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Botswana's Infrastructure

A Continental Perspective

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Abstract

Infrastructure made a net contribution of just over two percentage points to Botswana's improved per capita growth performance in recent years. Raising the country's infrastructure endowment to that of the region's middle-income countries could boost annual growth by about 1.2 percentage points.

Botswana has made significant infrastructure progress in recent years, spanning the transport, water and sanitation, power, and mobile telephony sectors. But the country still faces a number of important infrastructure challenges. The most pressing is in the power sector, where the country is economically and financially exposed to a lack of generation capacity and insufficient power supply, leaving the economy vulnerable to power price shocks and load shedding. Botswana's international transport connections and Internet connectivity also lag behind those of comparable countries.

Botswana's overall resource envelope of $800 million per year surpasses its $785 million needs estimate. Nevertheless, it loses $68 million a year to inefficiencies and faces a funding gap of $305 million per year, entirely in the power sector, traceable to the quality of spending decisions. Botswana will be in a good position to meet its infrastructure goals if it can reduce inefficiencies, increase public-sector receipts, and attract more public funding.

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Botswana's Infrastructure: A Continental Perspective

Cecilia Briceño-Garmendia and Nataliya Pushak

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Preliminary results and emerging messages of this paper were discussed in a workshop in Gaborone in November 2009. The team is grateful for the insightful comments and recommendations of the workshop's participants.

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Synopsis

Infrastructure made a net contribution of just over 2 percentage points to Botswana's improved per capita growth performance in recent years. But there is still room for improving quantity and quality of infrastructure, as the recent investments in power demonstrate. Raising the country's infrastructure endowment to that of the region's infrastructure leader Mauritius could boost annual growth by another 1.2 percentage points.

Botswana made significant progress toward improving its infrastructure in recent years. Botswana has posted a strong investment record in the road and water and sanitation sectors, and has successfully increased rural access to power. The country's power and water utility post some of the highest levels of operational efficiency to be found in Africa. Botswana has also made strides in expanding mobile telephony, with the number of cellular subscriptions exceeding the number of inhabitants for the first time in 2010.

At present, the country still faces a number of important challenges. Perhaps the most evident one is the timely completion of the critical 600 MW Morupule power generation project, which will restore supply-demand balance in the country following the 2008 power supply crisis. Other challenges include implementing the ambitious institutional reforms in the water sector, and balancing investment and maintenance spending in the transport sector.

With respect to regional integration, Botswana is doing well in maintaining its segments of international road corridors to at least a basic level. While the country has not yet achieved full regional connectivity of road, rail and networks, it had made substantial progress in connecting to the continent's western and eastern submarine cables.

Addressing Botswana's infrastructure challenges will require sustained expenditure of some $785 million per year over the next decade, split fairly evenly between investment and operations and maintenance. More than half of the total relates to the power sector. At just over 7 percent of gross domestic product (GDP), this level of effort is comparatively low compared to that required of other African nations to achieve comparable targets, and seems well within the reach of Botswana. To put things in perspective, Botswana's investment would absorb around 4 percent of GDP, far less than the 15 percent China invested in infrastructure during the mid-2000s.

Until 2008, the aggregated spending for the infrastructure sectors has been about $800 million per year, broadly in line with estimated needs. Nevertheless, due to resource allocation issues, the power sector faced a funding gap of $305 million per year, or about 3 percent of GDP; reflected in the power supply crisis that erupted in 2008. However, the major investments have subsequently taken place in the Morupule power generation project, correcting historic underspending in the sector, and are helping to restore supply-demand balance for electricity.

It is striking that Botswana's infrastructure spending is primarily funded from public resources. Despite its relatively strong economy and attractive investment climate, Botswana has not succeeded in capturing as much private finance for infrastructure (as a percentage of GDP) as many of its neighbors have done under less favorable circumstances, suggesting that this could be further explored in future.

As of 2008, Botswana faced efficiency issues including under-allocation of resources to the power sector, underexecution of infrastructure budgets, and misalignment of tariffs and costs in the power and water sectors. Over the period 2009/10, the government acted decisively to address these issues, and as a result of sound policy decisions the country has been able to recoup close to $68 million a year that were previously being lost to these various inefficiencies.

As a result, Botswana is perhaps the only African country that faces neither serious efficiency nor funding gaps for infrastructure; an altogether remarkable achievement.

The continental perspective

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

This report presents the key AICD findings for Botswana, allowing the country's infrastructure situation to be benchmarked against that of its African peers. Given that Botswana has reached middle-income status and is a resource-dependent economy, two sets of African benchmarks will be used to evaluate Botswana's situation: Middle-Income Countries (MICs) and resource-rich countries. Detailed comparisons will also be made with immediate regional neighbors in the Southern African Development Community (SADC) countries.

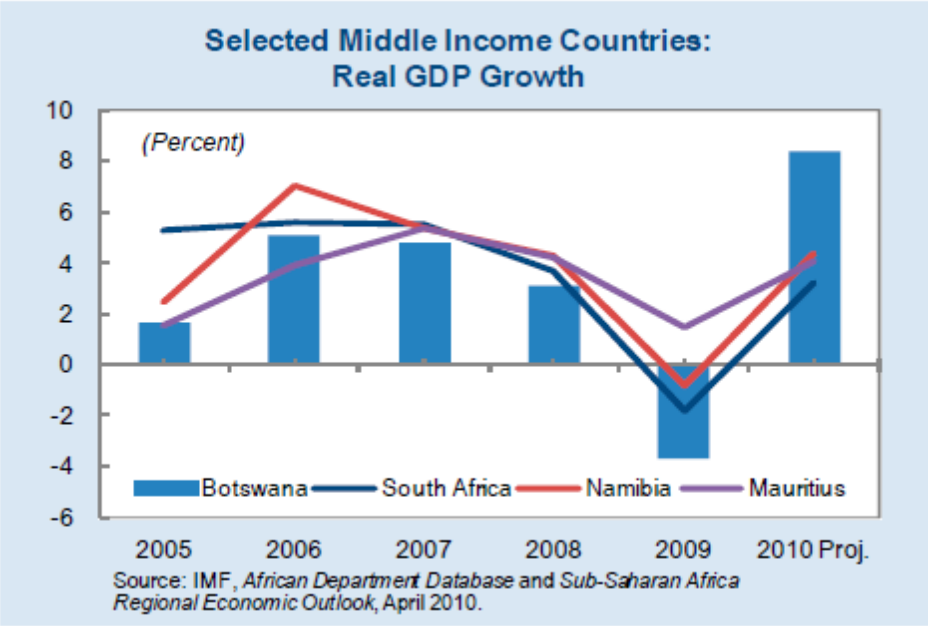
Several methodological issues should be borne in mind. First, because of the cross-country nature of data collection, a time lag is inevitable. The period covered by the AICD runs from 2001 to 2006 for countries for which data was collected in the first phase of the project. For the countries in phase two, including Botswana, data collection began later. Therefore most of the data for Botswana are from the 2004–08 period. 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. Since the period post 2008 has been particularly eventful for Botswana's infrastructure sectors, key changes are noted in the text even if they cannot be reflected directly in the data which for the sake of international comparisons must retain a consistent time period.

Second, to make comparisons across countries, we had to standardize the indicators and analysis so that everything was done on a consistent basis. This means that some of the indicators presented here may be slightly different from those that are routinely reported and discussed at the country level. In the specific case of spending needs, achievement of the Millennium Development Goals (MDGs) has been assumed as the social targets. These targets look indeed relatively modest for middle-income countries like Botswana, and therefore the spending needs of the water and sanitation sectors represent a lower bound yet a cross-country comparable spending targets for the country.

Why infrastructure matters

The growth performance of Botswana improved markedly between the 1980s and 1990s, driven by the boom of commodity prices in the international market. The growth performance during the 2000s was more modest (certainly more modest than in other Southern African countries) and it was strongly affected by the 2008 financial crisis. The overall improvement in per capital growth rates has been estimated at 1.9 percentage points, of which 1 percent is attributable to better structural policies and 0.9 percent to improved infrastructure. During the five years from 2003 to 2007, Botswana's economy grew at an average annual rate of 4.8 percent driven by the mining sector. The positive commodity price shock was managed with prudent macroeconomic policies, but collapsed demand for diamonds during the recent financial crisis led to an enormous contraction in 2009 (IMF 2010)The Botswana's economy rebounded in 2010 to a GDP growth of 7.2% (figure 1) .

