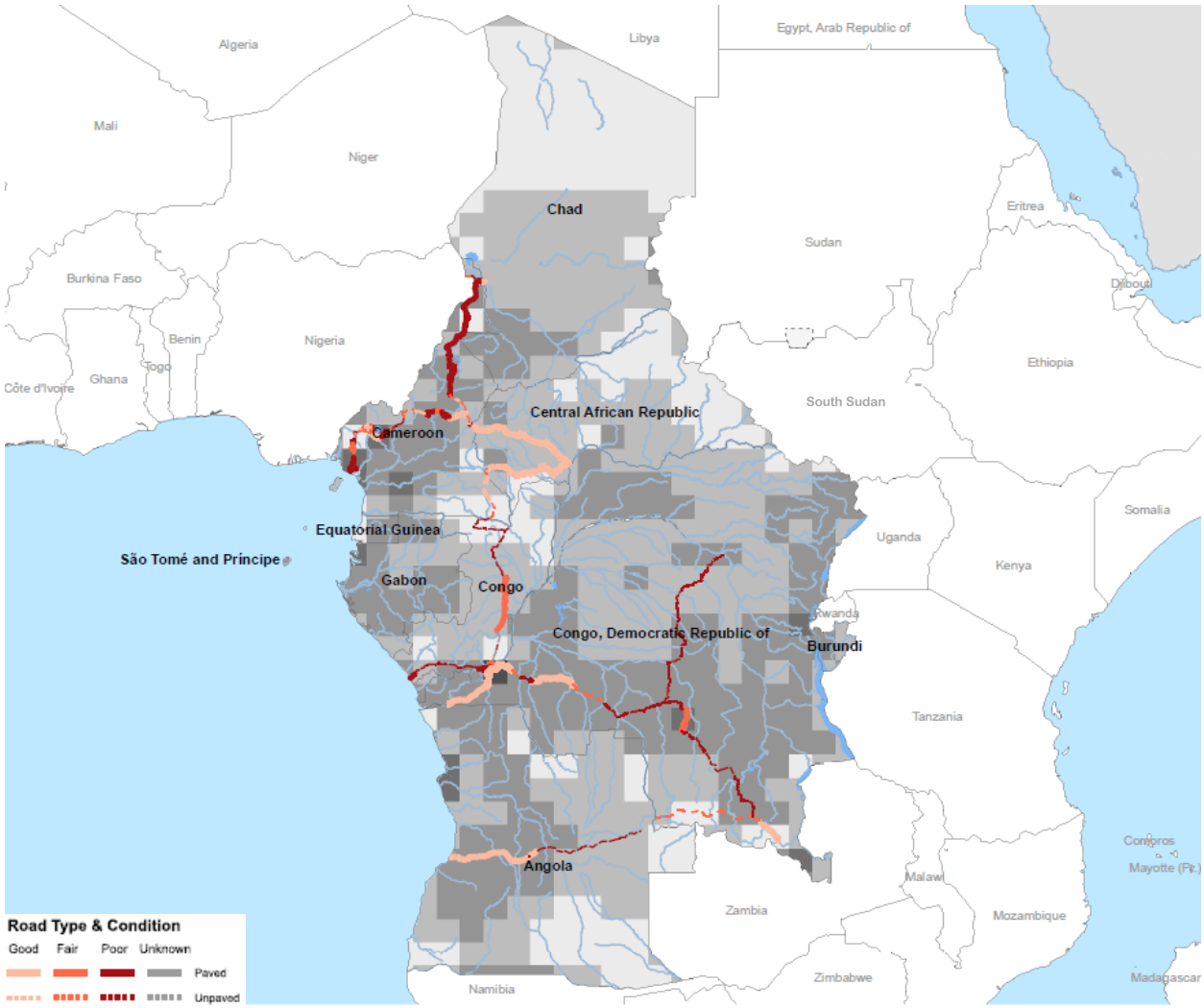
[3] The route between Matadi and Lubumbashi is not provided in table 2.4 due to data limitations.

cases, much of the corridor length sees less than 300 vehicles per day, which is below the economic threshold for paving.

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 times 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.

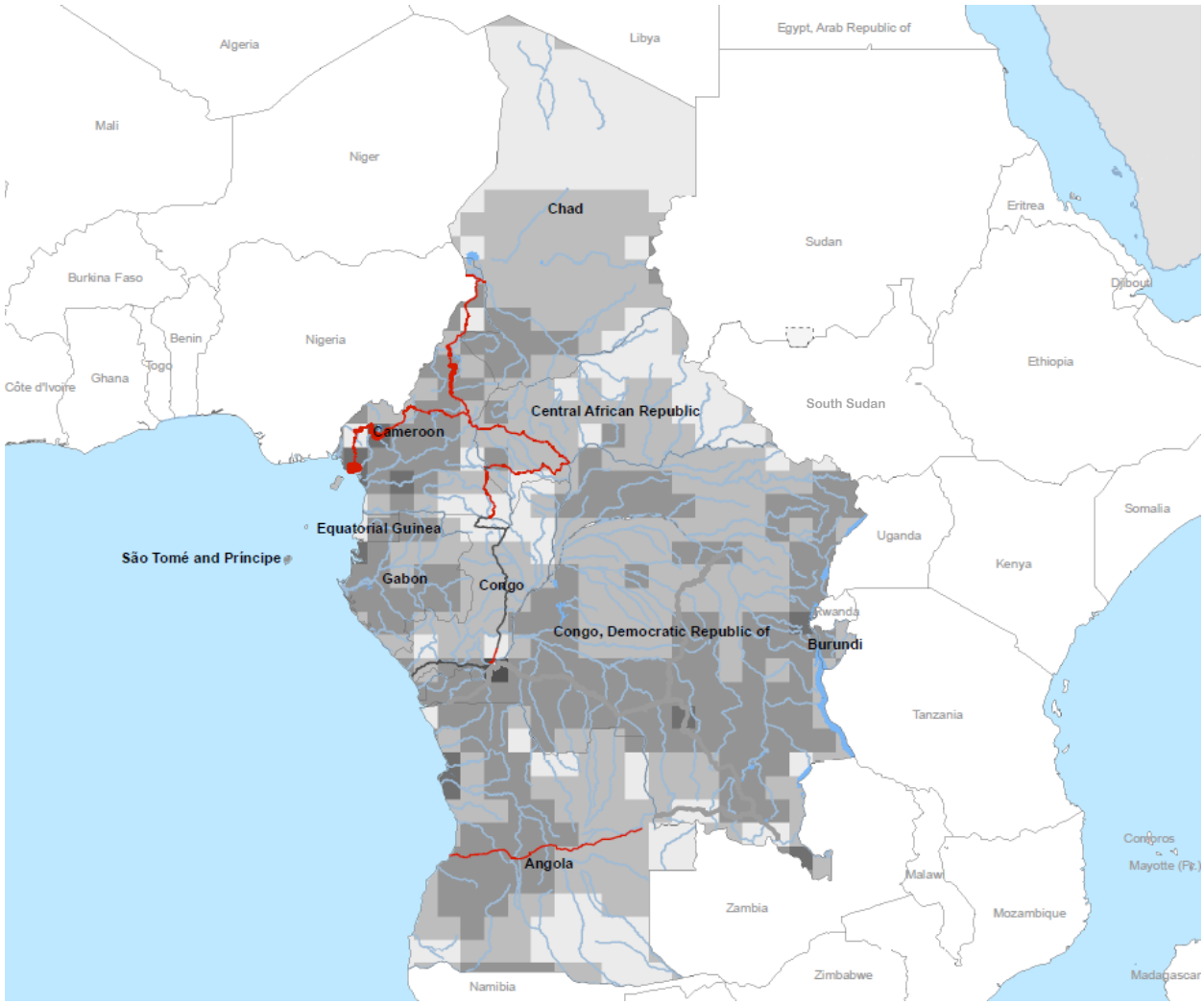
Figure 2.2. ECCAS's main regional road corridors

a. Road conditions



Source: AICD.

b. Traffic volumes



Source: AICD.

Where competing road and rail networks exist, transporting goods takes longer by rail but is a cheaper proposition than by road. One railway network, however, effectively competes with road transport in terms of speed: Camrail, which is indispensible to northern Cameroon. As of 2007 over 90 percent of the Central African Republic's exports were conveyed by rail, especially from Belabo to Douala (mainly timber), and around 90 percent of Chadian imports went by rail from Douala to Ngaoundere. In sum, Camrail plays an important role in Cameroon's intercountry trade and in the international trade of the Economic and Monetary Community of Central Africa (CEMAC) region (World Bank 2007). This confirms the strategic purpose of rail haulage for international traffic and long hauls.

Table 2.2. Road conditions along major transit corridors in ECCAS*

	Condition (%)				Type (%)			Traffic volumes (AADT) (%)			
Corridors	Good	Fair	Poor	Unknown	Paved	Unpaved	Unknown	>300	300–1,000	>1,000	Unknown
Douala to Bangui	53.9	23.4	22.7	0	68.6	31.4	0.0	64.6	20.4	15.0	0.0
Cameroon	29.6	35.7	34.7	0	52.1	47.9	0.0	53.1	24.0	22.9	0.0
Central African Republic	100.0	0.0	0.0	0	100.0	0.0	0.0	86.5	13.5	0.0	0.0
Douala to Ndjamena	18.9	24.5	56.6	0	67.3	32.7	0.0	25.9	49.4	24.7	0.0
Cameroon	18.9	24.5	56.6	0	67.3	32.7	0.0	25.9	49.4	24.7	0.0
Pointe-Noire to Brazzaville to Bangui	29.1	18.9	45.2	7	68.8	25.2	6.0	26.6	11.3	0.0	62.1
Cameroon	55.6	38.8	0.0	6	0.0	100.0	0.0	70.2	24.1	0.0	5.6
Central African Republic	99.2	0.0	0.0	1	99.2	0.8	0.0	79.5	19.3	0.0	1.2
Republic of Congo	0.0	21.3	69.4	9	27.9	62.8	9.2	0.0	6.1	0.0	93.9
Matadi to Kisangani	30.5	10.0	59.4	0	99.7	0.0	0.3	0.0	0.0	0.0	100.0
Congo, Dem. Rep. of	30.5	10.0	59.4	0	30.4	69.3	0.3	0.0	0.0	0.0	100.0
Lubumbashi to Lobito	38.5	29.7	31.0	1	68.1	31.9	0.0	47.0	15.0	0.0	38.0
Angola	50.1	0.0	49.9	0	50.1	49.9	0.0	75.8	24.2	0.0	0.0
Congo, Dem. Rep. of	19.5	78.1	0.0	2	97.6	2.4	0.0	0.0	0.0	0.0	100.0

Source: AICD calculations.

Note: * Another important corridor between Matadi and Lubumbashi has not been included due to data limitations; **Data for only the Cameroon portion of the corridor is available. Aggregates represent the information only for Cameroon.

AADT = average annual daily traffic.

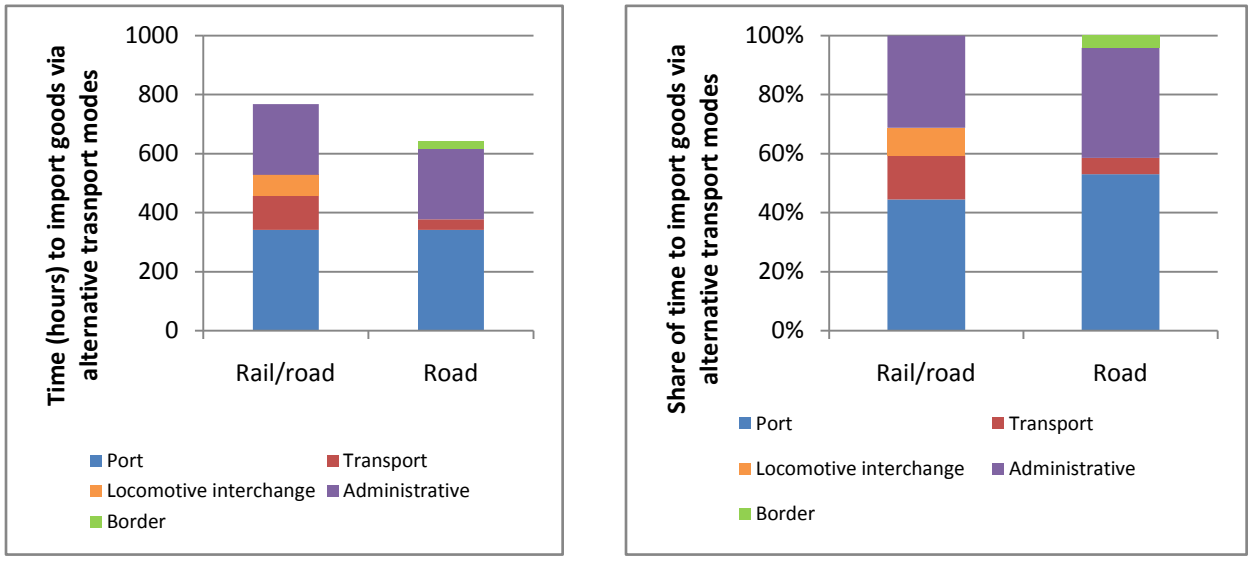
Importing freight via rail between Ndjamena and Douala takes longer than via road. On average, it takes around 5 days longer to import goods via rail than road. Much of this is due to the time required to shift freight from rail carriages to trucks for transport to Ndjamena from Ngaoundere via road (figure 2.3).

Despite the lengthy transit times, the cost of importing freight from Ndjamena to Douala provides rail with a competitive edge. The average freight tariffs charged by Camrail ($0.09 per tonne-km) are lower than road transport by $0.05 per tonne-km (figure 2.4). Importers consider the factors of both cost and time when choosing how to deliver their freight.

Among road corridors serving landlocked countries, there are significant cost differences across corridors. Overall transport costs along Central African corridors are very high, while the time taken to move imports is extremely long. The costs and times of moving imports along these corridors are well aligned with observed traffic patterns. An analysis of the time required for imports to reach a landlocked capital from the port ranges between 640 hours to over 1,700 hours (figure 2.5a). Around 50 to 80 percent of the times can be attributed to the rather inefficient operations that characterize Central African ports (figure 2.5b). Additionally, the regulatory processes of customs clearance and technical control in Central Africa are extremely lengthy as well as the time required to import into a landlocked capital.

Figure 2.3. Time required to import goods from Douala to Ndjamena via road and rail

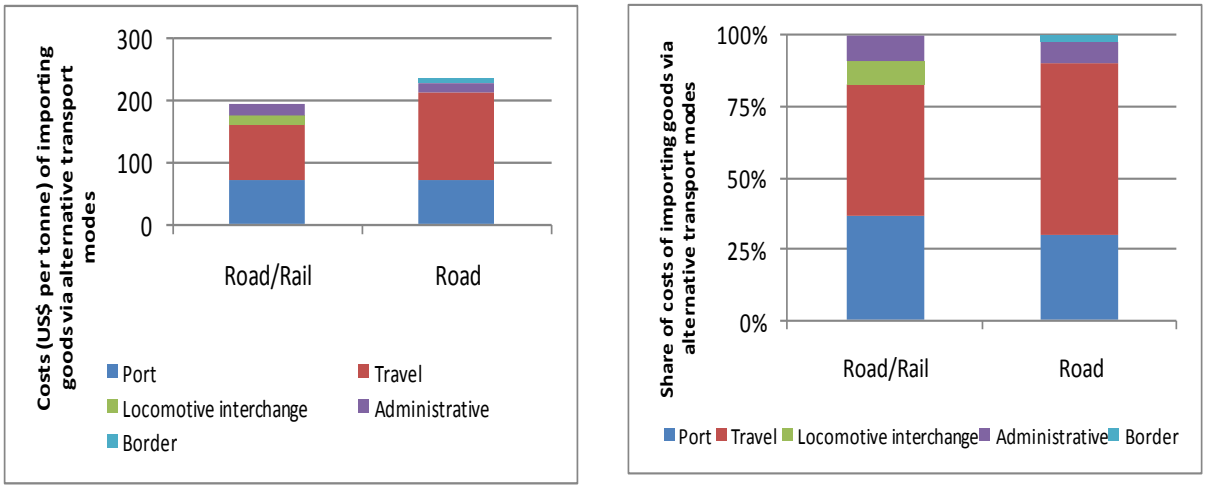
a. Total time (hours) **b. By step (% of total time)**



Source: Data collected from World Bank 2008; World Bank 2007; AICD ports and railway databases; and the Camrail Web site (http://www.camrail.net/en/prestation_fret.html).