Figure 1. Botswana's economy is set for recovery

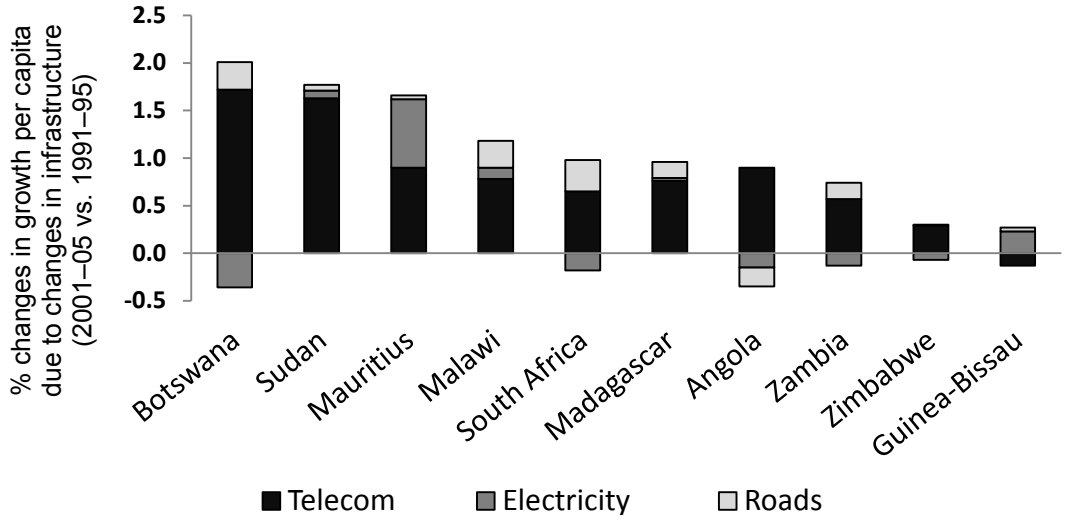


Source: IMF (2010).

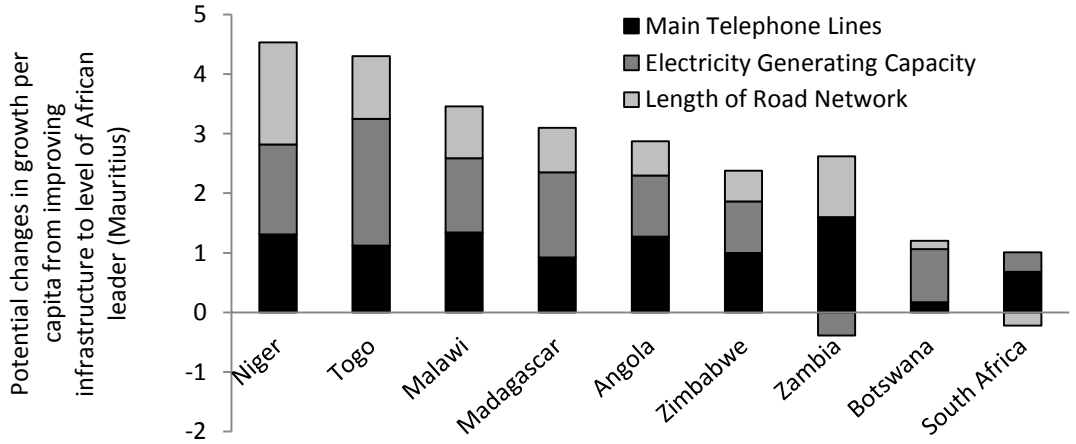
Improvements in infrastructure added about 2 percentage points to the per capita growth rate for the high-growth period 2003–07, a much higher contribution than what was observed in neighboring countries such as South Africa, Angola, Zambia, and Malawi (figure 2a). This boost to growth came predominately from the ICT revolution, followed by the development of transport infrastructures=. By contrast, Botswana's lack of electricity generation capacity held back the per capita growth rate by as much as 0.4 percentage points over the same period until 2007.

Figure 2. Until 2007, infrastructure's contribution to growth high, even as power holds back the economy

a. Infrastructure's contribution to annual per capita economic growth in selected countries, 2003–07, in percentage points



b. Potential contributions of infrastructure to annual per capita economic growth in selected countries, in percentage points



Source: Calderón 2009.

Looking ahead, the contribution of infrastructure to growth promises to increase even more as improvements in the power sector are achieved. Simulations suggest that if Botswana's infrastructure could be improved to the level of the African leader, Mauritius, annual per capita growth rates would be 1.2 percentage points higher than they are at present. This impact would come mainly from an increase in power generating capacity (figure 2b).

The state of Botswana's infrastructure

Botswana is a predominantly flat rolling tableland (figure 3c). A plateau divides the country into two topographic regions—bush country and grassland to the east and the Okavango Swamps and the Kalahari Desert to the west. The spatial distribution of Botswana's economy follows this pattern and shows marked differences between east and west. The east is characterized by relatively high population density and low poverty rates. It is here where most of the country's larger cities are found (figure 2a, b) as well as most of its economic activity: Botswana's mineral resources—in particular diamonds and metals including coal, nickel, uranium, and copper—are concentrated in this area (figure 2d). Moreover, Botswana's most fertile soil and most of its crop production are clustered around Gaborone, the capital, and Francistown, also in the east. Meanwhile, the west is sparsely populated, with a very high incidence of poverty and with a very poor natural resource endowment.

The distribution of Botswana's infrastructure networks broadly follows the patterns of economic activity and population. A much greater density of transport, power, and ICT infrastructure is observed in the east (particularly in the southeast) than in the rest of the country (figure 4a, 4b, 4c). Nevertheless, Botswana's infrastructure backbones—ICT, roads and rails, and the national power grid—do provide decent connectivity among populated centers within the country. The water sector is the most challenging. Water resources are very limited, and this constrains all water applications including the development of natural irrigation and water supply (figure 4d).

Since Botswana is a landlocked country, regional integration is an issue of strategic importance. Botswana has achieved better level of international bandwidth in recent year since its connection to the South Atlantic 3 (SAT-3) submarine cable skirting the west coast of Africa (figure 4c), the EASSy cable and soon in 2012, via Namibia, to WACS, another west coast cable. In the power sector, Botswana followed for years a regional approach by relying on South Africa for power supply. But the power generation crisis in South Africa in 2008 impacted Botswana as well and made evident the need to develop alternative sources of power, prompting investment in domestic coal-fired generation. In the medium term, until Morupule enters in full operation in 2012, it will be hard for Botswana to meet its power needs within the Southern Africa Power Pool (SAPP). In the longer term, and under the SAPP optimal expansion plan, Botswana is expected to become a net power exporter to its neighbors, including South Africa, with the implementation of Morupule B and the follow-up generation and transmission investments.

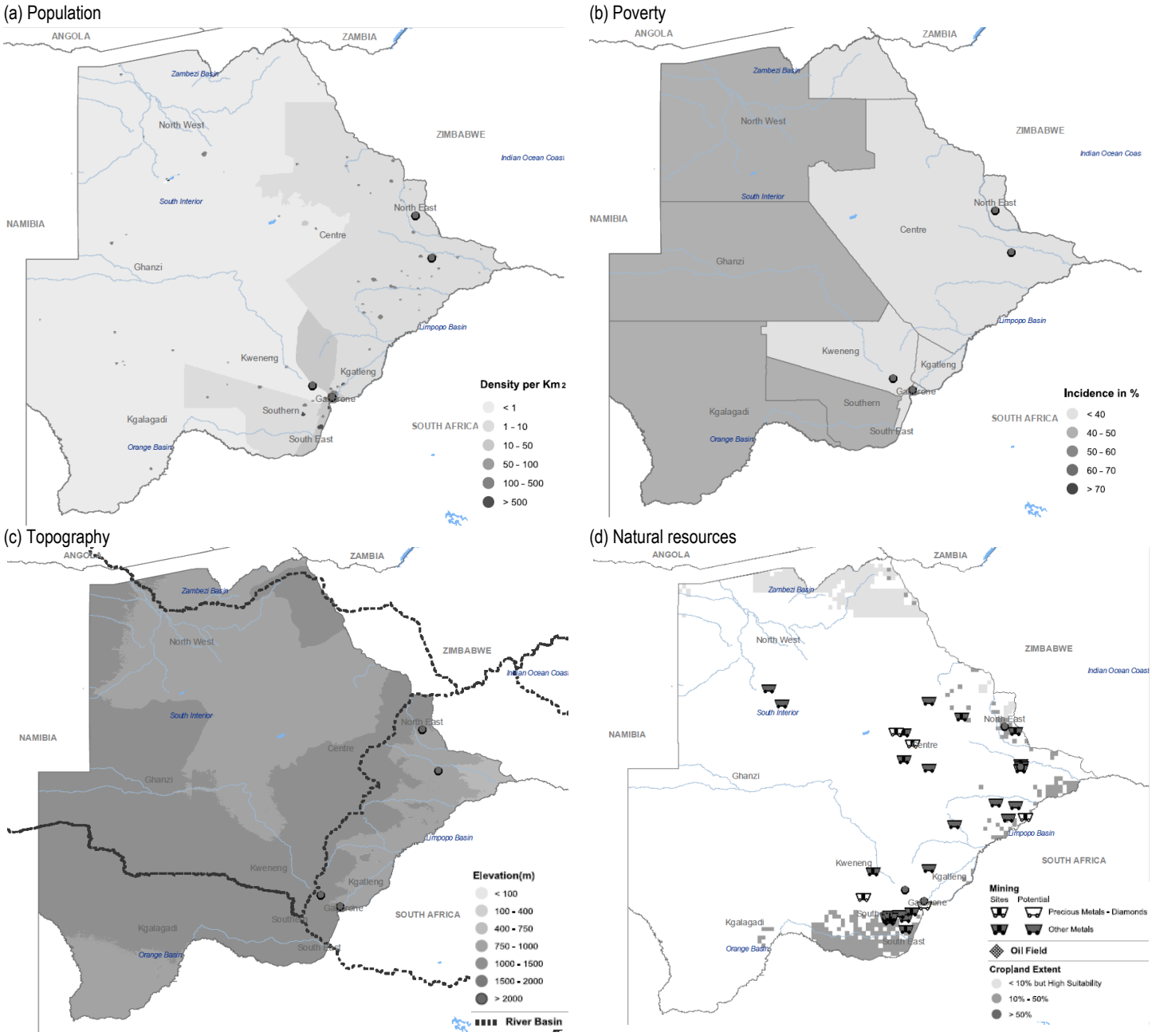
This report begins by reviewing the main achievements and challenges in each of Botswana's major infrastructure sectors, with the key findings summarized in table 1. Thereafter, attention will turn to the problem of how to finance Botswana's outstanding infrastructure needs.

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

	Achievements	Challenges
Roads	Procuring resources for road network expansion and maintenance of existing assets. Achieving good internal connectivity among main cities and population centers.	Creating institutional mechanisms to guarantee funds for increasing the preservation needs of an extended (and further extending) road network. Increasing the competitiveness of Botswana's segments of international corridors. Improving rural accessibility. Improving logistics and other cross-border elements of international corridors.
Railways	Keeping existing railway infrastructure in good condition relative to regional standards.	Decreasing freight traffic levels due to increasing regional competition. Minimizing subsidies to freight tariffs.
Air transport	Developing a clearer strategy for air transport that builds on nearby air hubs. Equipping Air Botswana with new and modern jets to provide links to regional hubs.	Incorporating Botswana under international safety oversight and standards. Liberalizing, diversifying and deconcentrating the air transport market.
Irrigation		Increasing the area with irrigation facilities. Increasing water storage availability.
Water and sanitation	Allocating increased and sustained resources in support of the needs of the sector. Significantly increasing access to and quality of services. Establishing an efficient water utility provider.	Overcoming the high development costs that geography imposes on expanding rural area services. Introducing a flexible tariff regime that better aligns costs with prices and introduces periodic tariff revisions.
Power	Doubling electrification rates. Setting in place a very efficient power distribution utility.	Completing the on-going expansion power generation capacity Introducing a flexible tariff regime and policy that better aligns costs with prices and introduces periodic tariff revisions, ensuring its implementation through an independent regulator.
ICT	Increasing mobile penetration to the highest rate in Africa via the successful liberalization of the sector.	Improving access to Internet. Improving regulation The regulator (BTA) should begin by leveling the payfield for new comers. Eliminating the BTC monopoly in fiber optics and gateways. Accelerating the privatization of BTC.

Source: Authors' own elaboration based on findings of this report.

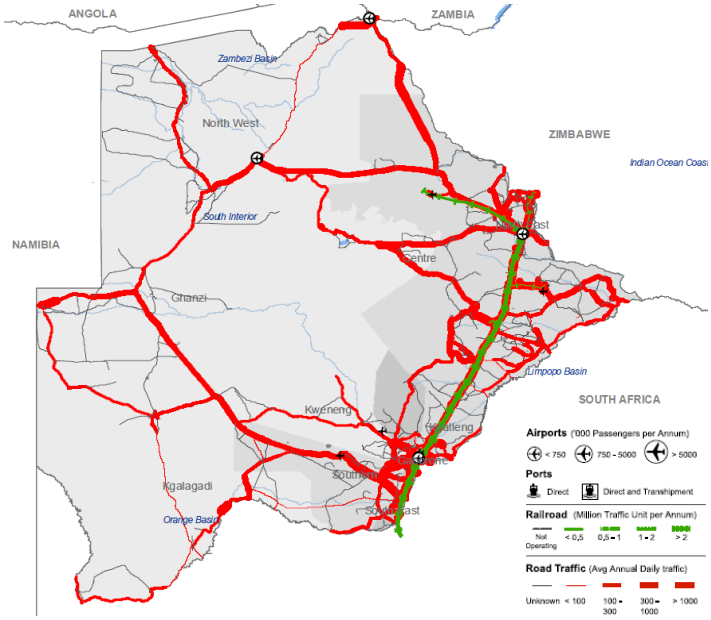
Figure 3. Botswana's population, income, and mineral resources are concentrated in the east



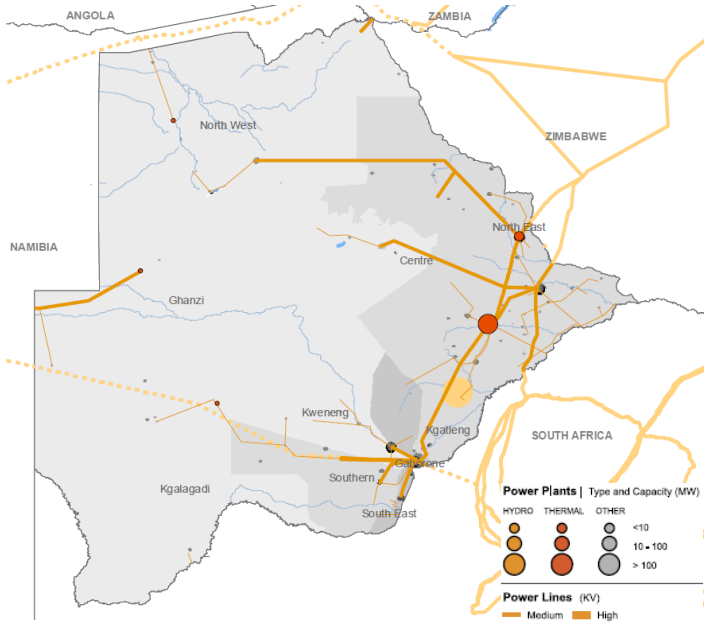
Source: AICD Interactive Infrastructure Atlas for Botswana (www.infrastructureafrica.org/aicd/system/files/bwa_new_ALL.pdf).

Figure 4. Botswana's infrastructure networks align with population density

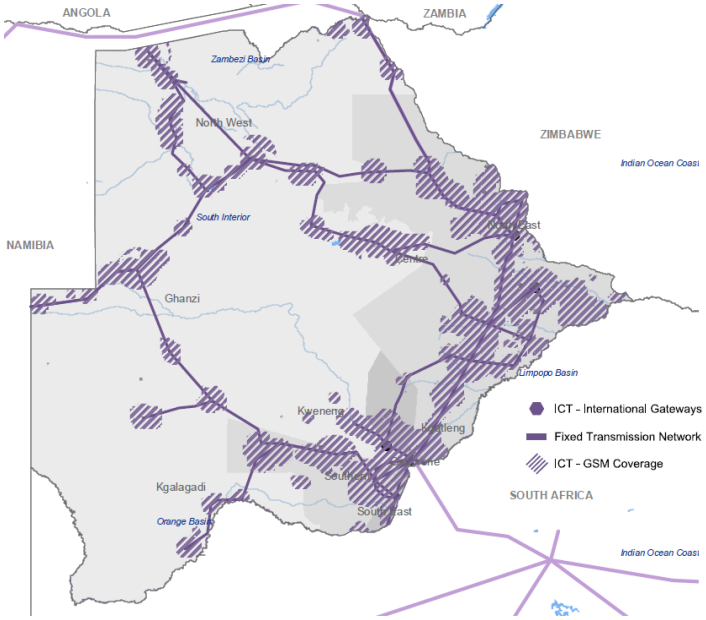
(a) Roads



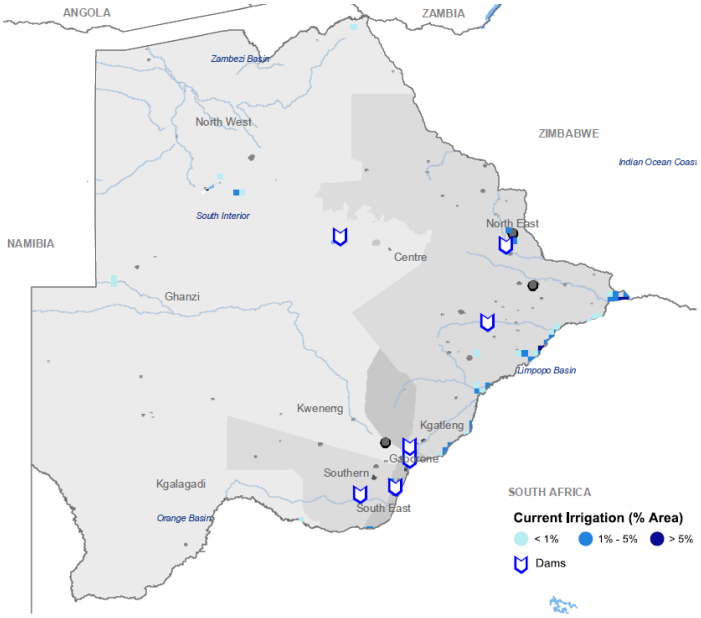
(b) Power



(c) ICT



(d) Water



Source: AICD Interactive Infrastructure Atlas for Botswana (www.infrastructureafrica.org/aicd/system/files/bwa_new_ALL.pdf).