Figure 2.4. Cost of importing goods from Douala to Ndjamena via road and rail

a. Total cost (US$ per tonne) **b. Composition of cost (% of total cost)**

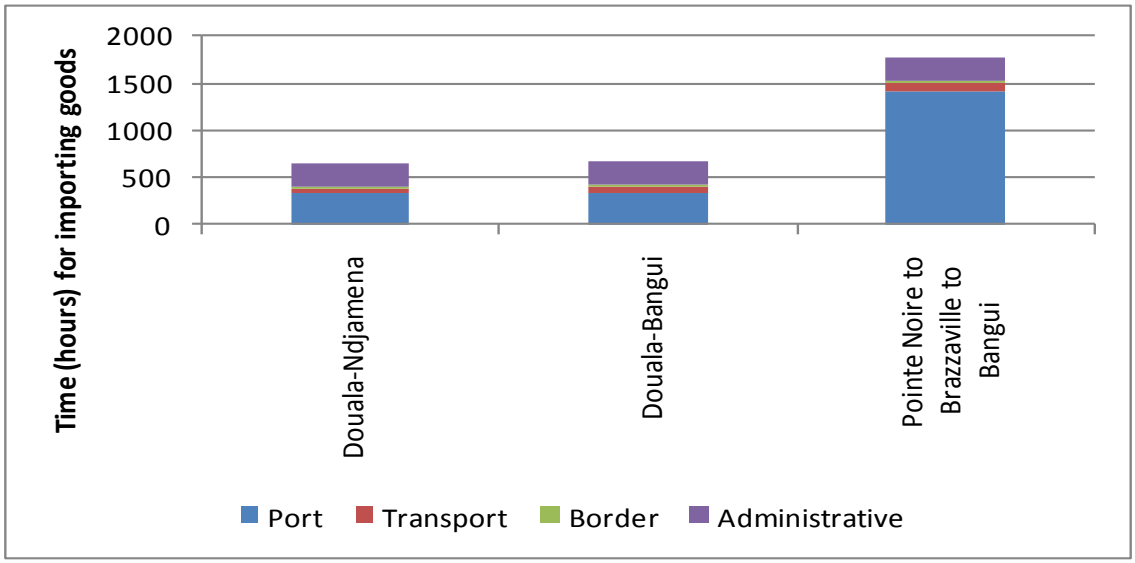


Source: Data collected from World Bank 2008; World Bank 2007; AICD ports and railway databases; and the Camrail Web site (http://www.camrail.net/en/prestation_fret.html).

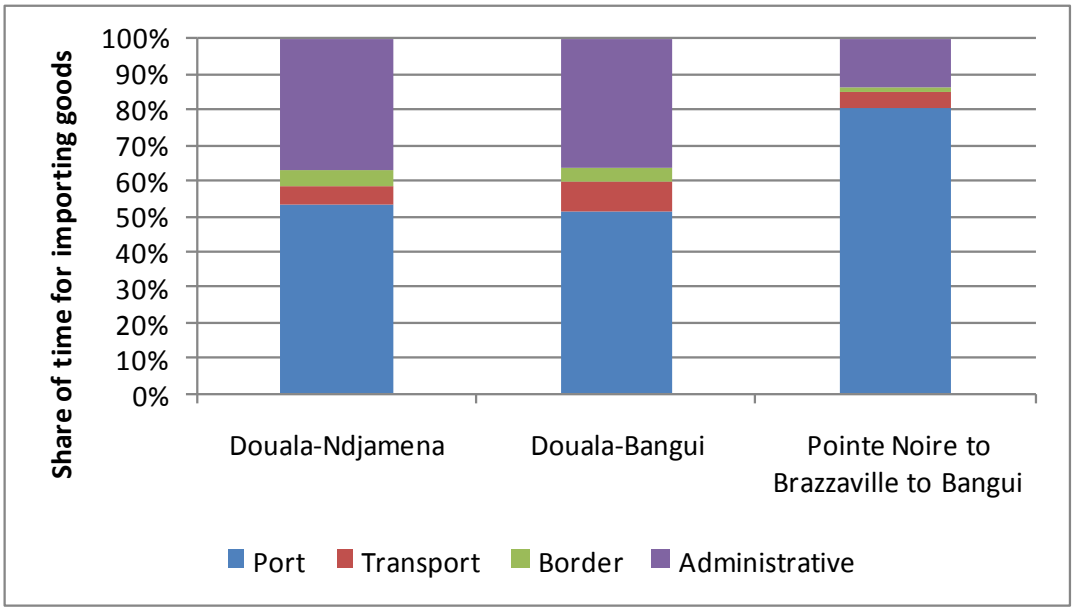
The corridors with the lengthiest import times are also those with the highest total costs for importing freight. It costs between $230 and $650 per tonne to import freight on intraregional corridors (figure 2.6a). The expensive transport costs along Central African corridors account for at least 50 percent of total costs, followed by ports, which compose 20 to 40 percent of total costs. Easing the restrictive trucking regime and improving port efficiency can alleviate the burden of transporting freight to landlocked countries (figure 2.6b).

Figure 2.5. Time required to import goods by road through alternate gateways*

a. Total time (hours)



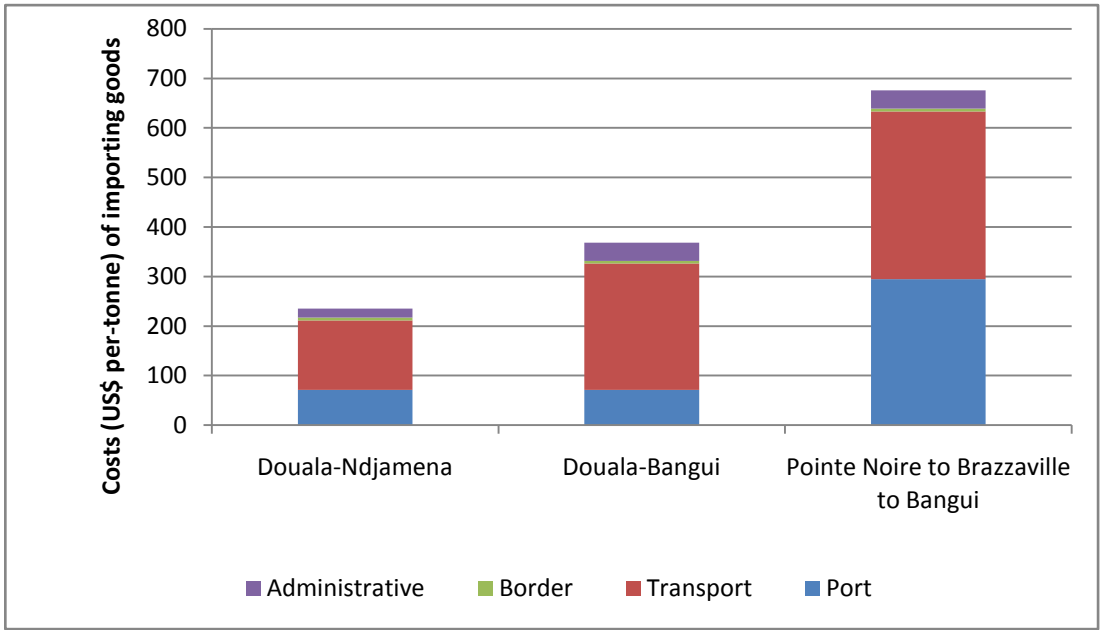
b. By step (% of total time)



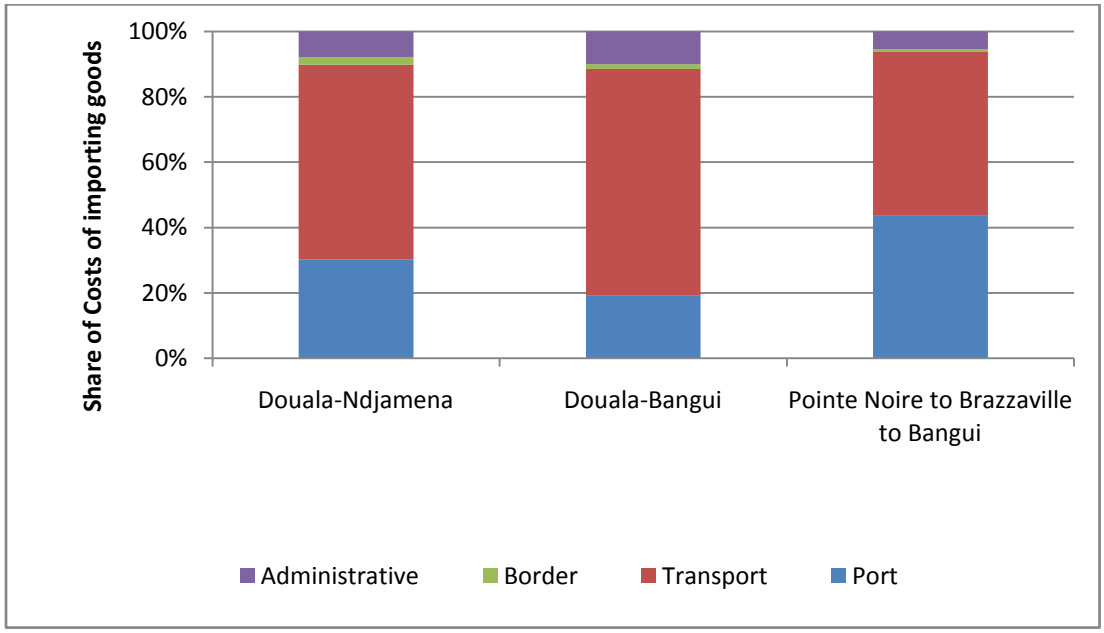
Source: Data collected from World Bank 2008; AICD ports database; Teravaninthorn and Raballand 2009.
Note: Ports data are based on indicators from 2006–07.

Figure 2.6. Cost of importing goods by road through alternative gateways

a. Total cost (US$ per tonne)



b. Composition of cost (% of total cost)



Source: Data collected from World Bank 2008; AICD ports database; and Teravaninthorn and Raballand 2009.

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, 43 percent of this network is already paved (table 2.3).

ECCAS members vary substantially in their track record on the maintenance of the regional road network. Overall, 48 percent of the regional network is in good or fair condition (table 2.3). As a general rule, most member countries are not doing enough to maintain their share of the regional network in good or fair condition. But there are three exceptions to this pattern. In Burundi and the Central African Republic, over 90 percent of the roads are in good or fair condition. A distant third is Gabon, where three-quarters of the roads are at least in fair 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 ECCAS's regional road network, by member country (%)

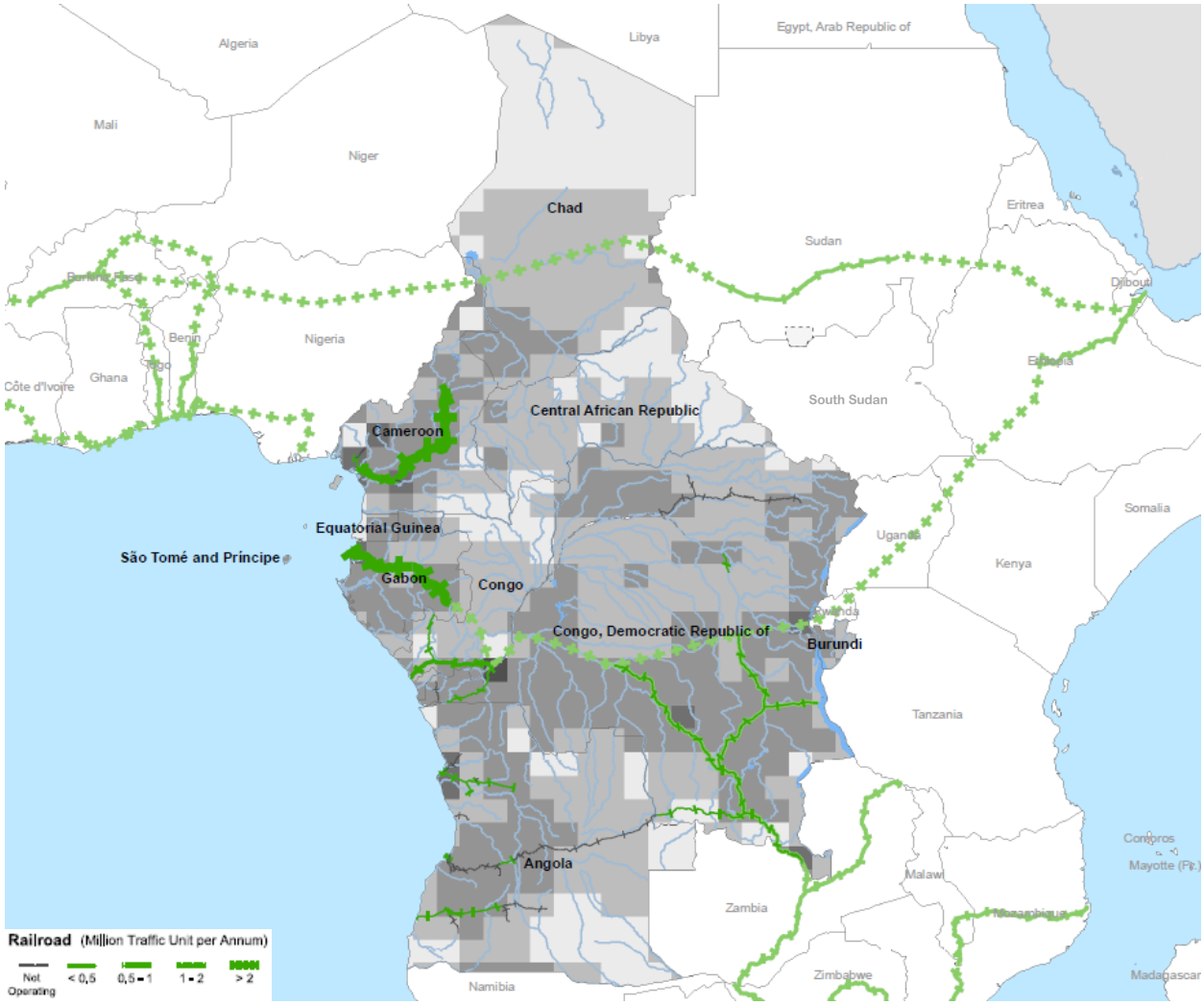
	Condition				Type		
	Good	Fair	Poor	Unknown	Paved	Unpaved	Unknown
Angola	71.4	5.5	23.2	0	71.4	28.6	0.0
Burundi	42.4	27.9	24.2	6	94.4	5.6	0.0
Cameroon	35.1	27.6	35.8	2	54.9	45.1	0.0
Central African Republic	62.6	17.0	17.6	3	97.2	2.8	0.0
Chad	9.0	44.7	14.9	31	12.5	87.5	0.0
Congo, Dem. Rep. of	14.2	12.6	61.5	12	17.7	82.1	0.2
Gabon	0.0	0.0	0.0	100	74.4	21.6	4.0
Republic of Congo	0.0	19.3	72.3	8	25.3	66.3	8.4
ECCAS	**29.1**	**18.4**	**39.3**	**13.2**	**42.6**	**56.7**	**0.7**
East Africa	**29.8**	**26.5**	**11.7**	**32**	**57.2**	**25.4**	**17.4**
ECOWAS	**45.1**	**28.4**	**22.5**	**4**	**91.9**	**8**	**0.1**
SADC	**46.7**	**24.1**	**22.8**	**6.4**	**74**	**25.8**	**0.2**

Source: AICD various sources.
Note: ECOWAS = Economic Community of West African States; SADC = Southern African Development Community.

Railways

Central Africa has a handful of disconnected railway systems that are far from forming a regional network (figure 2.7). This is in contrast to southern Africa, where interconnected national railway systems form a regional railway network that spans half a dozen countries and extends from the southern Democratic Republic of Congo all the way to Durban in South Africa. The railway network in Central Africa operates along 6,000 route-km—the smallest distance in Africa—and carries 4,000 net tonnes-km, the smallest load in Africa.