Transport

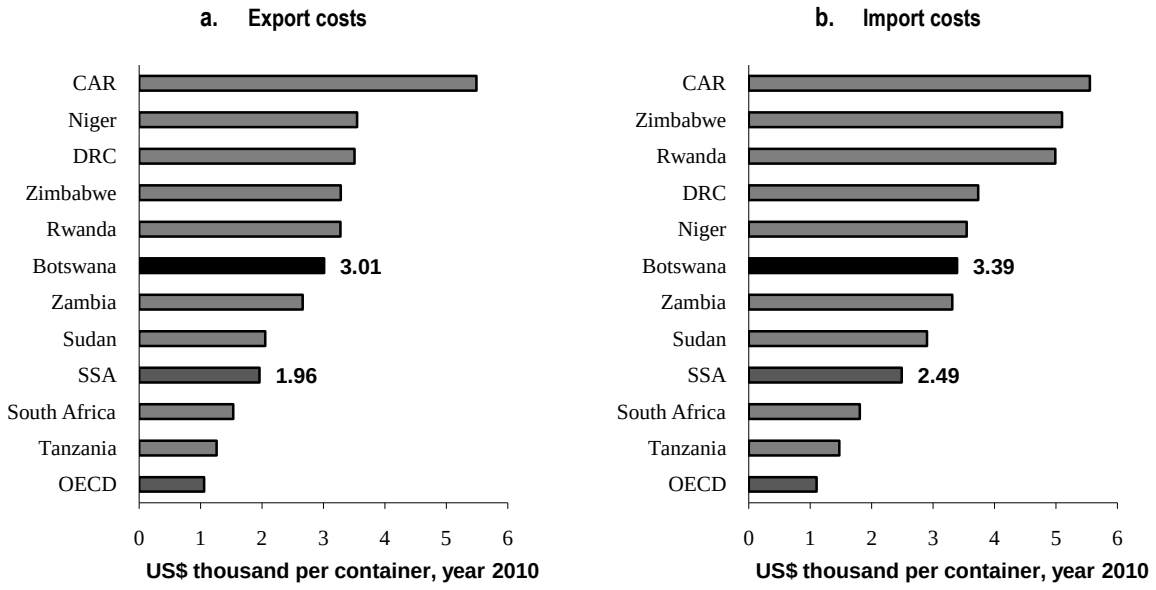
Botswana is part of the north-south road corridor, the most extensive in the region, which links the country to Zimbabwe, Mozambique, Zambia, the Democratic Republic of Congo, Malawi, Tanzania, and to the country's largest trading partner—the Republic of South Africa—with the busiest port in Africa. One of the corridor's main legs stretches from the Port of Durban in South Africa, via Johannesburg, to Francistown on the eastern border of Botswana, and on to Lusaka in Zambia and Lubumbashi and Kolwezi in the Democratic Republic of Congo. In addition, the north-south corridor provides Botswana with links to other important corridors such as the TransKalahari, Beira, Lobito, Dar es Salaam, and Nacala corridors (Curtis 2009).

Botswana Railways' single main line runs along the north-south corridor and currently transports only freight. It serves to provide access to the South Atlantic coast when connecting to the Trans-Kalahari railway. The total distance from key coal deposits to the port of Walvis Bay is 1,480 kilometers (km), of which 880 km is now a gap that would require new construction to be operational (Bullock 2009).

Botswana's landlocked condition makes it particularly vulnerable to logistical inefficiencies, cross-border charges, and other bureaucratic procedures. Not surprisingly, the country experiences very high export and import costs[1] by comparison to the Sub-Saharan African average and its neighbors (figure 5). To put this logistical challenge and cross-border burden in perspective, we might note that Botswana still ranks very well—52 among 183 countries[2] in 2010—with regard to the overall ease of doing business in the country. Yet the country is ranks 151st (out of 183 countries) in the "trading across borders" category. Constraints on trade imposed by transport deficiencies, bureaucracy, and other factors in effect neutralize some of the benefits of the overall ease of doing business in the country.

[1] Includes the costs for documents, administrative fees for customs clearance and technical control, customs broker fees, terminal handling charges, and inland transport.
[2] www.doingbusiness.org/data/exploreeconomies/botswana.

Figure 5. Trading across borders is costly for Botswana



Source: Doing Business Database 2010.
Note: CAR = Central African Republic; SSA = Sub-Saharan Africa; OECD = Organisation for Economic Co-operation and Development; DRC = Democratic Republic of Congo.

Roads

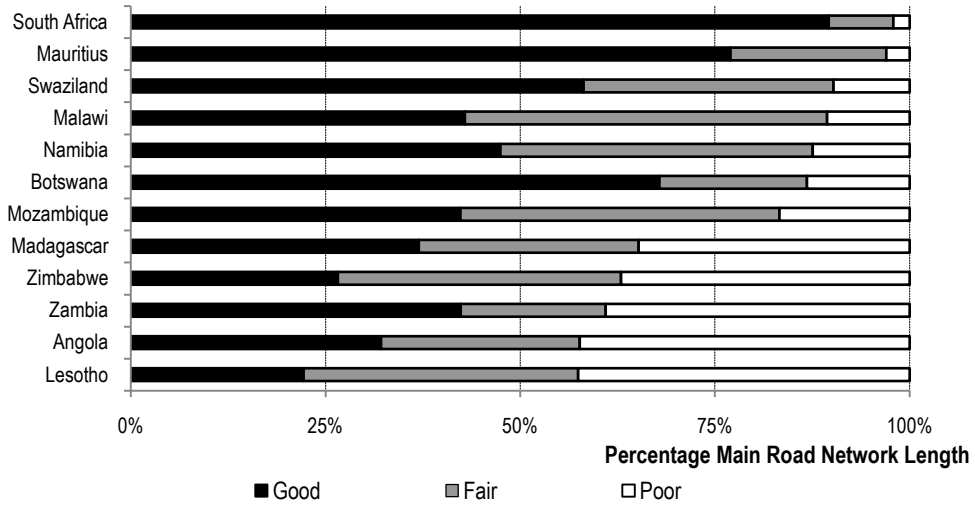
Achievements

Overall, Botswana has made remarkable achievements in its road sector, expanding its total paved road coverage from just 12 km at independence in 1966 to about 7,892 km in 2008. Moreover Botswana has tackled the maintenance of its existing roads comparably well, even though a separate road fund has not yet been established.

The total road network length was 28,152 km as of 2008. The classified network, with about 17,735 km, consists of primary and secondary networks (about 5,000 km) and 12,700 km of tertiary roads. The public highway network, which falls under the jurisdiction of the roads department, consists of 6,116 km of paved and 2,800 km of unpaved road. District roads fall under the responsibility of the district councils. The unclassified network is estimated to be around 5,668 km and the urban network 4,749 km.

Botswana has a strong record of road network expansion, quality, andto much lesser extent maintenance. The quality of roads is comparable to that found in the African MICs and only second to South Africa and Mauritius (figure 6). Eighty percent of the main road network and (perhaps even more impressive) 73 percent of the rural network are in good or fair condition (table 2). Other indicators, such as network density and road traffic, are below the typical levels for low-income countries (LICs). The low network density is correlated to the desert geography of much of the country rather than to a lack of connectivity.

Figure 6. Botswana's share of roads in good condition is among the highest in southern Africa



Source: AICD Road Sector Database on southern Sub-Saharan African countries.

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

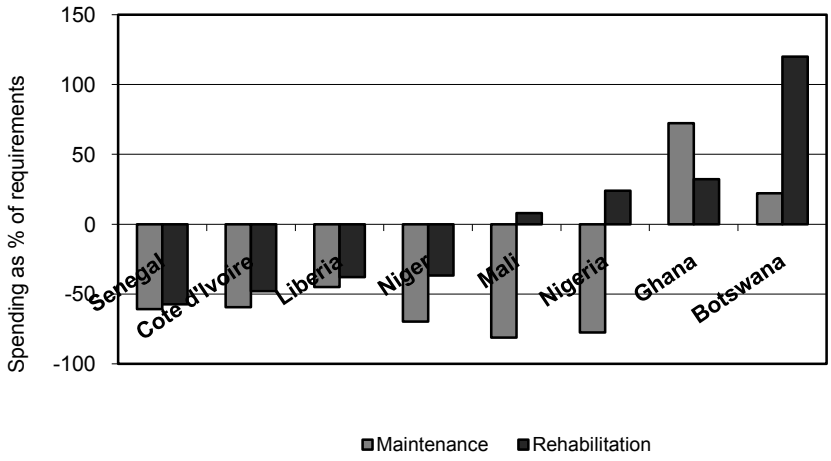
Indicator	Unit	Resource-rich countries	**Botswana**	Middle-income countries
Classified road network density	km/1,000 km^2 of land area	98	**31**	278
Total road network density [1]	km/1,000 km^2 of land area	128	**43**	318
GIS rural accessibility	% of rural pop. within 2 km of all-season road	20	**15**	31
Main road network condition [2]	% in good or fair condition	68	**80**	86
Rural road network condition [3]	% in good or fair condition	61	**73**	65
Classified paved road traffic	AADT	1,408	**858**	2,451
Classified unpaved road traffic	AADT	54	**95**	107
Primary network overengineering	% of primary network paved with 300 AADT or less	15	**23**	18
Perceived transport quality [4]	% firms identifying transport as major business constraint	27	**13**	18

Source: AICD Road Sector Database on 40 Sub-Saharan African countries.
Note:
[1] Total network includes the classified and estimates of unclassified and urban networks.
[2] Main network for most countries is defined as result of adding the primary and secondary networks.
[3] Rural network is generally defined as the tertiary network and does not include the unclassified roads.
[4] *Source:* World Bank—IFC Enterprise Surveys on 32 Sub-Saharan Africa countries.
GIS = geographic information system; AADT = average annual daily traffic.