Figure 2.7. ECCAS's regional railway network



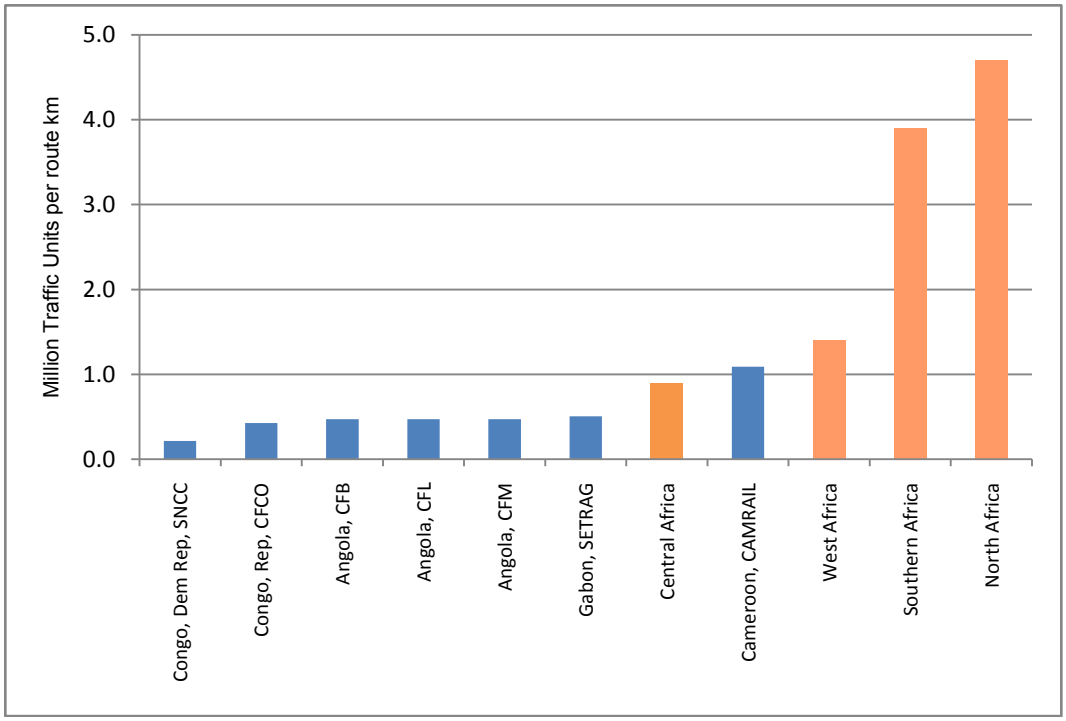
Source: AICD.

The case for further regional integration of railway networks is at present constrained by the relatively limited usage of existing lines, the significant distances between existing lines, and the absence of intraregional traffic. Rail traffic density in Central Africa is only a fraction of that found in southern Africa and North Africa (figure 2.8). With the exception of Camrail—which is one of the most used networks in Sub-Saharan Africa—Central African railways are serving well under 1 million traffic units per year. By global as well as by African standards, these kinds of traffic volumes are 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.

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. While most railways are generally able to carry bulk minerals competitively, they must also offer a reasonable level of service for general freight if they are to compete with roads without offering a significant price discount. In general, freight markets in Africa require reliable rather than high-speed services; a two-day trip of 1,200 km, to average out at a commercial speed (including en-route stops) of 25 kmph, does not require a maximum

speed of much more than 60 kmph. It does, however, require that infrastructure and rolling stock be maintained "fit for purpose," that en-route stops do not disrupt schedules, and that commercial arrangements ensure agreed rolling-stock turnarounds (often a limiting factor for small railways).

Figure 2.8. Traffic densities 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.

The railways in Cameroon and Gabon, as well as the CFM line in Angola, perform relatively well and have good productivity indicators. Cameroon implemented one of the earliest rail concessions in the region—Camrail—followed by a concession of railways in Gabon. The concession arrangements for these two railways have helped to boost operational efficiency and thus traffic, so that labor and rolling-stock productivity measures are better than for the region's major publicly owned railways and compare favorably with other rail concessions in the region (table 2.4). Camrail is carrying about 60 percent of nonmineral traffic from Douala toward the borders with Cameroon and Chad, and it also compares favorably with competing bus services on the route from Yaoundé to Ngaoundere, for which travel by unpaved road becomes difficult in the rainy season.

By contrast, the railways in the Democratic Republic of Congo and the Republic of Congo have very poor performance indicators. Angola's northern Benguela railway has fallen completely into disuse, though it is now in the process of being rehabilitated. These rail lines' poor quality of service makes it increasingly difficult for them to compete with roads. Poor maintenance over extended periods of time has caused the deterioration of many sections of the track beyond repair and has 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.

Table 2.4. Performance compared across Central African railways, 2005

	Labor productivity	Carriage productivity	Locomotive productivity	Wagon productivity	Freight yield	Passenger yield
Angola, CFM	580	4,045	30	950		
Cameroon, CAMRAIL	603	4,738	26	868	5	2
Congo, Dem. Rep. of, CFMK	18	64	10	257	14	4
Congo, Dem. Rep. of, SNCC	38	275	4	317	13	3
Congo, CFCO	221	3,212	27	300	11	6
Gabon, SETRAG	1,778	1,891	39	902		
Rail concessions	350	2,945	23	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.

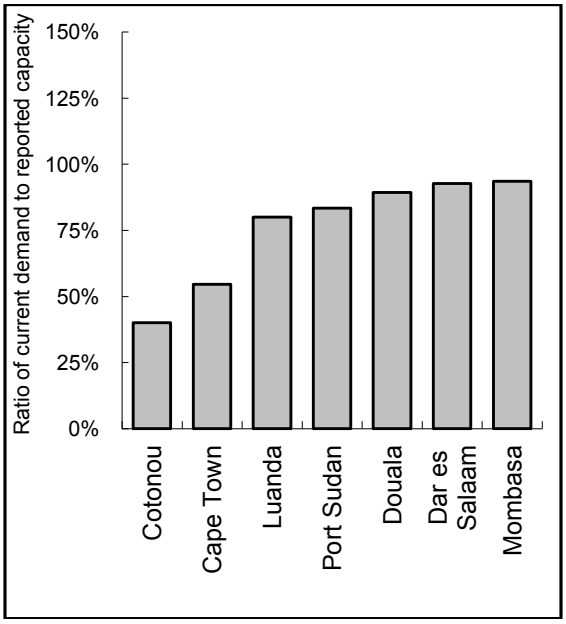
Ports

Central Africa has numerous ports, of which the two most significant ones are Douala and Pointe-Noire. Douala is the most important port from a regional perspective, since it handles transit traffic for the Central African Republic and Chad. Pointe-Noire is one of the best natural deepsea ports in Africa, and once played an important role in the region prior to the civil conflict affecting the Republic of Congo. But since that time, the quality of the country's road and rail surface transport links has deteriorated markedly, preventing cargo from being channeled into Pointe-Noire. In the meantime, neighboring Gabon has developed its own integrated rail and port infrastructure, diverting traffic that would previously have gone to Pointe-Noire. The Democratic Republic of Congo, with its very limited coastline, lacks a natural deepsea port and could benefit from access to Pointe-Noire. But the absence of well-functioning surface transport systems prevents this connection, and the Democratic Republic of Congo continues to rely on the rather limited Matadi port as it explores the development of the port of Banana to accommodate larger vessels. The possible development of a road-rail bridge linking Kinshasa to Brazzaville, as well as planned improvements to road and rail infrastructure on the Brazzaville to Pointe-Noire corridor, could potentially change this picture. Improvements to river navigability on the Congo Basin could also potentially open up the route from Brazzaville to Bangui. But all this is still some years away.

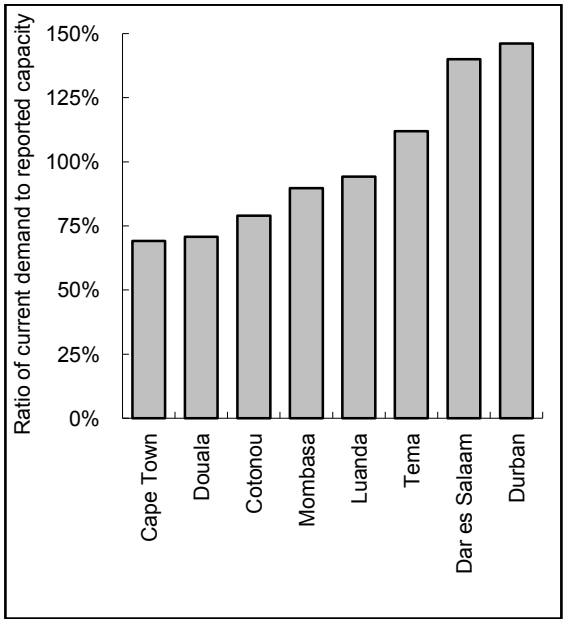
Even though systematic data for the growth of containerized and cargo traffic in Central African ports are not available, a number of indicators point to capacity constraints (figure 2.9). This is most notable in the cases of Douala (Cameroon) and Luanda (Angola), where the general-cargo traffic handled significantly exceeds design capacity. The port of Luanda (Angola) is also experiencing capacity constraints with respect to container traffic. There is some scope for easing capacity constraints by improving the efficiency of port performance although, ultimately, new investments will be required.

Figure 2.9. Ratio of current demand to reported capacity

a. General cargo



b. Container traffic



Source: AICD.

The performance and costs of Central African ports do not compare favorably with the rest of Africa, let alone with global best practices (table 2.5). Overall, Africa's ports are expensive to use and subject to extensive delays. (Though southern African ports tend to perform somewhat better than those in other regions across a range of parameters.) The services provided by Central African ports generally cost twice as much as those in other global ports. Crane productivity in Central African ports—in terms of containers and weight—is less than half the international benchmark. While the global best practice for truck cycle time is 1 hour, it can reach up to 10 hours in Central African ports. The international standard dwell time is 7 days or less, but in Central Africa most containers spend more than 2 weeks in the terminal. The result is terminal congestion and port inefficiencies. Incentives for speedier pickup might include a daily storage charge after a given number of free days and specific rules to prevent the dumping of empty containers at the terminal. Unlike in Central Africa, most southern African terminals offer a given number of free days' storage—typically up to 7 days—and thereafter apply a daily storage charge, sometimes on a sliding scale that increases with the number of days.

Table 2.5. Port performance compared across African regions

	East Africa	Southern Africa	**Central/ West Africa**	Global best practices
Performance				
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 (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 ECCAS countries (table 2.6). But even the best performers do not measure up to good global performance standards. Container dwell times are particularly high, around 25 days in Matadi in the Democratic Republic of Congo. Container dwell time is between 10 and 25 days, significantly worse than the global benchmark of 4 to 8 days. Truck-processing times are also relatively high in ECCAS's ports. In Matadi it takes as many as 18 hours for truck processing. Douala, which is considered one of the better performers in ECCAS, records a high crane productivity of 18.5 containers an hour—but this is only around 60 percent of global productivity standards. Prices are also exorbitant in most ports in ECCAS. The ports of Luanda and Owendo, for example, are among the most expensive in Africa, charging $320 per twenty-foot equivalent unit (TEU). Douala, which is one of the most used ports in Central Africa, charges $220 per TEU. General cargo handling is around $16 per tonne in Owendo, about twice the global benchmark. Douala and Pointe-Noire charge $5.50 to $6.50 per tonne, which is consistent with global good standards.

Table 2.6. Performance compared across West African ports

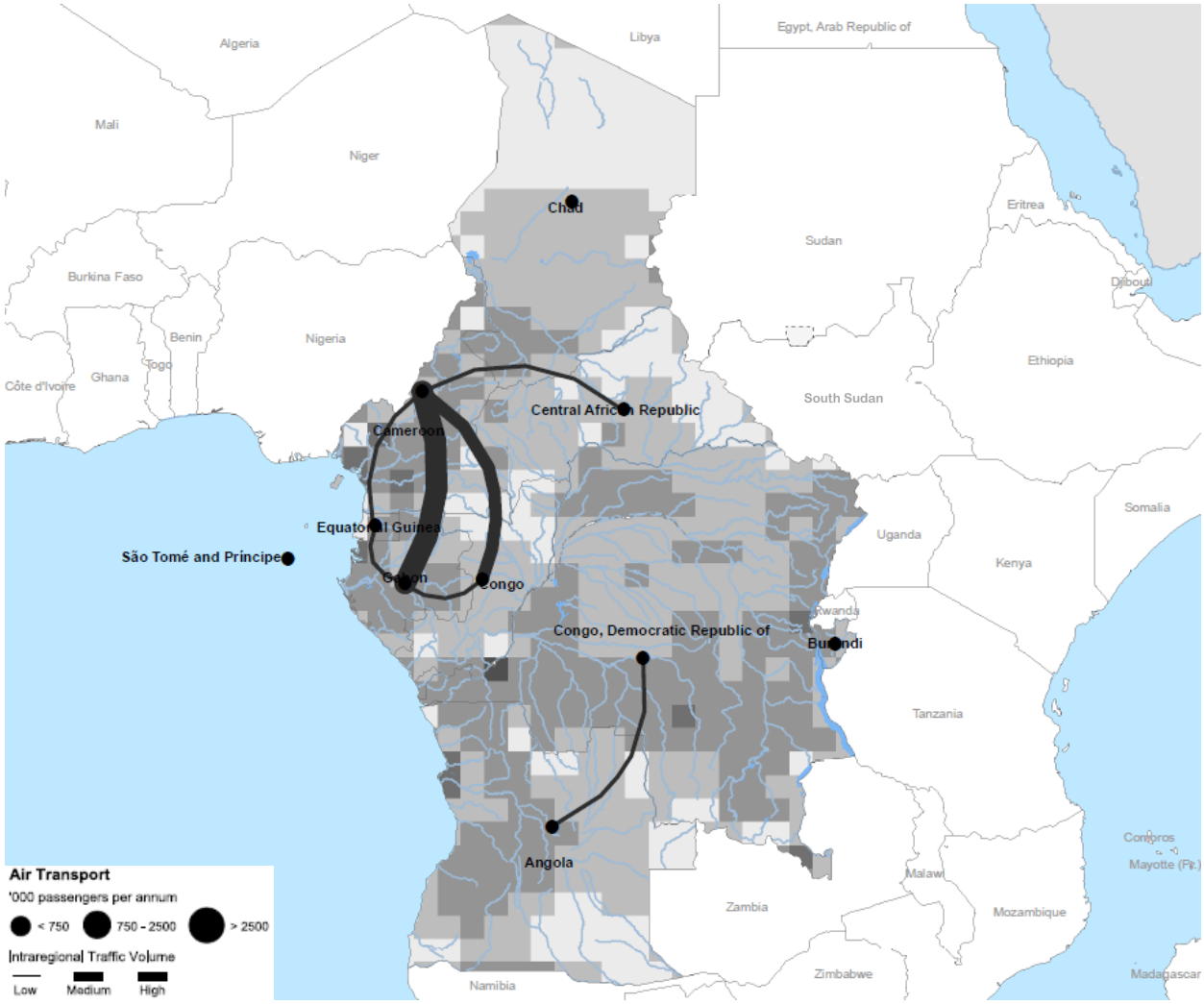
	Luanda (Angola)	Douala (Cameroon)	Matadi (Congo, Dem. Rep. of)	Owendo (Gabon)	Pointe-Noire (Congo, Rep. of)
Container dwell time (days)	12	12	25	10	18
Truck-processing time (hours)	14	12	18		12
Container crane productivity (containers per hour)	6.5	18.5	6.5		6.5
Container-cargo-handling charge (US$ per TEU)	320	220	120	340	140
General-cargo-handling charge (US$ per tonne)	8.5	6.5	10	16	5.5

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

Air transport

Air transport connectivity among the various members of ECCAS is strikingly absent (figure 2.10). While there is some air transport connectivity within the CEMAC region and between the Democratic Republic of Congo and Angola, there is complete lack of connectivity between the CEMAC-only members and members that also form a part of ECCAS (the Democratic Republic of Congo and Angola).

Figure 2.10. ECCAS's regional airports and air traffic flows



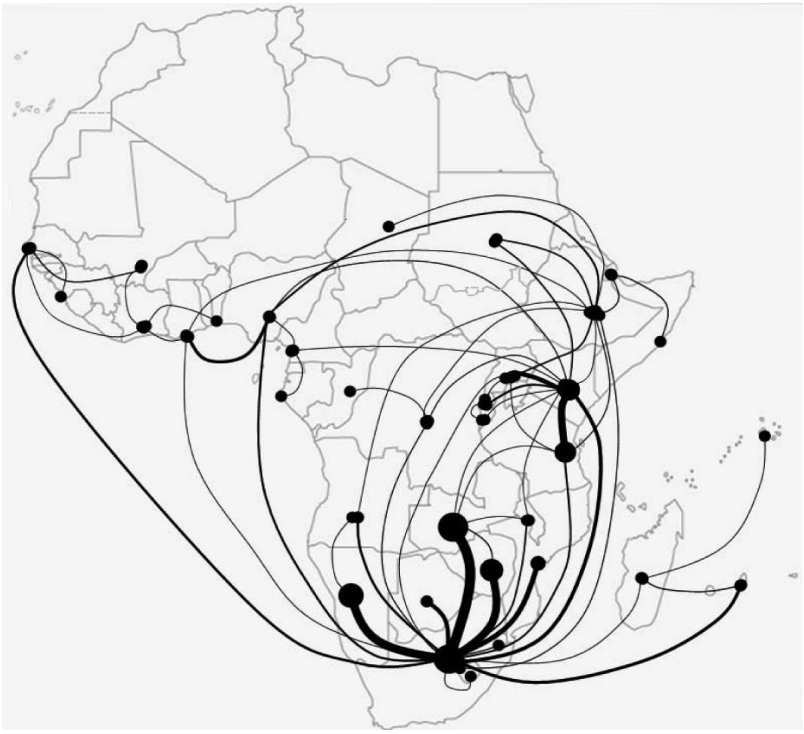
Source: AICD.