During its recent economic boom, the country has given priority to developing and maintaining surface connectivity. It has allocated substantial resources to expansion and rehabilitation of the existing network. Based on the physical configuration and condition of Botswana's road network, it is possible to estimate the resources that would be needed to maintain the network in good condition and properly rehabilitate it as per the road life cycle. These maintenance and rehabilitation norms, when compared against existing spending patterns, give a sense of how Botswana has succeeded in securing resources for road preservation (figure 7). As the benchmarking shows, Botswana spends a significant amount over the

norm on rehabilitation and higher though not significantly higher than the norm in maintenance. While the comparison suggests that maintenance spending in recent years is over the norm, the experience in the country indicates that maintenance was neglected for very loing leading to much higher spending on rehabilitation to compensate. At the same time it is important to note that since Botswana's road network is expected to expand considerably, its needs for maintenance spending will also increase in the future. So, if the quality of the road is to be maintained a further look at allocation to road maintenance might be necessary though higher public expenditure management.

Figure 7. Botswana's spending is commensurate with maintenance and rehabilitation needs



Source: Gwilliam and others 2008.

Botswana has prioritized the expansion of its road network. Over the 2005–07 period, the country spent an average of 1.3 percent of GDP on capital roads investments, which is an increase in comparison to previous periods and more than the 2003–09 investment planned under the 9th National Development Plan (NDP) (table 3). The country has thus consistently increased the resources invested in road expansion.

Table 3. Botswana's governmental investments in roads

Period	Period total, current pula	Constant 2007 $US per year	Constant 2007 $US per year per capita	GDP %
1966–86 (actual)	260,000,000	15,103,940	13	0.6
1991–97 (actual, NDP 7)	870,746,559	63,258,385	40	1.0
1997–2003 (actual, NDP 8)	661,274,384	27,119,970	16	0.4
2003–09 (planned, NDP 9)	2,467,660,000	72,944,329	39	0.6
2004 (actual)	315,433,705	73,784,049	41	0.7
2005 (actual)	604,046,771	125,494,297	68	1.2
2006 (actual)	791,362,633	139,454,757	75	1.2
2007 (actual)	1,157,844,594	188,610,310	100	1.5

Source: Botswana's Department of Roads for spending under NDP;[3] AICD annual data 2004–07; authors' calculations.

[3] www.gov.bw/en/Ministries--Authorities/Ministries/Ministry-of-Communications-Science--Technology/Departments/Department-of-Roads/Divisions/#de53b8ebc29748f6af6959fd7b5fab33.

Challenges

The strategic challenge for Botswana in the roads sector is to fulfill the potential of its geographic location at the center of the SADC region by expanding its network and ensuring smooth and reliable regional connectivity. Botswana could become a key player in regional trade by connecting the markets of South Africa and Namibia to Zambia, Angola, and East Africa, thus boosting its low road traffic levels. This connectivity expansion would need to be balanced against the requirements of existing traffic.

Some 23 percent of the main road network appears to be overengineered, meaning that it consists of paved roads with low traffic levels (below 300 vehicles per day) not typically considered adequate to justify paving. Such a high level of overengineering suggests that the country might need to consider reallocating the resources now earmarked for the sector (for upgrading and expansion) to sectors with relatively greater needs that promise higher economic returns on the public funds invested.

The challenge moving forward is to align the allocation of resources for maintenance with current needs, once the road network expansion plans are fully materialized. In other words, the priority is to make the road network sustainable over time. To achieve this goal, Botswana needs to develop institutions that support road maintenance, such as a Road Fund and independent roads authority, streamline the logistical procedures for cross-border traffic, provide timely and sustainable road maintenance, and secure sufficient funding.

Rail

Achievements

Botswana's railway network consists of a main line of 640 km connecting Ramatlabama on the border with South Africa to Bakaranga in the north, and two branch lines linking Francistown to the Sua Pan soda ash and salt mine (174.5 km) and Palapye to the Morupule Colliery coal mine (16 km). In 2009 the service operator Botswana Railways (BR) ceased to transport passengers. The railway carries a large proportion of nonport traffic: raw materials and products (coal, soda ash) being supplied to South Africa or being received from South Africa (cement, petroleum, and so on).

Railway network density per million people in Botswana (494 km) is the second-highest in Sub-Saharan Africa after Gabon (520 km), followed by South Africa (460 km). Most other Sub-Saharan countries range from 30 to 150 km per million. Relative to other railways in southern Africa, BR presents relatively high traffic levels, and good to average operational performance (table 4). For example, labor productivity is comparatively high.

Botswana's railway is nonconcessioned; however, Rail India Technical and Economic Services (RITES) supplied senior management to Botswana Railways as early as the 1990s under a management support and consultation contract.

Challenges

Botswana has seen a drop in its freight traffic, a result of the rerouting of through traffic between South Africa and the north via the new Beit Bridge Bulawayo Railway in 2009. Ironically, freight tariffs of just over $0.02 per tonne-km are significantly lower than those found elsewhere in Africa, and there is reason to believe they are subsidized (figure 8). This is reminiscent of the time when passenger traffic was

highly subsidized, artificially boosting traffic at very high fiscal costs. The situation was not sustainable and passenger services were completely stopped in Botswana in 2009, partly because of safety concerns and primarily because the subsidy from freight could no longer be sustained (Bullock 2009).

Table 4. Railway indicators for Botswana and select other countries, 2000–05

	CFM (Angola)	**BR (Botswana)**	CEAR (Malawi)	Nacala Railroad (Mozambique)	Beira Railroad (Mozambique)	Ressano Garcia Line (Mozambique)	Transnamib (Namibia)	Spoornet (South Africa)	RSZ (Zambia)	NRZ (Zimbabwe)
Concessioned (1)/ state run (0)	0	**0**	0	1	1	0	0	0	1	0
Freight density (1,000 tonne-km/km)	469	**827**	90	270	663	364	475	2,427	406	902
Passenger density (1,000 passenger-km/km)	—	**—**	38	103	44	44	33	60	92	166
Labor productivity (1,000 traffic units per employee)	580	**722**	131	710	281	—	484	3,308	502	390
Locomotive productivity (million traffic units per locomotive)	30	**41**	3	25	13	—	25	33	25	8
Carriage productivity (1,000 passenger-km per carriage)	4,046	**2,391**	1,176	3,333	750	—	—	—	3,286	—
Wagon productivity (1,000 net tonne-km per wagon)	950	**987**	82	260	476	—	805	913	377	195
Freight yield (US cents/tonne-km)	—	**—**	6	5	3	3	—	—	4	—
Passenger yield (US cents/passenger-km)	—	**—**	1	0.9	0.5	1	—	—	1	—

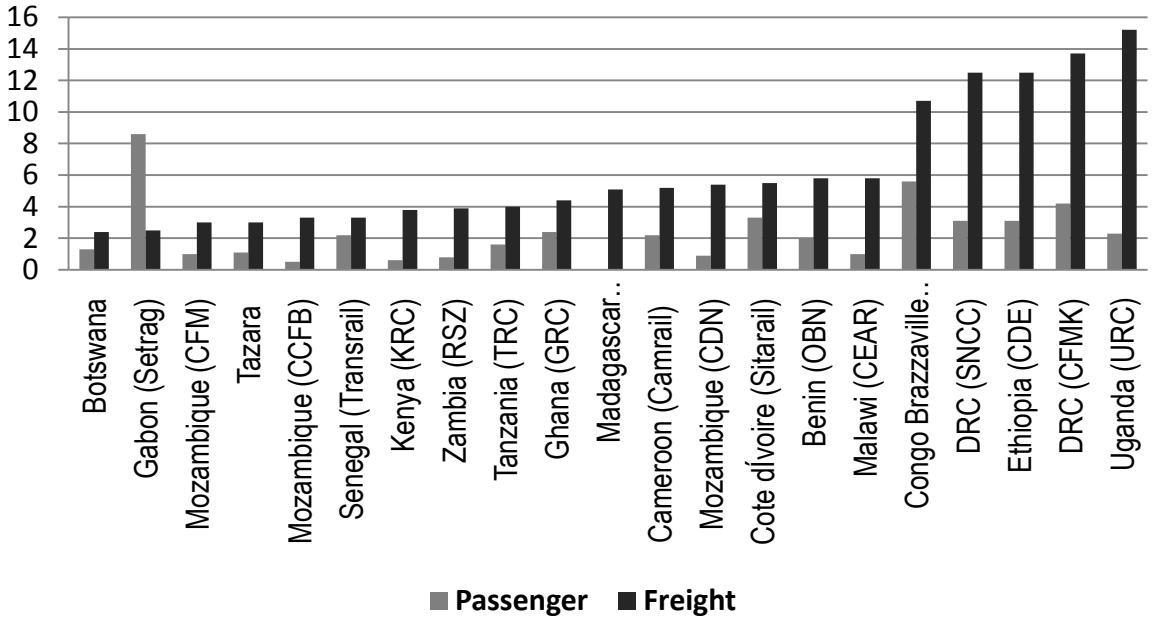
Source: Bullock 2009. Derived from AICD rail operator database (www.infrastructureafrica.org/aicd/tools/data).

Note: * With 2.5 passenger-km equivalent to 1 traffic unit, 1 tonne-km equivalent to 1 traffic unit.

— = Not available.

Figure 8. Freight carried by rail has a comparatively low unit cost in Botswana

Unit tariff per traffic unit—average in period 2000–05



Source: Bullock (2009).

Air transport

Achievements

Botswana saw steady growth in its overall air passenger numbers, even during the economic crisis. Compared to neighboring Zimbabwe and Zambia, it has a relatively high per capita capacity. The aircraft fleet of Air Botswana, the main airline of the country, is one of the newest on the continent, featuring small commuter-sized turboprop aircraft (table 5). Air Botswana's use of such efficient planes reflects the clever strategic approach to air transport services adopted by Botswana. The country is taking full advantage of its proximity to one of the most important air transport hubs in Africa: Johannesburg. Botswana does well to provide short local and regional links to South Africa, which in turn serves as the international gateway to the country.

Botswana has also spent a lot in recent years to upgrade the Gaborone and regional airports.

Table 5. Benchmarking air transport indicators for Botswana and select other countries[4]

Country	Botswana	Namibia	Zambia	Zimbabwe	Mozambique	South Africa
Traffic (2007)						
Domestic seats (seats per year)	241,696	84,162	437,658	237,835	1,144,644	31,767,537
Seats for international travel within Africa (seats per year)	435,708	877,812	1,459,766	1,109,986	582,836	6,314,557
Seats for intercontinental travel (seats per year)	n.a.	242,736	113,217	182,585	91,637	7,707,063
Seats available per capita	0.357	0.574	0.168	0.118	0.087	0.954
Herfindahl-Hirschmann Index—air transport market (%)	60.25	39.39	17.53	30.20	31.54	16.66
Quality						
Percent of seat-km in newer aircraft	100.0	79.0	63.8	71.4	57.0	83.8
Percent of seat-km in medium or smaller aircraft	100.0	28.3	50.6	42.7	42.5	32.8
Percent of carriers passing IATA/IOSA audit	0	100	0	33.3	100.0	33.3
FAA/IASA audit status	No audit	No audit	No audit	Failed	No audit	Passed

Source: Bofinger 2009. Derived from AICD national database (www.infrastructureafrica.org/aicd/tools/data).
Note: The Herfindhal-Hirschmann Index (HHI) is a commonly accepted measure of market concentration. It is calculated by squaring the market share of each firm competing in the market and then summing the resulting numbers. An HHI of 100 indicates the market is a monopoly; the lower the HHI, the more diluted the market power exerted by one company/agent.

FAA = U.S. Federal Aviation Administration; IASA = International Aviation Safety Assessment; IATA = International Air Transport Association; IOSA = IATA International Safety Audit.
n.a. = Not applicable.

Challenges

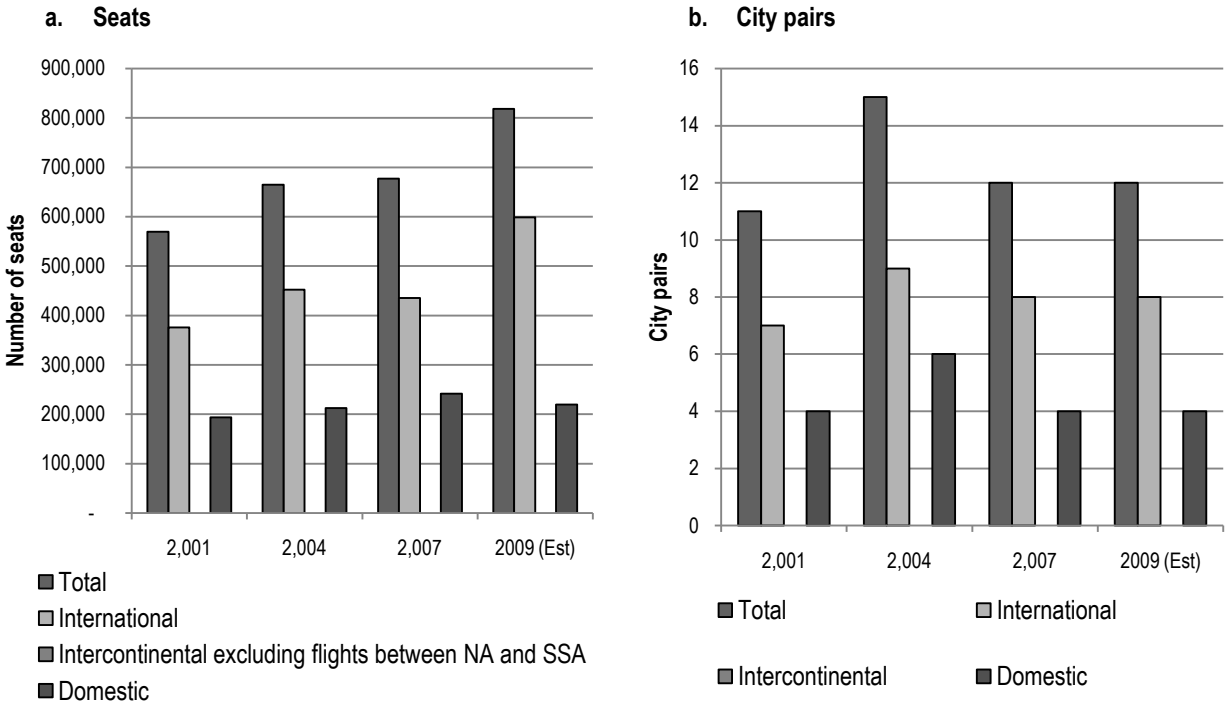
Since no airline in Botswana flies to Europe or the United States, it is neither audited by the U.S. Federal Aviation Administration (FAA) or ranked by the European Union (EU). But safety oversight is a challenge for Botswana. Air Botswana is not on the International Air Transport Association (IATA) registry, and a 2008 International Civil Aviation Organization (ICAO) audit of the safety oversight system found noncompliance with standard and recommended practices to be over 72 percent, compared to the global average of 30.8 percent for the year. Beyond Air Botswana, tourists flying on local charter flights may also be at risk.

The air transport market is concentrated: Air Botswana dominates, carrying over 75 percent of capacity, with an additional capacity of roughly 18 percent provided by South African Airlink Express.

[4] All data as of 2007 are based on estimations and computations of scheduled advertised seats, as published by the Diio SRS Analyzer. This captures 98 percent of worldwide traffic, but a percentage of African traffic is not captured by these data.

In fact, the lack of competition is argued to be one of the potential causes of Air Botswana domestic reputation for poor service with a very high index of delays and cancellations. This lack of reliability is commonly cited as a major obstacle to better performance in the tourism sector.

Figure 9. Evolution of seats and city pairs in Botswana



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

Water resources

Botswana has scarce water resources compared to countries occupying similar climatic zones. The renewable water resource per capita is estimated at about 6,819 cubic meters (m^3) per year (including cross-border flows), below the Sub-Saharan African average of 7,000 m^3 per year. Rainfall levels vary considerably across regions and during the course of the year, averaging a low 416 millimeters annually.

Botswana's population growth (1.5 percent annually) has put significant pressure on its water resources. Demand for drinking water has increased over time due to the increasing rate of urbanization, and some 95 percent of the population is reported to have access to improved drinking water resources. Domestic use accounts for 34 percent of water withdrawals. Need for agricultural production adds to the stress. Irrigation and livestock account for 47 percent of water withdrawals. Industry accounts for around 20 percent of total water demand, particularly the mining sector.