Viewed from a continental perspective, there is a lack of strong regional air transportation hubs in the ECCAS region. The map of the top 60 intracontinental routes in Africa serves to highlight the main traffic patterns across the continent (figure 2.11). While none of Sub-Saharan Africa's 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. Central Africa hardly features in the top 60 routes. The hub-and-spoke structure found in other regional economic communities is noticeably absent in ECCAS, complicating air transport both within the ECCAS region and between Central Africa and the rest of the continent.

Relative to other regions, Central Africa's air transport market is extremely small. CEMAC is the smallest air transport market in Africa, followed by ECCAS. These two regions also have the continent's lowest number of seats available per capita. The annual number of seats flown in the region is one-thirteenth that of southern Africa, which is Africa's largest transport market. The number of domestic and international city pairs served is also the continent's smallest. West Africa serves double the domestic city pairs and southern Africa serves four times the domestic city pairs of Central Africa. The seat-km flown on older aircrafts is 43 percent of the total, significantly worse than in other regions of Africa.

Figure 2.11. International routes within Sub-Saharan Africa for 2007



Source: Bofinger 2009.

The semblance of a regional air transport market can be found around Douala. The strongest route in Central Africa is between Cameroon and Gabon. There is very little traffic headed for the Central African Republic and no traffic figures available for Chad. Most CEMAC members are able to connect with one another through Cameroon. Libreville also offers some connectivity within the regional economic community, although to a much lesser extent. ECCAS as a whole, however, lacks a regional transport market because the Democratic Republic of Congo and Angola are completely isolated from the rest of CEMAC.

Table 2.7. Benchmarking air transport in ECOWAS and other regional economic communities

	ECOWAS	CEMAC	EAC	SADC
Annual seats, domestic ('000s)	2,034	235	1,345	3,076
Annual seats, international within Sub-Saharan Africa ('000s)	362	187	1,196	964
Domestic city pairs served (number)	8	4	13	17
International city pairs served (number)	20	15	29	26
Seat-km in old aircraft (% of total)	43	30	33	29
Seat-km in recent aircraft (% of total)	57	70	67	71
Domestic market Herfindahl Index	0.84	0.83	0.64	0.73
International market Herfindahl Index	0.19	0.24	0.25	0.34
Market Herfindahl Index (domestic and international)	0.21	0.30	0.27	0.42

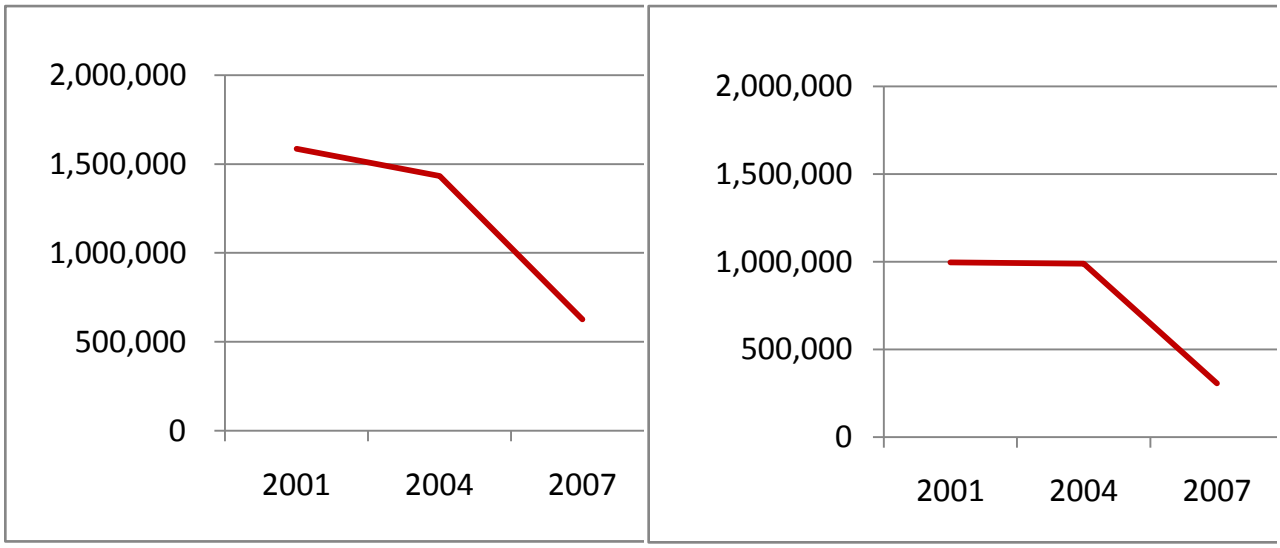
Source: AICD database.

Note: ECOWAS = Economic Community of West African States; CEMAC = Economic and Monetary Community of Central Africa; EAC = East African Community; SADC = Southern African Development Community. The SADC aggregates include South Africa and Tanzania and the EAC includes Tanzania, which are not a part of COMESA.

Air transport connectivity in Central Africa has fallen steadily since 2001. This overall pattern is consistent with air transport connectivity in ECCAS and CEMAC, which have both fallen, albeit at different rates (figure 2.12). The air transport connectivity for ECCAS in 2007 was only 40 percent of the connectivity of 2001 and the number of seats in 2007 only a little over 600,000. In CEMAC the air transport connectivity in 2007 was only 30 percent of the connectivity in 2001. The total number of seats in 2007 was a little over 300,000, compared with almost a million in 2001.

Figure 2.12. Seats for intra-REC travel within ECCAS and CEMAC

a. ECCAS **b. CEMAC**



Source: Derived from Bofinger 2009.

Note: REC = regional economic community; CEMAC = Economic and Monetary Community of Central Africa.

The loss in the total estimated seats between 2001 and 2007 can be largely attributed to the collapse of Cameroon Airlines and Air Gabon. The collapse of Air Afrique also had an impact.

Domestic connectivity is largely absent in the CEMAC countries, except for Cameroon and Gabon. Looking at the broader ECCAS grouping, Angola and the Democratic Republic of Congo are connected to a modest number of city pairs. The absence of domestic city pairs in CEMAC may simply be because the countries are physically small, but it more generally reflects low traffic volumes and limited purchasing power in the domestic market. This makes it difficult for air transport to compete with surface transport alternatives, such as roads. International city pairs are also relatively few in number. The Central African Republic connects to two international city pairs and Burundi and São Tomé and Príncipe connect to four. All countries have at least one intercontinental city pair (table 2.8).

Table 2.8. 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
Burundi	5	1	4	
Cameroon	28	8	17	3
Central African Republic	3	1	2	
Chad	8	1	7	
Congo, Rep. of	22	2	19	1
Congo, Dem. Rep. of	49	3	21	25
Equatorial Guinea	19	4	14	1
Gabon	22	1	12	9
São Tomé and Príncipe	5	1	4	

Source: Bofinger 2009.

By and large, each country in CEMAC has one daily connection with Cameroon. Gabon and Cameroon have the strongest connectivity in the regional economic community with 18 flights daily. The origin-destination matrix for the ECCAS countries shows the minimal levels of air connectivity that are prevalent in the region. It is also striking that connections between the CEMAC countries and the rest of ECCAS barely exist. For example, Angola is connected with the Democratic Republic of Congo, Equatorial Guinea, and São Tomé and Príncipe with at least one daily flight. But Angola does not have any air transport connectivity with the rest of the CEMAC member countries. The Democratic Republic of Congo's only connection with CEMAC is a single daily flight to Cameroon and three flights to Equatorial Guinea, and São Tomé and Príncipe's connectivity with CEMAC is with Gabon.

Beyond basic connectivity, it is also important to evaluate the convenience and velocity of air travel. Cameroon and Gabon have the greatest frequency of flights, both direct and indirect. Cameroon serves as a hub for the CEMAC countries. São Tomé and Príncipe and the Central African Republic have three or fewer direct flights per week. Lower velocity of air travel is associated with lengthy travel times (table 2.10b). The flights originating from the Central African Republic to Equatorial Guinea and from São Tomé and Príncipe to Gabon have low velocities, implying that passengers spend a longer amount of travel time, in part due to waiting for connecting flights.

Table 2.9. All flights within ECCAS, one week in November 2007

Origin \ Destination	Angola	Cameroon	Central African Republic	Congo , Dem. Rep. of	Equatorial Guinea	Gabon	São Tomé and Príncipe
Angola				1	4		1
Cameroon			1	1	3	19	
Central African Republic		1					
Congo, Dem. Rep. of		1			3		
Equatorial Guinea	2	3		2		2	
Gabon		18			4		2
São Tomé and Príncipe	1					2	

Table 2.10. Proportion of direct flights and speed of air service in East Africa

a. Directness of service

	All flights	Direct flights
Angola	6	4
Cameroon	24	23
Central African Republic	1	1
Congo, Dem. Rep. of	4	3
Equatorial Guinea	9	4
Gabon	24	22
São Tomé and Príncipe	3	3

b. Speed of service

Origin \ Destination	Angola	Cameroon	Central African Republic	Congo, Dem. Rep. of	Equatorial Guinea	Gabon	São Tomé and Príncipe
Angola					443	559	
Cameroon							
Central African Republic				559	***230***	348	402
Congo, Dem. Rep. of			559				
Equatorial Guinea			646			514	
Gabon	436		348		533		***204***
São Tomé and Príncipe			392			***143***	

Source: Bofinger 2009.

CEMAC's air transport market is considered among the most liberalized in Africa, though minor restrictions remain. By instituting free pricing and lifting capacity and frequency restraints, the region has made significant progress toward implementing the Yamoussoukro Decision (YD). Specifically, the number of flights flown under fifth-freedom arrangements (that is, by carriers that are not registered either in the origin or destination country) is on the rise. This progress puts the CEMAC region ahead of most of east and southern Africa.

The structure of the regional air transport market has altered significantly since 2001 with the collapse of regional players and the emergence of new carriers (table 2.12). As of 2007 the regional air transport market comprised three major carriers—Air Service, Hewa Bora Airlines, and TAAG Angola Airlines—which together accounted for 65 percent of the regional market. Other carriers—Trans Air Congo, Ethiopian Airlines, and Star Equatorial Airlines—comprised a further 25 percent of the market. Ethiopian Airways is a growing presence in the region. The situation in 2007 was a complete turnaround from 2001, when the three major carriers—Air Afrique, Air Gabon, and Cameroon Airlines—accounted for over 70 percent of the market. European carriers such as Air France, Swiss Air, or Brussels Air SN that were present in 2001 had largely disappeared by 2007.

Table 2.11. 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	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	The 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.

No countries in ECCAS have made progress toward achieving international standards in air safety, making this an area ripe for further regional collaboration. In some cases, problems with air transport safety have been an undesirable consequence of market liberalization (figure 2.13). Regional cooperation could help to improve oversight and safety by pooling scarce human resources and increasing regulatory independence—a process that is under way. With support from France, CEMAC member countries already belong to the Agence pour la Sécurité de la Navigation Aérienne en Afrique et à Madagascar (ASECNA), which provides air traffic safety services. There is scope to broaden and deepen this kind of collaborative arrangement. A Cooperative Development of Operational Safety and Continuing Airworthiness Project (COSCAP) has been planned for the CEMAC region.

Table 2.12. Changes in market share of major regional carriers, 2001–07 (%)

Market share (%)	2001	2004	2007
Air Service			25.2
Hewa Bora Airways		0.6	22.9
TAAG Angola Airlines	10.2	12.4	16.9
Trans Air Congo (TAC)		1.5	8.9
Ethiopian Airlines	1.1		8.8
Star Equatorial Airlines			6.9
Cameroon Airlines	32.7	46.7	
Air Gabon	24.6	32.4	
Air Afrique	14.6		
Market concentration measures			
Concentration of top 3	71.9	91.5	65

Source: Bofinger 2009.

An important factor of air safety is the vintage of the airline fleet. Unlike in southern Africa and other regions, the Central African airline fleet was not significantly renewed between 2001 and 2007. Here, the percentage of the airline fleet classified as "Western old" has remained relatively steady at 36–37 percent. In fact, the number of planes classified as "new" or "somewhat new" decreased between 2001 and 2007 from 42 percent to 35 percent (figure 2.14).

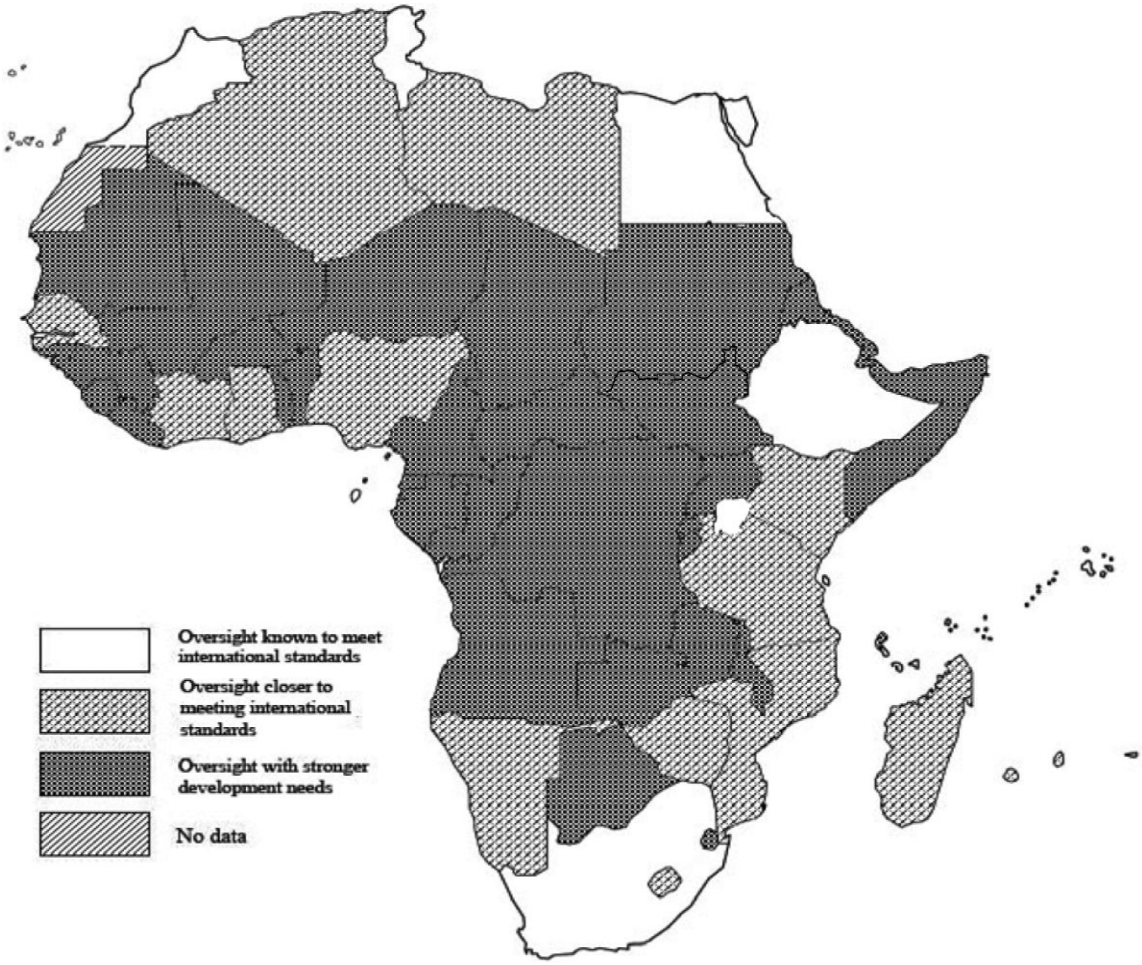
Airport charges in the CEMAC region are extremely high by international standards—30 to 40 percent higher than the charges at Fraport in Frankfurt, a commonly used international benchmark. Gabon and Cameroon, two CEMAC countries for which data are available, record extremely high airport charges.

Box 2.1. Airport concession in Cameroon: A rare phenomenon in Africa

Few public-private partnerships (PPPs) have been implemented in Africa to improve the overall performance of the airports. Cameroon is one of the few African countries with one such PPP, a 15-year joint management contract involving shared risk between the public and private sector. The contract was comanaged by the Aéroports de Paris (34 percent) and government of Cameroon (24 percent), along with other carriers and a bank, from 1993 to 2008; the agreement covered 7 of Cameroon's 14 airports.

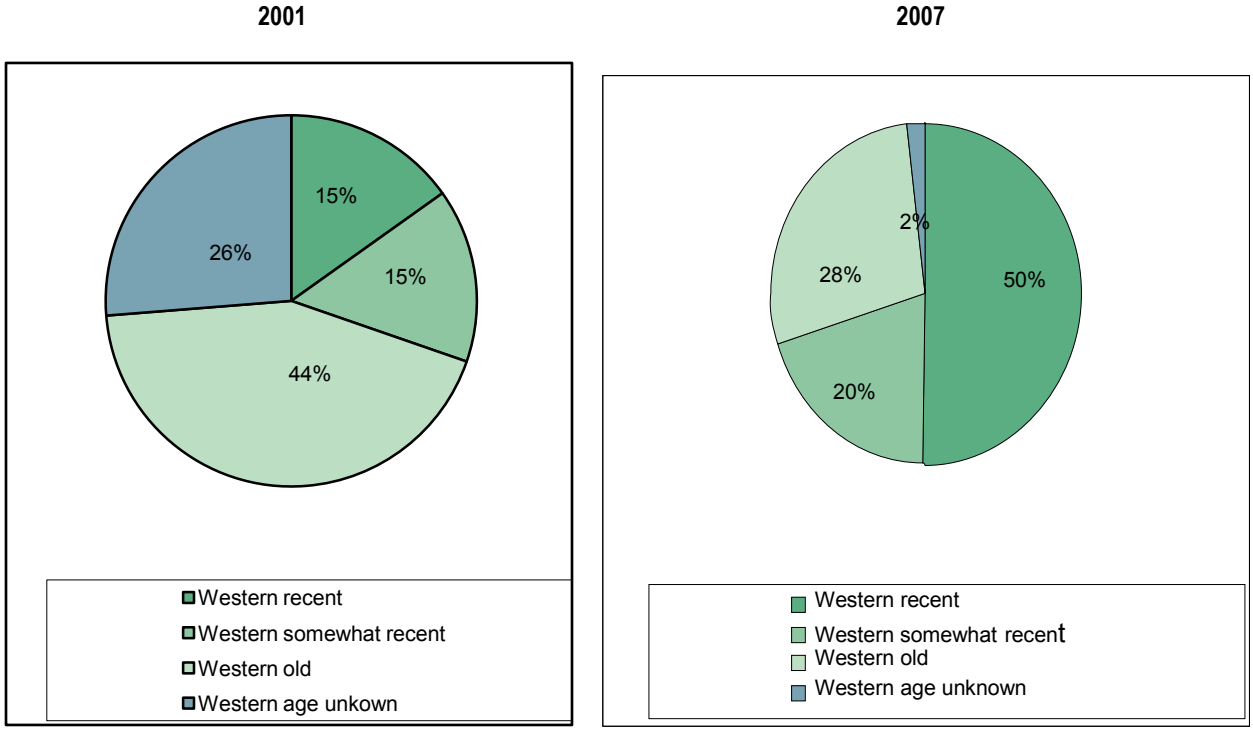
Source: Bofinger 2009.

Figure 2.13. Status of African safety oversight, using several criteria



Source: Bofinger 2009.

Figure 2.14. Age distribution of airline fleet in the ECCAS region

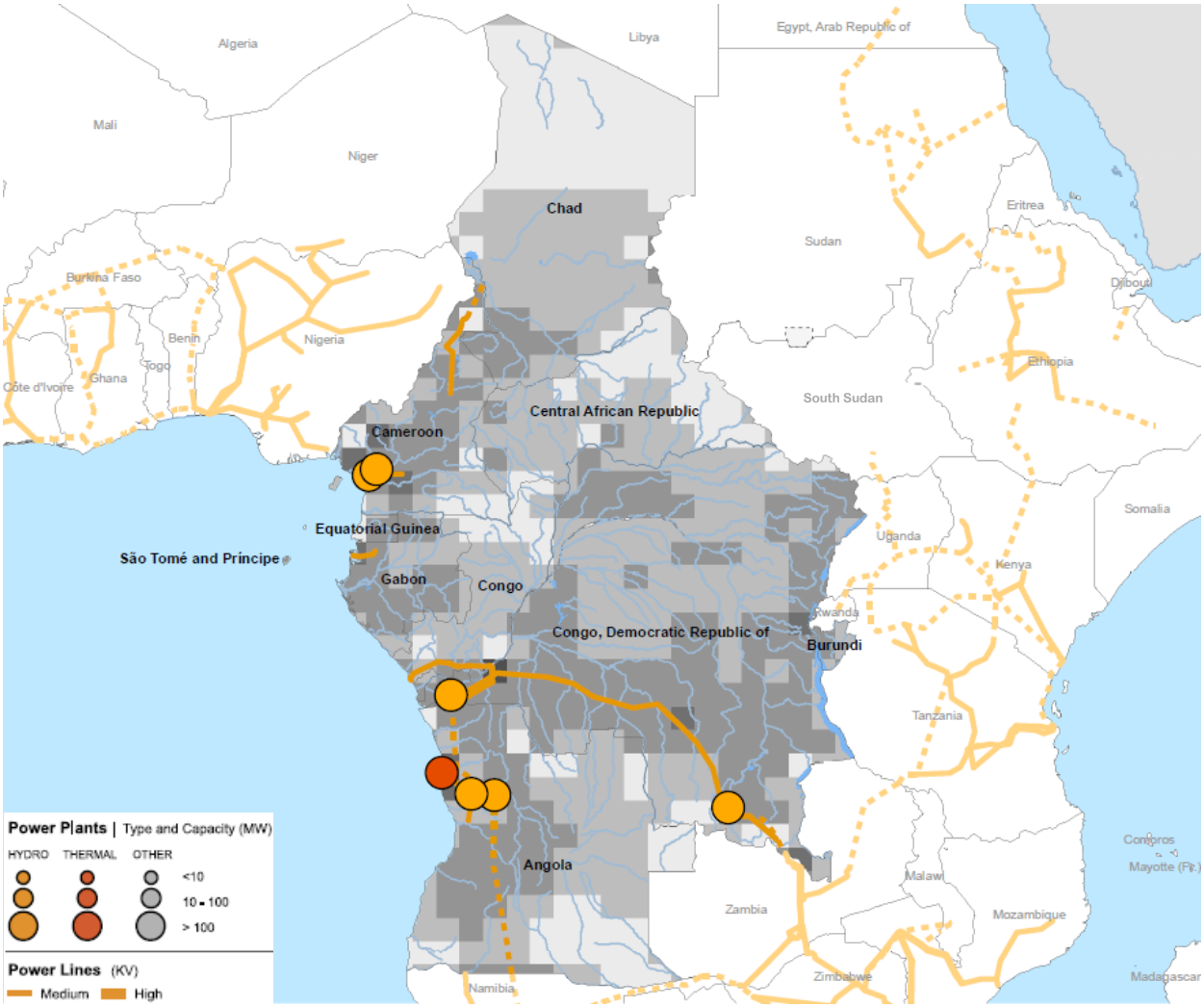


Source: Bofinger 2009.

3 Power

Few countries in Central Africa have developed significant national power grids. The only major regional transmission link is that from the Inga site into the Southern Africa Power Pool (SAPP) via Zambia. The formation of a regional grid is still some way away, and in contrast to some of theother regions, there seem to be no firm plans for the routes of future regional power lines (figure 3.1). The region's larger power plants are concentrated in Cameroon, at the Inga site in the Democratic Republic of Congo, and in northern Angola.

Figure 3.1. ECCAS's regional power network and infrastructure



Source: AICD.

The power sector performance of the Economic and Monetary Community of Central Africa (CEMAC) is weaker than other parts of Africa as measured by many criteria. Table 3.1 corroborates the glaring absence of installed generation capacity in Central Africa. Southern Africa has seventeen times the installed capacity of Central Africa, and West Africa seven times. The per capita generation capacity in CEMAC, though better than East Africa, is much lower than southern and West Africa. The frequency of power outages and the loss of value however, are not dramatically different than in West and East Africa. Despite the lack of power generation, a relatively large share of the population has access to power. Utility performance in the CEMAC region is particularly poor. Over 30 percent of the already minimal generation is lost due to system outages. And, at less than 50 percent, cost-recovery rates are the worst in Africa.

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
Net generation per capita, annual (kWh/capita/year)	171	147	114	82	1214	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
	WAPP		CAPP	EAPP	SAPP		
Average historic cost (US$/kWh)	0.21		0.49	0.19	0.14	—	—
Long-run marginal cost (US$/kWh)	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; SADC = Southern African Development Community; kWh = kilowatt-hour; MW = megawatt; WAPP = West African Power Pool; EAPP = East African Power Pool (expanded to include the key Nile Basin trading partners Egypt, Ethiopia, and Sudan); CAPP = Central Africa Power Pool; SAPP = Southern African Power Pool.

The remainder of this section will focus on the Central African Power Pool (CAPP) countries. This is because power sector issues in Central Africa are best analyzed in the context of regional trade arrangements. For the purposes of this analysis, the CAPP is defined as including Cameroon, the Central African Republic, Chad, the Republic of Congo, Equatorial Guinea, and Gabon.[4] The CAPP will be

[4] The Democratic Republic of Congo also belongs to the CAPP. But the AICD analysis does not allow for the same country to belong to more than one regional power pool, and so the Democratic Republic of Congo was mapped to

benchmarked against other regional power pools, namely, the East African Power Pool (EAPP-NB, expanded to include the key Nile Basin trading partners Egypt, Ethiopia, and Sudan) and the SAPP.

As of today, only 90 percent of the region's effective power demand is being met. The baseline total net demand for power in the CAPP was 10.7 terawatt-hours (TWh) in 2005, making it by far the smallest power market in Sub-Saharan Africa. At the country level, between 7 and 11 percent of total power demand is suppressed. In the Central African Republic, the Republic of Congo, and Gabon, frequent outages suppress as much as 10 percent of demand. In Cameroon, where there are several power generation plants, outages suppress demand by as much as 7 percent.

Power demand in the CAPP area is expected to almost double over the next decade. Taking into account the need to fully 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 of electrification from 35 percent to 53 percent of households — it is estimated that power demand could reach 20.2 TWh by 2015. This would require the development of 4,400 megawatts (MW), or 2.5 times existing generation capacity (table 3.2). Over half the current capacity—900 MW—needs to be refurbished.[5]

Table 3.2. Demand and suppressed demand in the CAPP

	Total net demand in 2005	% of suppressed demand as a total of net demand	Market demand 2015	Social demand with national targets 2015	Total net demand 2015
CAPP	10.7	**9**	**17.1**	**3.1**	**20.2**
WAPP	31.3	42	69.6	24.8	94.3
SAPP	258.8	1	383	14	396.9
EAPP	100.6	1	144.8	24.2	169
Island states	1.1	5	1.6	1.5	3
Cameroon	3.4	7	5.2	1.2	6.4
Central African Republic	0.1	11	0.1	0.4	0.6
Chad	0.1	10	0.1	0.8	1
Congo, Rep. of	5.84	11	9.8	0.5	10.3
Equatorial Guinea	0.03	10	0.1	0.05	0.1
Gabon	1.2	11	1.7	0.1	1.8

Source: Rosnes and Vennemo 2009.

Note: WAPP = West African Power Pool; EAPP = East African Power Pool; CAPP = Central Africa Power Pool; SAPP = Southern African Power Pool.

Future power demand can be met by either expanding national production or by expanding cross-border power trade within the CAPP. Two alternative scenarios will be considered in this report. The

the SAPP, where it already participates in regional trade. While this is a limitation, an additional scenario is considered in which part of the Democratic Republic of Congo's hydropower generation is sold into the CAPP.

[5] 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 is 2.25 TWh (or 9 percent), mostly due to decreases in demand in the Republic of Congo (10 percent) and Cameroon (9 percent).

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 CAPP 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.

Table 3.3. Annualized costs of system expansion in the CAPP, 2015 (million)

(Annualized cost millions $)	Trade expansion	Trade stagnation
Generation		
Investment cost	860	798
Refurbishment cost	48	53
Variable cost (fuel, O&M)	92	347
T&D and connection		
Investment cost	292	253
- Cross-border	39	0
- Domestic	252	252
Refurbishment cost	28	28
Variable cost (existing capacity)	67	67
Total		
Capital cost	1,227	1,131
- Investment cost	1,151	1,051
- Refurbishment cost	76	81
Variable cost	159	414
Total for CAPP	1,386	1,546
Total for EAPP	15	16
Total for SAPP	18.4	19.5
Total for WAPP	12.2	12.7
Island states	0.6	0.6

Source: Rosnes and Vennemo 2009.
Note: EAPP = East African Power Pool; SAPP = Southern African Power Pool; WAPP = West African Power Pool; CAPP = Central Africa Power Pool; T&D = transmission and distribution; O&M = operation and maintenance.

Deepening regional integration would save the CAPP area $160 million 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 $1.55 billion to $1.39 billion, saving the region $160 million each year. Under the trade expansion scenario, countries would have to make larger investments in capital-intensive hydropower generation of $62 million each year as well as invest $39 million a year in the development of cross-border transmission capacity. These higher investments of $101 million a year are more than compensated by reduced variable costs of $255 million a year, which are essentially the annual reduction in the fuel bill associated with reduced reliance on thermal generating plants. The net savings are thus $160 million each year.

To make trade expansion possible, significant additional investments would be required. In particular, Cameroon would need to develop 1,400 MW of additional hydropower capacity to be dedicated to supplying export markets in neighboring countries. All countries in the CAPP region except the Central African Republic would need to invest in developing a total of 1,662 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 Cameroon and the Republic of Congo, which compose 80 percent of the required cross-border investment.

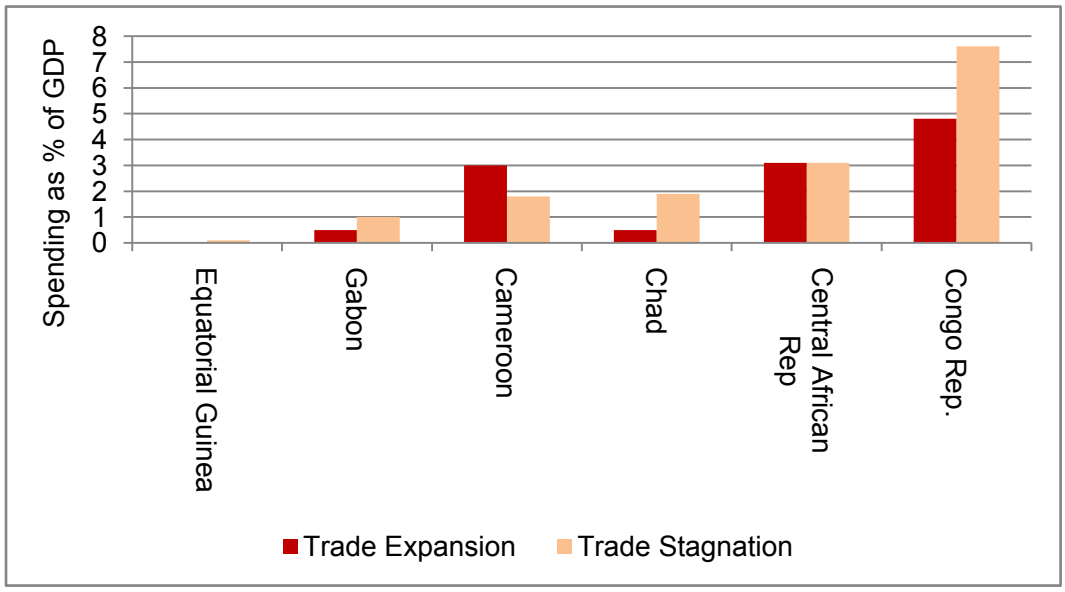
The CAPP region as a whole would need to spend around 2 percent of GDP to meet power needs, and most countries stand to save money by deepening regional trade (figure 3.2). For individual countries, the impact of adopting trade can substantially influence the burden of power sector development needs on their national economies. Under trade stagnation, the amount that countries need to spend to meet their power sector needs varies. Gabon, Cameroon, and Chad would have to spend between 1 and 2 percent of their GDP to meet their power needs, while the Republic of Congo would have to spend as much as 7.5 percent of its gross domestic product (GDP). Under trade expansion, the pattern of spending shifts. Most countries would spend substantially less to meet their power sector needs than under trade stagnation. Gabon and Chad would need to spend less than 1 percent of their GDP to meet their power needs. Meanwhile, the burden of spending in the Republic of Congo would decrease from over 7 percent to less than 5 percent of the GDP, benefitting the most from trade. But the expenditure burden for Cameroon would increase substantially, reaching 3 percent of GDP. Under the trade expansion scenario, Cameroon becomes the main exporter of hydropower in the region and has to bear the burden of additional investments to fulfill this role.