Given the wide range of competing sources of demand (agriculture, water supply, and industry) and frequent droughts, it is essential to have a clearly defined basis for allocating water rights among sectors so as to enhance efficient water use and to maximize its development impact. Furthermore, water rights are also determined by international riparian rights. The most important drainage basins are the South

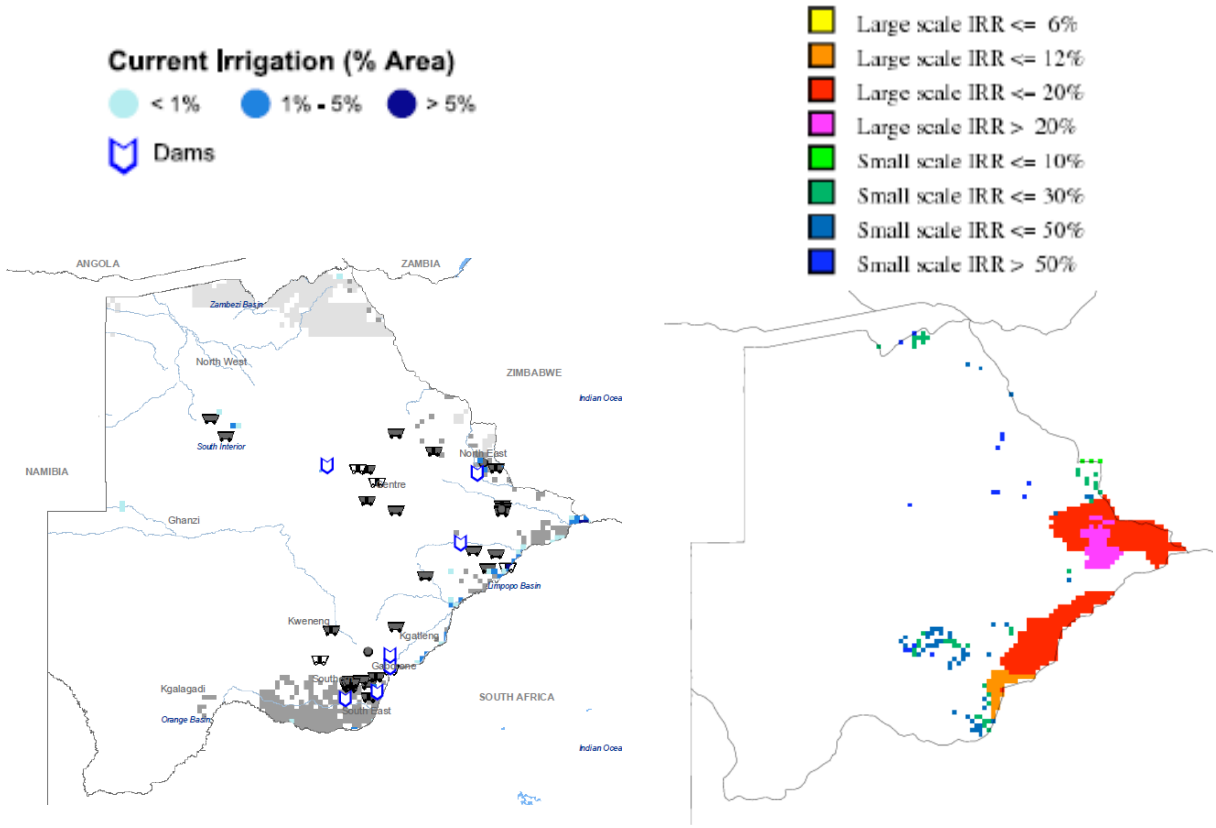
Interior, Limpopo, Orange, Okavango, and Zambezi basins, all of which extend across international borders. Many of these institutional, legal and regulatory issues are being taken care of in the on-going water sector reform (Box 1)

Irrigation

The share of land suitable for agriculture is relatively small—only 5 percent of the territory, or around 2,900,000 hectares (ha)—as Botswana is dominated by the Kalahari Desert. Less than one-fifth of even this small area has been cultivated (as of 2004, the cultivated area was estimated at 380,000 ha). Part of the explanation for this is the lack of irrigation facilities. As little as 0.4 percent of the country's cultivated area (or 1,439 ha) is equipped for irrigation, well below the African average of 3.5 percent (figure 10a), and less than half of the irrigable area is actually irrigated during the dry season. Despite the huge untapped potential, improvements in irrigation have been minimal. Between 1973 and 2003 irrigated area growth amounted to zero.

Figure 10. Botswana's irrigation sector: Current vs. potential cultivated area

a. Current irrigation area **b. Potential (baseline scenario)**



Source: Map of current area: AICD Interactive Infrastructure Atlas for Botswana (www.infrastructureafrica.org); Map of irrigation potential: You 2008.

Note: Baseline scenario was calculated assuming an investment cost of $3,000 per hectare, a canal maintenance and water-delivery cost of 1¢ per cubic meter, on-farm annual operation and maintenance costs of $30 per hectare, and a discount rate of 12 percent.

IRR = internal rate of return.

The country's current irrigated area could be increased substantially with good economic returns. Simulations suggest that with a threshold internal rate of return (IRR) of 6 percent it would already be economically viable to develop a further 25,796 ha of land for irrigation, of which 98 percent would be large-scale projects. If the threshold IRR is raised to 12 percent, the economically viable area for irrigation does not change substantially. The required investment for attaining this expansion is $52 million (table 6). The area with irrigation potential is concentrated around Gaborone and Francistown (figure 10b), where the most fertile soils are located and most of the crop production takes place.

Table 6. Botswana's irrigation potential

	Large scale			Small scale			Total		
	Investment	IRR	Area increase	Investment	IRR	Area increase	Investment	IRR	Area increase
Cutoff (%)	$ million	%	ha	$million	%	ha	$ million	%	ha
0	49	20.0	25,243	3	0.0	553	52	19.5	25,796
6	49	20.0	25,243	3	0.0	553	52	19.5	25,796
12	49	20.0	25,243	3	0.0	553	52	19.5	25,796
24	0	0.0	0	2	0.0	342	2	0.0	342

Source: Derived from You and others (2009).

Note: Water for irrigation can be collected in two ways: through large, dam-based schemes or through small projects based on the collection of runoff from rainfall. The investment costs of large-scale irrigation development reflect only irrigation-specific infrastructure, such as distribution canals and on-farm system development. The potential for small-scale irrigation is assessed not only on the basis of agroecological conditions, but also in terms of market access, since irrigation is typically viable only if the increased yields can be readily marketed. The unit cost for large-scale projects is set at $3,000/ha and for small-scale projects at $2,000/ha.

IRR = internal rate of return; ha = hectare.

Water supply and sanitation

Achievements

Botswana has one of the highest access rates to improved water sources in Africa. About 95 percent of the total population has access to improved water sources, a level comparable to what is observed in the upper range of MICs in Sub-Saharan Africa (93 percent).

This achievement reflects a conscious policy decision. Botswana has made important progress toward moving its population up the water supply and sanitation ladder. Only 3.3 percent of the population still relies on surface water, and a major effort has been made to upgrade access to utility water from stand posts to direct piped connections (table 7). As of 2006 access to piped water, at 64.9 percent, was above the level of other MICs, at 52.1 percent. Reliance on surface water was only one-quarter of that registered in similar African peers.

In the case of sanitation, Botswana has managed to improve service options by moving people from traditional to improved latrines and by increasing access to flush toilets, therefore reducing the practice of

open defecation. Even though these improvements are significant, access to flush toilets, at 32.2 percent, remains below the level of MICs (40.8 percent); while open defecation, at 23.2 percent, is higher than that of similar African countries.

Table 7. Benchmarking water and sanitation indicators

	Unit	Low-income countries	Botswana			Middle-income countries
		Mid-2000s	1988	2000	2006	Mid-2000s
Access to piped water	% pop	9.3	19.5	43.1	64.9	61.1
Access to stand posts	% pop	17.1	68.6	48.6	26.3	22.1
Access to wells/boreholes	% pop	39.3	6.1	3.8	5.6	4.8
Access to surface water	% pop	34.2	5.8	4.6	3.3	10.9
Access to flush toilets	% pop	4.7	12.3	18.1	32.2	47.7
Access to improved latrines	% pop	18.3	23.5	30.5	26.3	33.7
Access to traditional latrines	% pop	38.5	23.6	30.6	18.5	6.9
Open defecation	% pop	38.3	40.6	20.8	23.2	11.0
			2000	**2005**	**2008**	
Domestic water consumption	liter/capita/day	50.9	76.7	69.6	80.5	196.4
Revenue collection	% sales	94.1	95	95	95	99.3
Distribution losses	% production	34.8	21.0	12.6	10.6	28.8
Labor costs	connections per employee	175.9	—	—	—	203.4
Total hidden costs as % of revenue	%	111	—	29	19	67

		Botswana		Countries with scarce water resources	Other developing regions
		2005	**2008**		
Residential tariff	U.S. cents per cubic meter	45	45	60.26	3.0–60.0
Nonresidential tariff	U.S. cents per cubic meter	88	88	120.74	

Source: Demographic and Health Surveys and AICD water and sanitation utilities database (www.infrastructureafrica.org/aicd/tools/data).
Note: Access figures from the Demographic and Health Surveys (1988 and 2006) and Multiple Indicators Survey (2000).
Total cost recovery is calculated assuming a capital cost of 40 cents/m3.
— = Not available.

Botswana's progress in increasing access to improved water supply is spread across both urban and rural areas. Between 2000 and 2008 4.2 percent of the population gained access to piped water per year, while 0.2 percent stopped using surface water as their water source. In rural areas, 1.8 percent of the population gained access to piped water per year, and 0.4 percent stopped using surface water.

During the period covered by this report (2004-2008), the reform of the water sector was still under discussion. The water service came from one three entities Water Utilities Corporation (WUC), Department of Water Affairs (DWA) in the Ministry of Minerals, Energy and Water Resources or the local councils. Due to difficulties getting access to the data, the analysis of providers provided in this report only covers WUC. Since 2009, a number of important changes have taken place (box 1).

Box 1. The water sector reform

In 2009 the Government of Botswana initiated overhauling changes of the water sector and its institutions that covers, among other things:

Implementation of the reform plan as presented in Option 3 of the National Water Master Plan Review (NWMPR). In this plan, the Water Utilities Corporation (WUC) has the sole authority for the provision of water supply, bulk water and sewerage services for the entire country.