Table 3.4. Additional infrastructure requirements for trade expansion (MW)

	Cross-border transmission	Additional hydropower (MW)
Cameroon	831	1,383
Central Africa Republic	0	0
Chad	202	
Congo, Rep. of	498	0
Equatorial Guinea	20	0
Gabon	111	0

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

Figure 3.2. Regional spending needs as a percentage of GDP



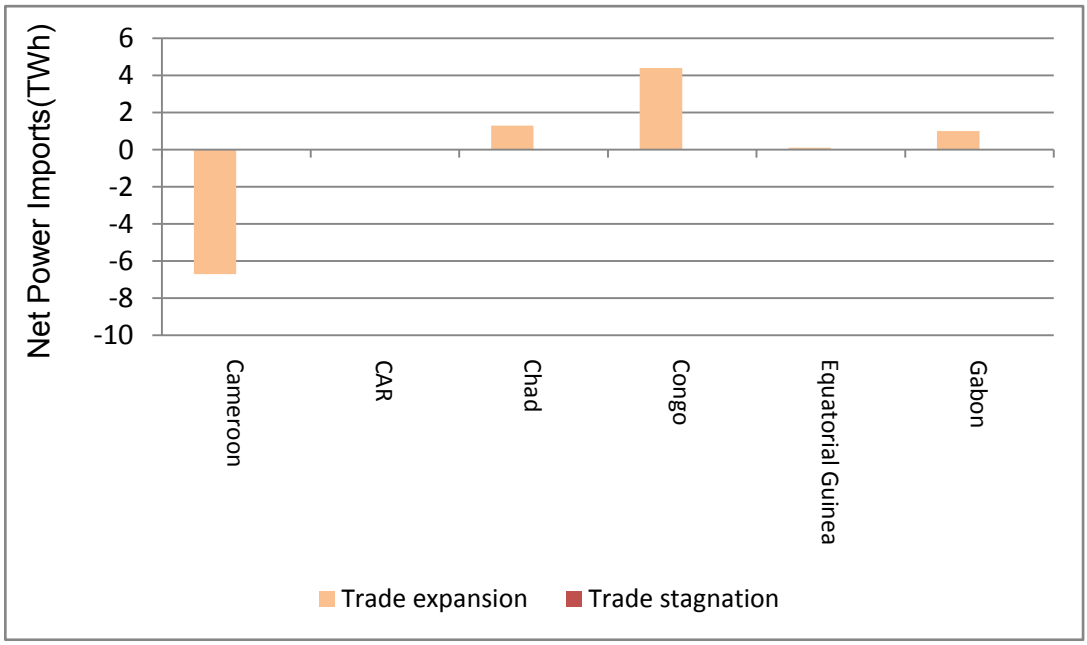
Source: Derived from Rosnes and Vennemo 2009.
Note: GDP = gross domestic product.

As of 2005 power trade flows in the CAPP region were minimal, at 1.8 TWh of exports and 0.1 TWh of imports. These consisted of exports from the Democratic Republic of Congo to its neighbors, the Central African Republic and the Republic of Congo.

Under trade stagnation, negligible amounts of power would be traded. All countries would have to rely on domestic production for power generation. Therefore, the Republic of Congo, Chad, and Gabon would all need to increase their production considerably, with new hydropower plants in the Republic of Congo and Equatorial Guinea and a considerable increase in Heavy Fuel Oil -based generation in Gabon.

Under trade expansion, Cameroon would capitalize on its rich hydropower potential and export power to all the countries in the CAPP except the Central African Republic, which would remain self-sufficient. The resulting additional 1,450 MW of hydropower in Cameroon would support exports to Republic of Congo, Chad, Gabon, and Equatorial Guinea (figure 3.3).

Figure 3.3. Simulated patterns of future power trade in the CAPP, 2015 (TWh)



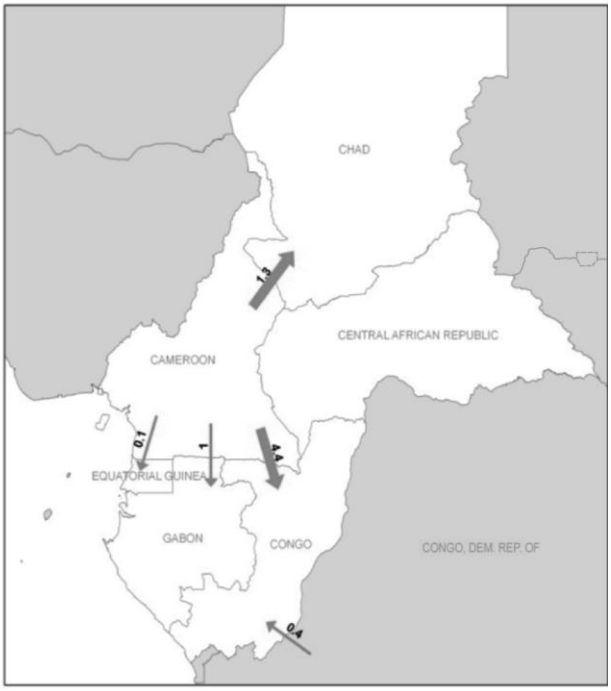
Source: Rosnes and Vennemo 2009.

Note: CAPP = Central Africa Power Pool; TWh = terawatt-hour.

Figure 3.4. Trade flows in the CAPP, 2015 (TWh)

a. Trade stagnation

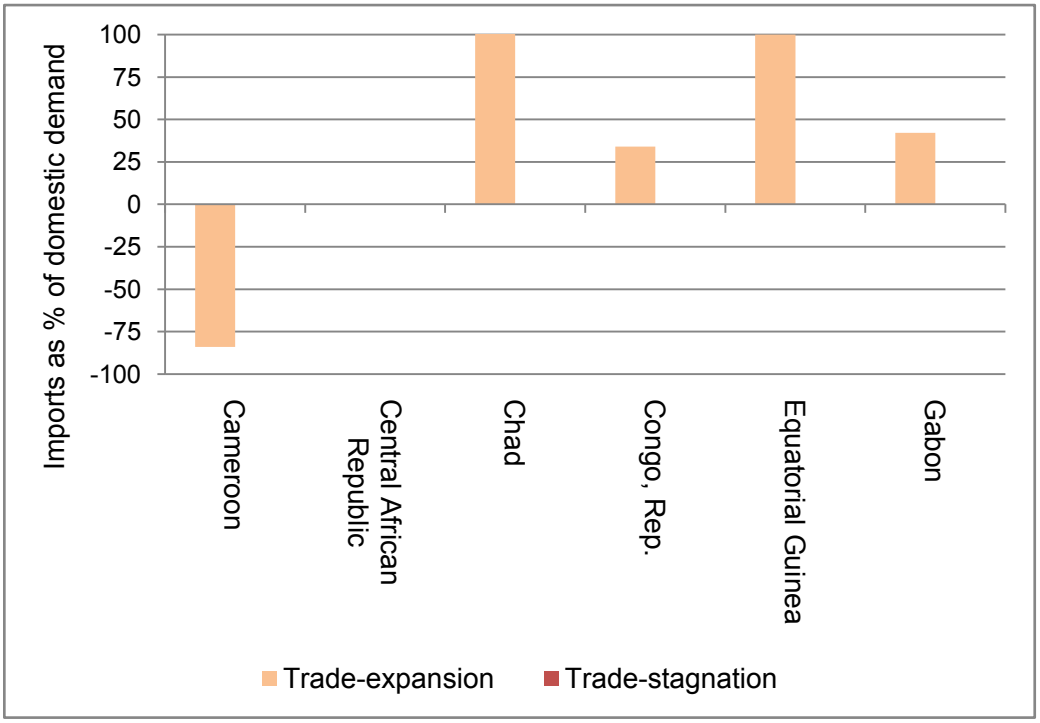
b. Trade expansion



Source: Rosnes and Vennemo 2009.
Note: CAPP = Central Africa Power Pool; TWh = terawatt-hour.

Under the trade expansion scenario, Cameroon would export around 80 percent of its domestic consumption to several neighbors. Chad and Equatorial Guinea would find it more economic to import 100 percent of their power requirements from Cameroon than to generate power domestically. The Republic of Congo would import around a third of its consumption from both Cameroon and the Democratic Republic of Congo. Gabon would import around half of its consumption from Cameroon. The Central African Republic would not be impacted by trade expansion as it is completely self-sufficient.

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



Source: Derived from Rosnes and Vennemo 2009.
Note: CAPP = Central Africa Power Pool; TWh = terawatt-hour.

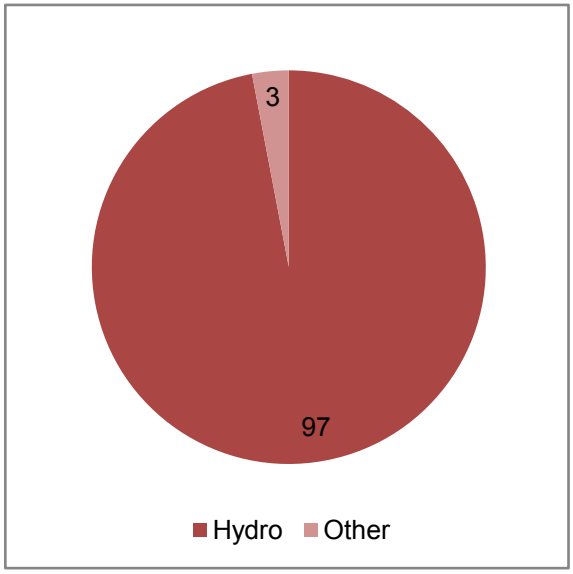
When the Democratic Republic of Congo is mapped to the SAPP rather than the CAPP, the CAPP relies primarily on Cameroon for cost-effective hydropower generation. Nevertheless, in reality, the Democratic Republic of Congo could potentially supply the CAPP with some of the power to be developed at the Inga site. Analysis suggests that with the development of 9,500 MW of additional hydropower capacity under the Inga III and Grand Inga 1 projects, the Democratic Republic of Congo could export as much as 52 TWh to the SAPP. Since demand growth in the CAPP region over the same period is not projected to be much more than 10 TWh, a small share of the Democratic Republic of Congo exports could be diverted northward to the CAPP, making a significant contribution to the power supply in this area.

To illustrate the implications, a scenario in which the Democratic Republic of Congo exports 5 TWh of power via the Republic of Congo into the CAPP is considered. These imports displace some 550 MW of hydropower capacity for export in Cameroon and a further 300 MW of hydropower capacity for domestic consumption in the Republic of Congo that would otherwise have been developed. But even though imports from the Democratic Republic of Congo to the Republic of Congo replace imports from Cameroon to some extent, they do not eliminate them. Congo still imports 1.3 TWh from Cameroon, and Gabon still relies heavily on Cameroon. Allowing the Democratic Republic of Congo to export to the CAPP provides overall annual savings of $220 million. Of this total, $180 million is from reduced investment in generation capacity in the CAPP region, while the rest is due to lower operating costs and fewer cross-border transmission investments. This, however, does not account for costs incurred in the Democratic Republic of Congo.

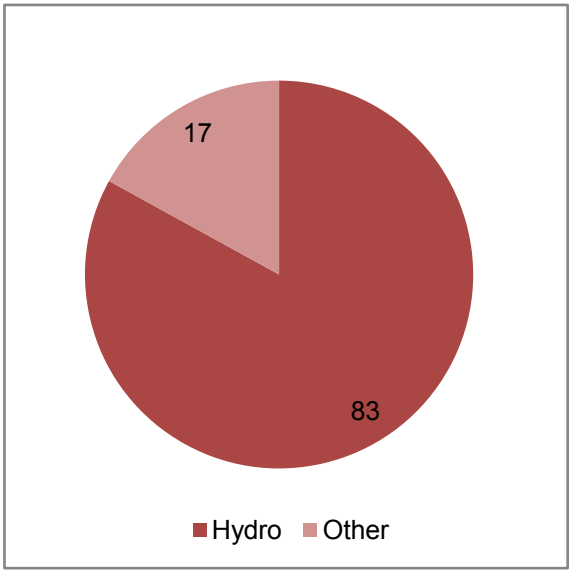
Trade expansion significantly increases the weight of hydropower in the regional generation portfolio, from 83 to 97 percent. Doing so spurs annual savings of some 4 million tonnes of carbon emissions. The main impact of trade expansion would be to enable a shift away from thermal generation and relatively dispersed small-scale hydropower, toward larger and more cost-effective hydropower resources that would generate some 0.3 TWh of additional power (table 3.5). Other sources of power would also be displaced, decreasing from 17 percent to 3 percent under trade expansion (figure 3.6). The savings in carbon emissions is smaller than that projected in other regional power pools, where 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 in trade expansion and stagnation

	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: WAPP = Western African Power Pool; SAPP = Southern African Power Pool; EAPP = East African Power Pool; CAPP = Central Africa Power Pool; TWh = terawatt-hour; HFO = heavy fuel oil

Table 3.6. Long-run marginal costs of power in the CAPP

(US cents/kWh)	Trade expansion	Trade stagnation	Absolute differential	Percentage differential
CAPP	7	9	–2	–22
EAPP	12	12	0	0
SAPP	6	7	–1	–14
WAPP	18	19	–1	–5
Cameroon	7	6	1	17
Central African Republic	11	11	0	0
Chad	7	11	–4	–36
Congo, Rep. of	6	8	–2	–25
Equatorial Guinea	8	10	–2	–20
Gabon	7	7	0	0

Source: Rosnes and Vennamo 2009

Note: CAPP = Central Africa Power Pool; SAPP = Southern African Power Pool; WAPP = West African Power Pool; EAPP = East African Power Pool; kWh = kilowatt-hour.

Power trade expansion would reduce the long-run marginal cost (LRMC) of power in the CAPP by $0.02 per kilowatt-hour (kWh), or 22 percent overall. The savings accrued in the CAPP under trade expansion are greater than all other power pools and promise substantial economic benefits to the region.

Given that power is a key production input to the economy, any reduction in the reference level of power costs would have an important and positive effect in terms of productivity and competitiveness. For the CAPP as a whole, trade expansion would reduce the LRMC of power from $0.09 to $0.07 per kWh, a reduction of 22 percent (table 3.6).

The magnitude of power cost savings, however, varies across individual countries in the CAPP area (table 3.6). Small countries that have traditionally relied on very expensive small-scale oil-based generation have the most to gain from switching to the import of hydropower from Cameroon. In particular, Chad, Equatorial Guinea, and Republic of Congo could save between $0.02 and $0.04 per kWh, a percentage reduction in power costs of between 20 and 36 percent. Chad, which currently produces power domestically at high costs, could save $0.04 per kWh and reduce costs of generating power by as much as 36 percent under trade expansion. The Central African Republic and Gabon do not accrue significant savings under trade. The Central African Republic continues to rely on domestic sources for power. Cameroon, the major power exporter under trade expansion, would face an increase in LRMCs due to the need to develop a much larger amount of power, and hence more expensive schemes than those that would be strictly necessary to meet domestic demand alone.

The costs related to transmission grid expansion are about $310 million higher (since there are additional investments in cross-border transmission lines). On the other hand, the annual costs of the enlarged system (variable costs) in 2015 are $255 million lower.

The additional capital investment is recouped in less than four years through savings in variable cost expenditures. This is equivalent to a return on investment of 28 percent. Annual savings are 11.5 percent of the annualized cost of expansion.

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

Country	Price gain (US$/kWh)	Net power trade (TWh)	Annual benefits (US$ million per annum)	One-time investment (US$ million)	Rate of return (%)
Exporter					
Cameroon	0.04	6.7	322	2,680	12
Importer					
Chad	0.04	0.1	4	0	
Congo, Rep. of	0.02	5.84	117	106	110
Equatorial Guinea	0.02	0.01	0	15	
Gabon	<0.01	1.2	0	2	

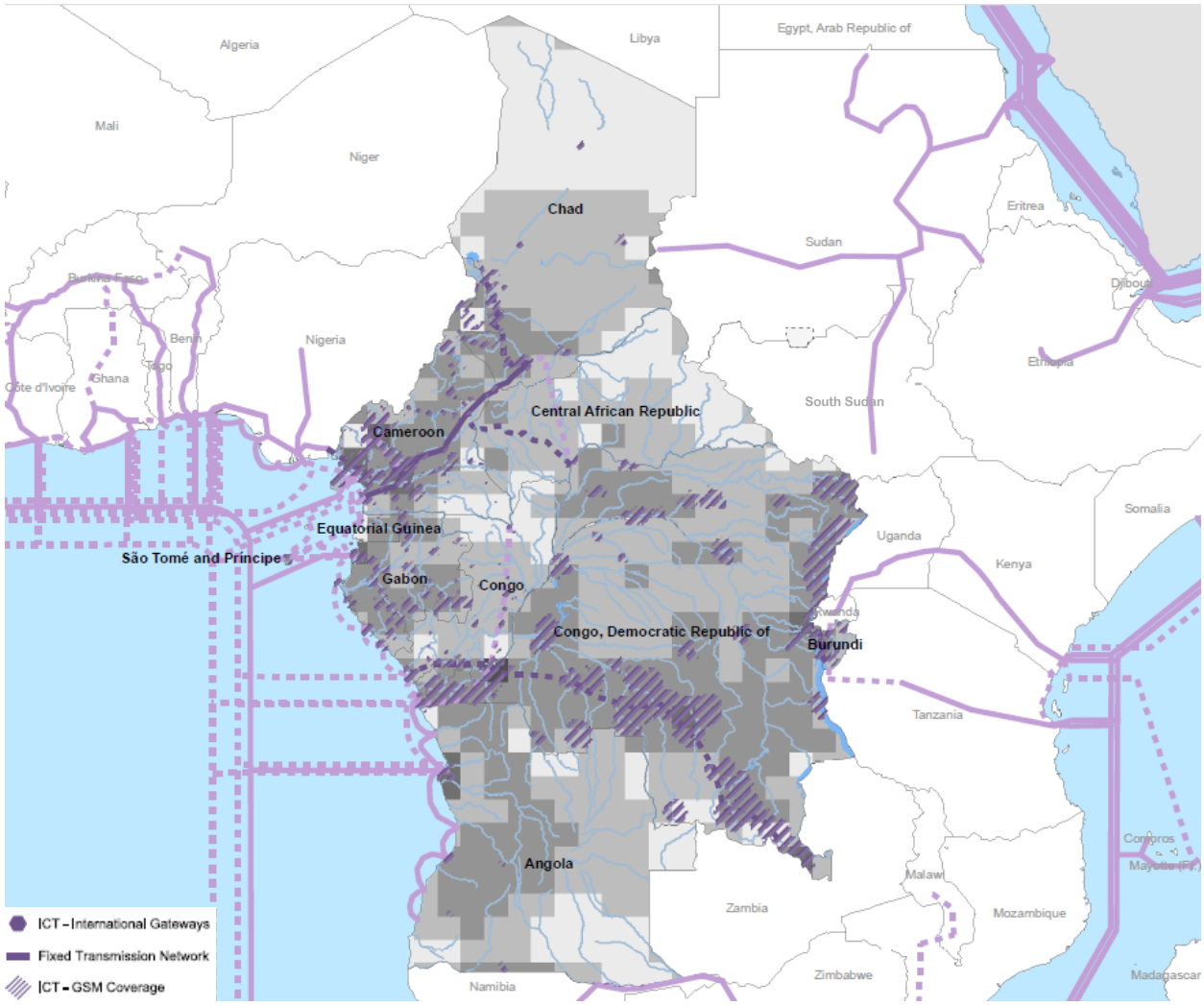
Source: AICD calculations.

The rates of return for importers and exporters vary at the country level. Based on limited evidence, regional power integration offers large and promising rates of return for power exporters and importers alike. A one-time investment of $2.6 billion to develop additional hydropower potential and interconnectors in Cameroon can result in a return of 12 percent on investment. Similarly, on the importer side, a one-time investment of $106 million in interconnectors in the Republic of Congo could result in a return on the order of 110 percent every year (table 3.7).

4 Information and communication technologies

The Economic Community of Central African States' (ECCAS's) information and communication technology (ICT) backbone infrastructure is still in an incipient stage (figure 4.1). Compared with other regional economic communities, the Economic and Monetary Community of Central Africa (CEMAC) has the lowest access to Internet and voice services in all of Africa and faces very high prices for critical ICT services. The level of broadband subscribers, at 0.01 per 100 inhabitants, is lower than all the other regional economic communities. International bandwidth, at 11 bits per capita, is the same as the East African Community (EAC) and lower than other regional economic communities, and the number of mobile subscribers, at 22 per 100 inhabitants, is also relatively low. High tariffs may explain part of this difference. Prices of ICT services are relatively high and in some cases are prohibitive. In particular, the price of a prepaid mobile basket, at $15, is higher than all other regions. The price of a three-minute call to the United States, at $5.68, is significantly higher (table 4.1).

Figure 4.1. ECCAS's regional ICT network



Source: AICD.

Note: ICT = information and communication technology.

Table 4.1. Benchmarking ICT infrastructure across regions

	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
Prepaid mobile price basket (US$ per month)	14.04	**15.11**	9.09	12.18	11.32
Price of a three-minute call to the United States (US$ per 3 minutes)	0.83	**5.68**	2.20	1.37	1.50
Price of the 20-hour Internet basket (US$ per month)	79.98	**67.97**	50.91	95.70	75.60
Price of fixed-telephone price basket (US$ per month)	9.35	**12.59**	6.85	13.33	13.27

Source: Ampah and others 2009.

Note: ECOWAS = Economic Community of West African States; CEMAC = Economic and Monetary Community of Central Africa; COMESA = Common Market for Eastern and Southern Africa; EAC = East African Community; SADC = Southern African Development Community; ICT = information and communication technology.

ICT access and prices at the regional level mask significant variations across countries (table 4.2). Gabon is clearly the best performer in terms of access to ICT services. Excluding Gabon, there are two groups of countries. The first group—Burundi, Cameroon, the Republic of Congo, and São Tomé and Príncipe—has mobile coverage of over 60 percent, mobile subscribers of 25 subscribers per 100 inhabitants or over, and Internet bandwidth of over 200 megabits per second (Mbps). In this group, global system of mobile communications (GSM) coverage reaches four out of five people. Burundi and the Republic of Congo, however, stand out for their rather low international bandwidth. Despite relatively low levels of access to ICT services, Cameroon and Angola are among a handful of African countries that added the highest number of Internet users between 2000 and 2008 (around half a million each) (ITU 2009). The second group—Angola, Chad, the Central African Republic, the Democratic Republic of Congo, and Equatorial Guinea—have mobile coverage of between 30 and 60 percent and rather low Internet bandwidth, with the exception of Angola. It should be noted that even though the absolute level of mobile connections is low in Chad, it is among the top 10 countries in Africa for mobile growth between 2003 and 2008 (ITU 2009).

Fixed telephone penetration in the region is extremely low. Average penetration is well below 1 landline subscriber per 100 inhabitants. Only 4 countries have a landline penetration of over 1; São Tomé and Príncipe enjoys the highest rate, at just over 5 per 100.

Pricing structures vary across countries but do not parallel the same country groupings as for access. Gabon enjoys relatively good access to ICT services but also faces very high prices for these services. The price of a prepaid monthly basket varies from $2.00 in Burundi to $21.40 in Gabon. The price of a 20-hour Internet basket range from $28 in Burundi to $148 in the Central African Republic.

Table 4.2. Benchmarking ICT across ECCAS member states

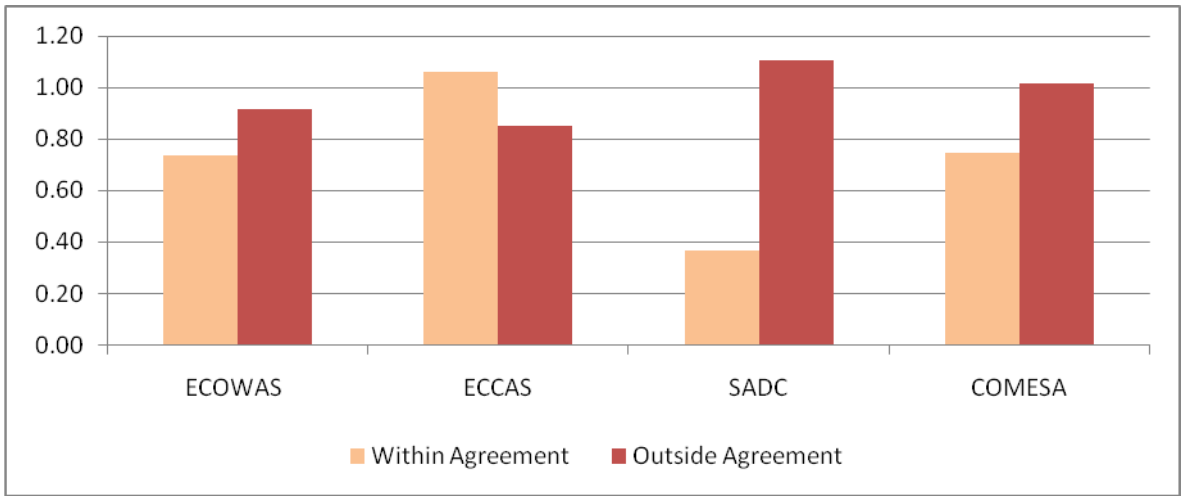
Access	Angola	Burundi	Cameroon	Central African Republic	Chad	Congo, Dem. Rep. of	Congo, Rep. of	Equatorial Guinea	Gabon	São Tomé and Príncipe
Coverage of mobile network (% of population)	35	60	80	20	50	53	80	30	80	80
Mobile telephone subscribers (per 100 inhabitants)	22.3	3.2	24.5	6.8	8.5	8.9	35.4	43.4	87.9	19.4
Broadband subscribers (per 100 inhabitants)	0.07		0.002					0.039	0.25	0.19
Internet subscribers (per 100 inhabitants)	0.3		0.02	0.06	0.03			0.25	0.76	1.78
International Internet bandwidth (Mbps)	250	4	203	10	6	10	8	17	200	4
Prepaid mobile monthly basket (US$)	11.6	11.5	14.4	12.7	16	11.2	18.8	18.6	13.7	9.9
Price of a three-minute call to United States (US$)	3.7	2.4	0.6	14.4	12.5	1.2	2.4		2.3	3.8
Price of 20-hour Internet basket (US$)	63	52	28	148	105	93	85	35	40	53
Price of the fixed-line monthly phone basket (US$)	20.5	2.5	14.3	12.9	8.3				21.4	10.1

Source: Ampah and others 2009.

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

As far as fixed-line international calls are concerned, ECCAS is the only regional economic community in Africa in which it is cheaper to call outside the community than within it. The average cost of an international fixed-line call within ECCAS, at $1.06 per minute, is higher than calling outside ECCAS, which costs about $0.86 per minute (figure 4.2). The cost of calling outside ECCAS is lower than for any other regional economic community. The cost of an intra-ECCAS call varies from $0.51 in the Democratic Republic of Congo to $2.41 in Equatorial Guinea. In Angola, the Democratic Republic of Congo, Equatorial Guinea, and São Tomé and Príncipe, it is cheaper to call the United States than it is to call within ECCAS. In Cameroon and the Central African Republic, it costs as much to call the United States.

Figure 4.2. Price of a 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; SADC = Southern African Development Community; and ECCAS = Economic Community of Central African States.

Perhaps more relevant than fixed-line international calls are regional roaming arrangements for mobile services, an area in which ECCAS has room to grow. Given that fixed-line services have largely been overtaken by mobile services in Central Africa, the regional availability of roaming arrangements on mobile tariffs is in many ways a much more relevant measure of the costs of internal communications. Relative to other regional economic communities, ECCAS has made less progress in promoting preferential roaming arrangements through special interoperator roaming arrangements. Neither Burundi nor São Tomé and Príncipe offer roaming within the region. Only three countries offer roaming across the other Central African countries (the Republic of Congo, the Democratic Republic of Congo, and Gabon). Meanwhile, the special roaming plans (prepaid, no charge for incoming calls, preferential outgoing call rates) that are available in other regions in Africa are not prevalent in Central Africa (table 4.3).

These roaming arrangements are helpful because subscribers who belong to one network can use their mobile handsets in other countries, where they do not pay for incoming calls and are charged local rates for outgoing calls. Prepaid users can also recharge their phones in the country where they are roaming. Subscribers who are not a part of a specific network can still use their mobile phones in other ECCAS countries as long as there is a roaming agreement with the operator in the country in which they are roaming. Without such arrangements, users have to pay to receive incoming calls as well as pay a surcharge on outgoing calls.

Table 4.3. GSM roaming in ECCAS

	Angola	Burundi	Cameroon	Central African Republic	Chad	Congo, Rep. of	Congo, Dem. Rep. of	Equatorial Guinea	Gabon	São Tomé and Príncipe
Angola		X		X		X	X	X	X	
Burundi										
Cameroon				X	X	X	X	X	X	
Central African Republic	X		X		X	X	X	X	X	
Chad			X	X		X	X		X	
Congo, Rep. of			X		X		X	X	X	
Congo, Dem. Rep. of	X	X	X		X	X		X	X	
Equatorial Guinea	X	X	X	X	X	X	X		X	
Gabon	X		X	X	X	X	X	X		
São Tomé and Príncipe										

Source: Derived from Ampah and others 2009.

Note: P = preferential (cheaper tariffs and free incoming calls when using same group network—typically available for prepaid subscribers); X = available but with regulator roaming charges and typically limited to postpaid subscribers; GSM = global system for mobile communications.

A few large operators are beginning to develop a regional presence. All ECCAS countries allow foreign investment in the telecommunications sector. Most countries have two to three foreign operators (table 4.4). There are over a dozen different strategic investors in the region. Zain of Kuwait has the most investments (four countries), followed by France Telecom (three countries). Incumbent operators are partly privatized in three of the countries through sales to strategic investors in Equatorial Guinea (France Telecom), Gabon (Maroc Telecom), and São Tomé and Príncipe (Portugal Telecom). France Telecom once owned part of the incumbent in the Central African Republic but the status of this shareholding is presently unclear. No shares in any telecommunications operator in the region are listed on local stock exchanges.

Relative to other regions, Central Africa suffers from a lack of connectivity to submarine fiber-optic cables. Only Angola, Cameroon, and Gabon have direct access to the undersea fiber-optic South Atlantic 2/West Africa Submarine Cable (SAT-2/WASC). This cable extends from Malaysia to South Africa and then up the west coast of Africa to Portugal and Spain. At present, only three coastal ECCAS countries have landing stations for SAT-3: Angola, Cameroon, and Gabon. The remaining coastal and landlocked countries are bypassed at present—and also lack terrestrial fiber-optic connections with the regional network, which would at least provide some form of indirect access.

A number of cables are planned for the region, including the Africa Coast to Europe (ACE) cable, which would provide direct access to most of the region's coastal nations.[6] Several additional undersea cables are also planned, so by the year 2012 Central Africa will likely be served by at least five submarine cables (figure 4.3). For example, the planned ACE7, which will run from France to Gabon, is expected to be operational by 2011. The 14,000-kilometer Main One cable system is expected to interconnect 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 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, from Morocco to South Africa (more than 25 countries in Africa and western Europe). In November 2008, 17 operators signed a memorandum of understanding, and this cable is scheduled for launch in 2011.[9] The West African Cable System (WACS) will link Europe, West Africa, Central Africa, and South Africa. The WACS consortium has 11 operators from 9 countries.[10]

Table 4.4. Foreign investors in ECCAS's telecommunications sector

Country	Etisalat (UAE)	France Telecom	Millicom (Luxembourg)	MTC (Zain, Kuwait)	MTN (South Africa)	Orascom (Egypt)	Portugal Telecom	Other	Total	Note
Angola							25%		**1**	
Burundi						100%		*	**3**	Other = Econet (Zimbabwe); VTEL (UAE)
Cameroon		99.50%			70%				**2**	
Central African Republic	*	100%				100%			**3**	
Chad			88%	100%					**2**	
Congo, Rep. of				90%	100%			76%	**3**	Other = Warid (UAE)
Congo, Dem. Rep. of			100%	99%				*	**4**	Other = ZTE (China) (51%); Vodacom (South Africa) (51%)
Equatorial Guinea		40%						*	**2**	Other = HiTs (Saudi Arabia)
Gabon	*			90%				51%	**3**	Other = Maroc Telecom
São Tomé and Príncipe							51%		**1**	
Total	**2**	**3**	**2**	**4**	**2**	**2**	**2**		**24**	

Source: Adapted from company reports.

Note: Status as of December 31, 2008. Percentages indicate size of shareholding. UAE = United Arab Emirates. * = Not available

[6] http://www.francetelecom.com/en_EN/press/press_releases/att00012462/ACE_cable_Press_release-06092009.pdf.

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

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

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

[10] http://allafrica.com/stories/200910270242.html.

In order to benefit from these new projects, coastal countries need to establish an international gateway to the submarine cable, while landlocked countries need to establish fiber-optic connectivity with their coastal neighbors. Efforts are already under way. The first phase of the Central Africa Backbone Project (CAB), involving Cameroon, the Central African Republic, and Chad, aims to improve regional connectivity among the three countries by leveraging fiber-optic cables laid along the Chad-Cameroon oil pipeline. Burundi is building a national backbone with World Bank assistance that will have two international exits via Rwanda and Tanzania to connect to East African submarine cable systems.[11]

The arrival of new submarine infrastructure could be expected to reduce consumer charges for the Internet and other international communications, both by providing access to lower-cost technology and by increasing competition in its supply. The costs of critical ICT services, including the cost of calling within Africa, are lower in countries with access to the submarine cable (table 4.3). The cost of Internet access is also cheaper by $20 per month on average. But even where submarine connections exist, costs remain relatively high due to lack of competition across international gateways.

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

	Price per minute for a call within Sub-Saharan Africa (US$)	Price per minute for a call to the United States (US$)	Price for 20 hours of dial-up Internet access per month (US$)
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.

Access to the submarine cable is a necessary but not sufficient condition to lower prices of critical ICT services. Levels of competition and access to competitive gateways are key. Countries with competitive international gateways have significantly cheaper rates to call within Africa and to the United States than those with monopolistic international gateways. On average, those countries with competitive gateways are charged $0.30 less per minute to call within Africa and $0.40 per minute to call the United States.

[11] http://web.worldbank.org/external/projects/main?pagePK=64312881&piPK=64302848&theSitePK=40941&Projectid=P094103.

Countries have taken several steps to open up the telecommunications sector to competition. Mobile virtual network operators (MVNOs) have proved to be an effective way to enhance commercial competition in a market. In July 2008 Cameroon launched an MVNO under the brand name Yemba (ITU 2009).

To attain full intraregional connectivity, ECCAS member countries will have to install almost 5,000 kilometers (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).

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

Country	Gaps (km)	Necessary investment (US$ million)
Angola	782	21
Burundi	90	2
Congo, Dem. Rep. of	1,781	48
Congo, Rep. of	425	12
Central Africa Republic	325	9
Gabon	1,418	38
Equatorial Guinea	89	2
Total	4,910	139

Source: AICD calculations .

In addition to the interregional connectivity, Central Africa combined with West African countries will have to spend $1 billion on intercontinental connectivity (table 4.7). This investment—the largest required among regional economic communities—is required for the installation of the Infinity, GLO-1, and WAFS. The bulk of it will be funded by the private sector.

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 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 services. Based on regional experience, every 10 percent reduction in broadband prices can be expected to bring about a significant increase in broadband penetration. This makes 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.

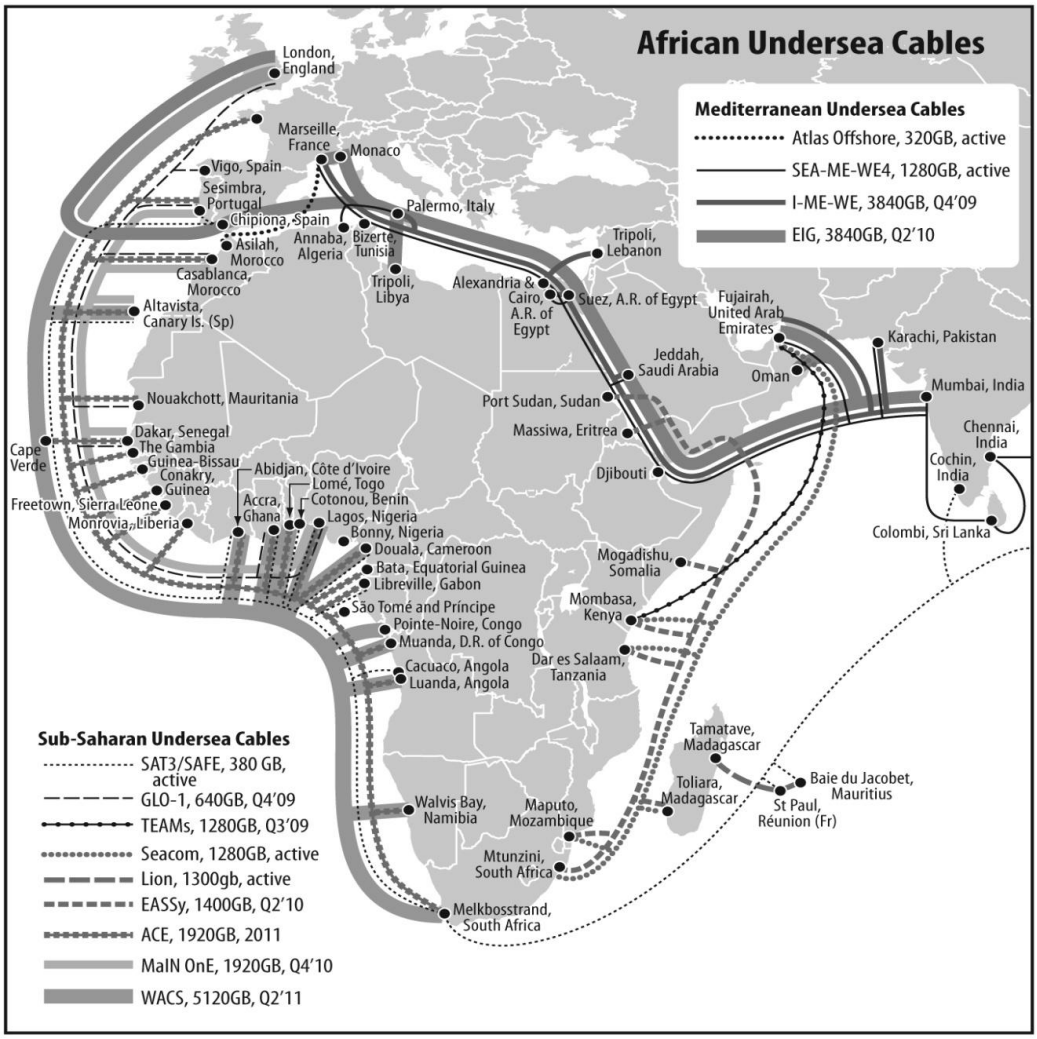
Table 4.7. Intercontinental and intraregional spending needs for ECCAS over 10 years

	Intercontinental connectivity	
	Projects	Required annual investment ($ millions)
East Africa	EASSy, TEAMS	260
Southern Africa	Infraco, SRII	510
Central Africa	Infinity, GLO-1, WAFS	1,010
West Africa		
Total, Sub-Saharan Africa		1,780

Source: Mayer and others 2009.

Note: EASSy = East African Submarine Cable System. ; TEAMS= The East Africa Marine System ; GLO1= Globacom 1 ; WAFS= West Africa Festooning System.

Figure 4.3. Proposed fiber-optic connectivity



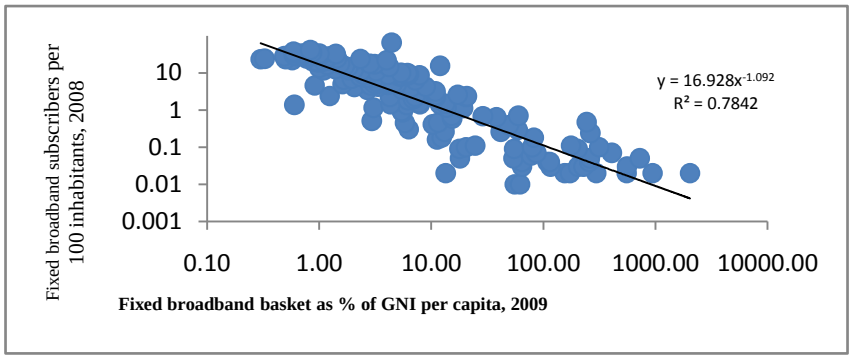
Source: Mayer and others 2009.

Note: 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= Globacom 1; WACS= West Africa Cable System; SEACOM = South Africa–East Africa–South Asia fiber-optic cable; LION = Lower Indian Ocean Network; ACE = Africa Coast to Europe;

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 if countries allow Internet service providers open access to the cables. For example, in Kenya, connectivity to a fiber-optic cable spurred a 75 percent drop in international bandwidth prices.

Assuming Kenya's wholesale cost reduction was applicable to other countries and that international wholesale prices accounted for half of the Internet service provider's 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 packages that differ according to speed. 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 on through retail prices. It also assumes that there is a lone relationship 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-off 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 Central Africa's infrastructure backbone would entail sustained spending of $1.8 billion a year over the course of a decade in the Economic Community of Central African States (ECCAS). 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. To put this in perspective, the total amount of infrastructure spending needed in the ECCAS region to fulfill both regional and national infrastructure demands amounts to $2.4 billion a year. For the Economic and Monetary Community of Central Africa (CEMAC) region, the total drops to $680 million annually, which is 29 percent of the total spending needs for infrastructure.[12]

The amount of spending needed varies widely across countries and sectors. The country with the highest spending need is the Democratic Republic of Congo, with Cameroon and the Republic of Congo in a distant second and third place. Together, these three countries account for 80 percent of the total regional spending needs. The Democratic Republic of Congo would need to spend $960 million annually to meet the regional infrastructure targets, with about 80 percent related to export-oriented hydropower development. Cameroon would need to spend $354 million annually to meet the regional spending needs for infrastructure, of which over 80 percent is again related to export-oriented hydropower development. The Republic of Congo would need to spend $140 million overall, mainly on regional road infrastructure investments and maintenance.

Maintaining ECCAS's regional backbones, once completed, would cost a significant $222 million a year. Although the bulk of the regional infrastructure spending needs relate to new investment, there is also a significant ongoing need for maintenance spending, most of it ($196 million) for the regional road network.

The burden of regional spending as a percentage of gross domestic product (GDP) is 2 percent for ECCAS and 1 percent for CEMAC. But these aggregates mask country variations (figure 5.1). The ECCAS countries would need to spend between 1 and 14 percent of their GDP annually to meet regional infrastructure requirements. The Democratic Republic of Congo and Central African Republic have the highest needs in terms of GDP. The Democratic Republic of Congo would have to spend almost 14 percent of its GDP to fulfill regional investment needs. The Central African Republic would have to spend over 5 percent. These levels of spending are far beyond what these small and fragile economies could sustain, making it unlikely that they would be able to deliver their portion of the regional backbone without external assistance. The other ECCAS countries—Chad, Cameroon, and Republic of Congo—would need to spend 2 percent of their GDP annually on regional infrastructure requirements.

Regional spending needs at the country level look extraordinarily high relative to overall historic spending on infrastructure. The ECCAS countries would need to devote around 28 to 198 percent of their

[12] The total regional and national spending required for ECCAS infrastructure is not calculated, as data for Burundi and Angola are not available at this time. The total spending for CEMAC and the Democratic Republic of Congo is $1.641 billion a year, which is 68 percent of the total regional and national spending needs.

existing infrastructure budgets to fulfill regional spending requirements. The Democratic Republic of Congo would have to spend an untenable 198 percent of its historic infrastructure budget on regional infrastructure needs. Even the Republic of Congo, Cameroon, and Chad would need to spend 30 to 60 percent of their existing infrastructure spending on regional needs, which is not a very realistic proposition.

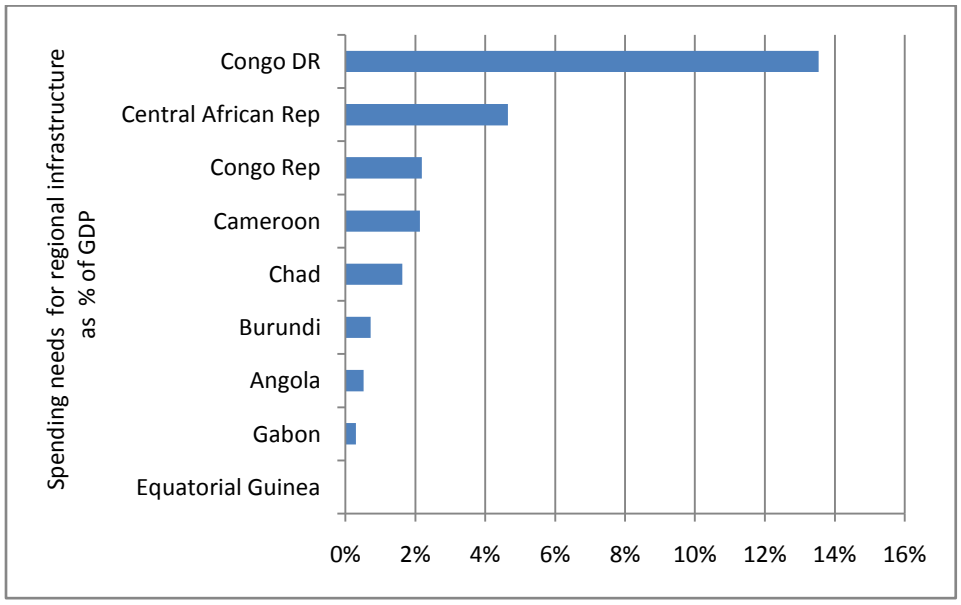
Table 5.1. Regional spending needs by sector

	Transport		ICT		Power		Total		Total needs
($ millions)	Investment	O&M	Investment	O&M	Investment	O&M	Investment	O&M	
Cameroon	34	27			268	25	302	52	354
Central African Republic	44	18	1	0			45	18	63
Chad	74	22					74	22	96
Congo, Rep. of	13	13	1	0	15		29	13	140
Equatorial Guinea			0	0	1		1	0	1
Gabon	12	8	4	0	2		18	8	26
CEMAC	**177**	**88**	**6**	**0**	**286**	**25**	**469**	**113**	**680**
Angola	34	36	2	0	88		125	36	160
Burundi	1	3	0	0	1		2	3	6
Congo, Dem. Rep. of	139	69	5	0	748		892	69	961
ECCAS	**352**	**196**	**13**	**1**	**1,123**	**25**	**1,488**	**222**	**1,808**

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; CEMAC = Economic and Monetary Community of Central Africa.

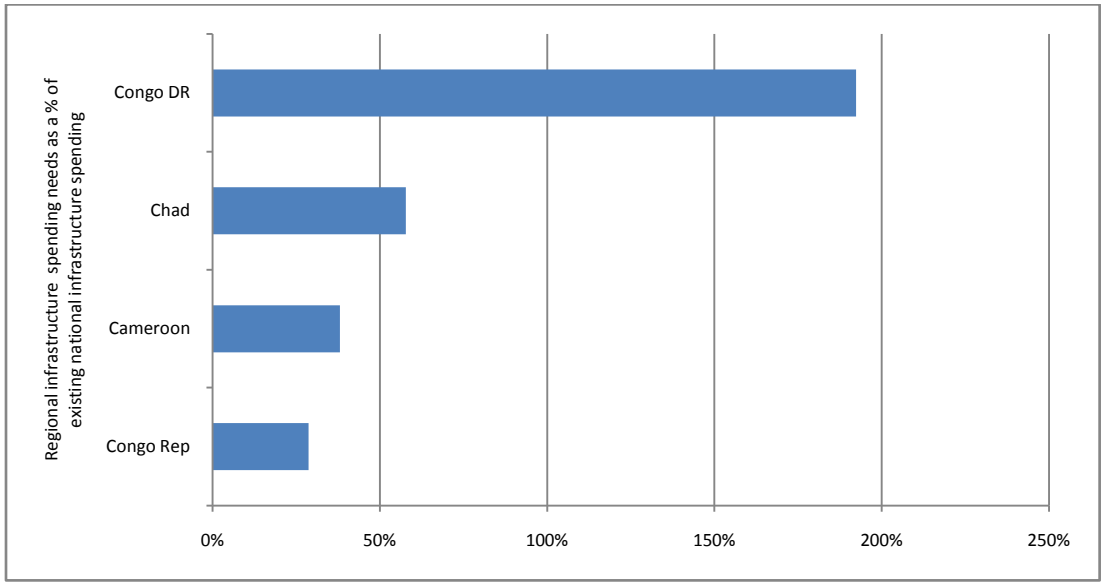
Figure 5.1. Spending on regional infrastructure as a share of GDP



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

Note: GDP = gross domestic product.

Figure 5.2. Spending on 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. All of these can be downloaded from the project website: www.infrastructureafrica.org. For papers go to the document page (http://www.infrastructureafrica.org/aicd/documents), for databases to the data page (http://www.infrastructureafrica.org/aicd/tools/data), for models 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 below.

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AICD
AFRICA INFRASTRUCTURE
COUNTRY DIAGNOSTIC

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.