Establishment of new institutions that would include a regulatory regime consisting of the WRC, Water Regulator and the restructured DWA. The Plan should also include the critical time frames and strategic actions required to move the sector from its current situation toward the future vision.

Definition of institutional arrangement and restructuring. The NWMPR has identified various institutions that need to be setup as part of the reform of the sector. The reform should achieve clear definitions of the roles, authorities and responsibilities of the various institutions. This includes restructuring and definition of mandate of of DWA, WRC, Regulator and WUC.

Development of water and wastewater policy framing a policy document on the water and wastewater strategy for submission to parliament.

Development of water and wastewater sector tariff strategy: The independent water regulator as envisaged will be responsible for the tariff setting (formal methodology, tariff levels and nature and type of subsidies) and the protection of consumers from natural monopoly such as WUC. The tariff strategy should cover the tariff for water supply, bulk water supply and wastewater.

Adapted from World Bank (2009).

The Botswana Water Utility Corporation (WUC), which at the time of collecting the data was in charge of operating the water systems of Gaborone and other five major cities, has been one of the best performers among African utilities; its performance has positively evolved over time. Distributional losses fell from 21 percent of production in 2000 to 10.6 percent in 2008, half the level of a well-performing utility. In fact, as of 2008 the WUC's nonrevenue water was only 40 percent of the losses reported by similar African utilities. The collection ratio has been reported at 95 percent of bills since 2000 (table 8), a ratio that financially contributes reliable, high-quality service (24/7). In 2008, 70 percent of consumers were satisfied with the service versus the 50 percent reported in 2006. But systematic adjustments of tariffs have not been carried out since 2004, and the residential tariff has remained at the same level since.

Box 2. The hidden costs of utilities

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

Source: Briceño-Garmendia, Smits, and Foster (2009).

The sector's overall good performance is also reflected in the very low level of hidden costs due to inefficiencies (box 2) (table 8, figure 11a). WUC fully recovers operating costs, allowing for surpluses that give WUC substantive cash flows. What is not fully clear is whether tariffs, as set up to 2008, would

allow for full cost recovery if a premium to amortize capital is taken into account. A first approach to full recovery (operating and capital costs) is presented in table 8. Based on a first order estimation of full operating *and* capital costs, it would appear that WUC faces significant underpricing.[5]

Table 8. Evolution of operational indicators associated with the Botswana Water Utility Corporation

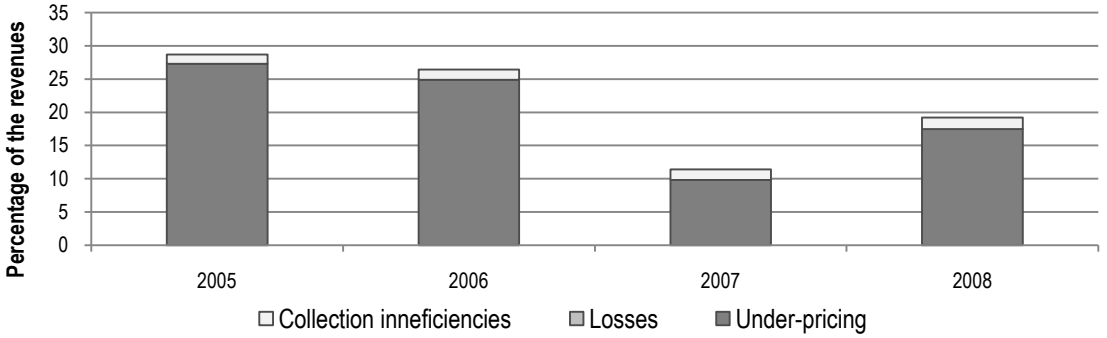
	Water delivered (million m^3/year)	System losses (%)	Collection ratio (%)	Average total cost ($/$m^3$)	Average effective tariff ($/$m^3$)	Total hidden costs ($ million/year)	Total hidden costs (% revenues)
2005	41	13	95	1.21	0.61	23	29
2006	55	12	95	1.10	0.61	19	26
2007	45	11	95	0.80	0.61	9	11
2008	48	11	95	0.91	0.61	14	19

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

In a regional context, Botswana's utility ranks among the most efficient utilities, with hidden costs that are one-fourth of the next-most-efficient utilities (figure 11b). In 2009 mispricing of water services and—to a lesser extent—collection inefficiencies accounted on average for 19 percent of revenues, down from 29 percent in 2005. As a result of these major performance improvements, WUC ranks as one of the most efficient utilities in the continent.

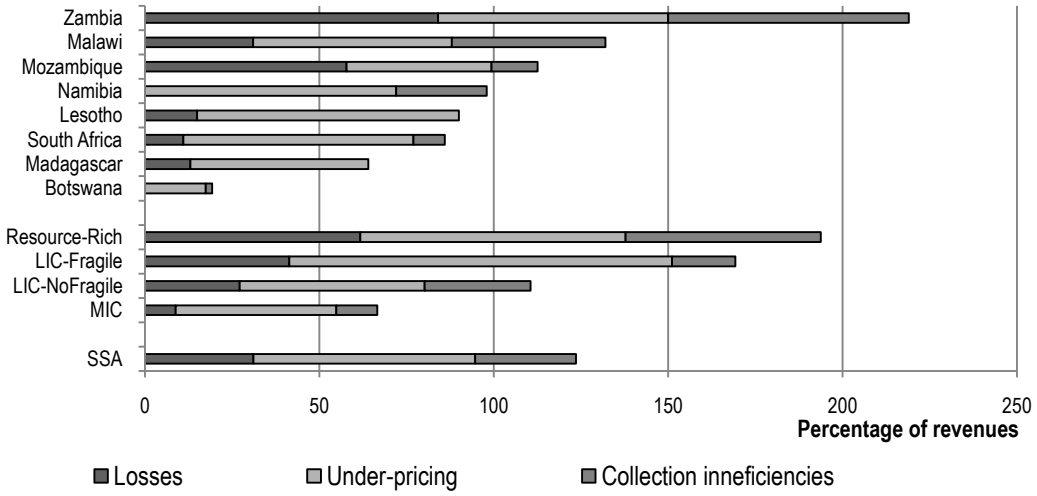
Figure 11. Hidden costs

a. Evolution of hidden costs in Botswana's water sector



[5] The AICD exercise used full cost recovery as the norm to estimate underpricing or mispricing. Here we are following that definition to allow for consistent cross-country comparison. Admittedly, this norm is out of reach for most African utilities that by design aim at achieving ONLY operating cost recovery, leaving capital cost and a transfer or subsidy from the central government.

b. Hidden costs of selected water utilities, percentage of revenues



Source: Derived from Briceño-Garmendia, Smits, and Foster (2009).
Note: LIC = low-income country; MIC = middle-income country; SSA = Sub-Saharan Africa.

Challenges

The government has consistently allocated significant resources to the sector despite challenging conditions. In particular, the provision of rural water in Botswana is more costly than in an average Sub-Saharan Africa country. This is first because Botswana's large, sparsely settled rural areas often include vast spaces between settlements, making economies of scale difficult to realize. Second, due to high evaporation rates and a deep water table the costs of water provision are relatively high. Most of the rural supply comes from boreholes that are often quite deep (in some cases, hundreds of meters, as the layer of the Kalahari Desert can be quite thick). Exploration and operation of such deep wells is difficult and expensive (World Bank 2010).

The ongoing reforms of the water sector pose a big challenge to the WUC, which will take over the water supply for the whole country. The capital investments needed to continue providing high-quality services are not negligible. Expanding access to flush toilets and improved latrines in the years to come is a major challenge, as is keeping pace with the urbanization trend and reducing the practice of open defecation.

Power

Achievements

Botswana more than doubled its electrification rate between 2006 and 2008, pushing it from 22 percent to 50 percent; a remarkable achievement (table 9). According to the National Development Plan (NDP), the target is to reach 80 percent national power access and 60 percent rural access by 2016. Between 2004 and 2007, rural access to electricity also doubled, to 44 percent; which is a major improvement even though still falling short of national targets.

Table 9. Benchmarking power indicators

	Unit	Resource-rich countries	Botswana		Middle-income countries
		Mid-2000s	2006	2008	Late-2000s
Installed power generation capacity	MW/mil. people	43	132	132	796.2
Power consumption	kWH/capita	206	1,476	1,504	4,473
Power outages	Day/year	14.5	1.7		5.6
Firms' reliance on own generator	% consumption				0.5
Firms' value lost due to power outages	% sales	6.99	1.40		0.8
Access to electricity	% population	46.05	22	50	59.9
Urban access to electricity	% population	79.41	45	47	83.7
Rural access to electricity	% population	28.03	9	44	33.4
Growth access to electricity	% population/year	2.38	—	—	
Revenue collection	% billings	81.07	98	100	99.9
Distribution losses	% production	25.80	10.0	10.2	15.7
Cost recovery	% total cost	53.94	96	87	
Total hidden costs as % of revenue	%	168.29	6.4	14.6	

		Botswana		Countries with predominantly thermal generation	Other developing regions
		Mid-2000s	Late 2000s		
Power tariff (residential at 75 kWh)	U.S. cents	5.2	5.2	15.71	5.0–10.0
Power tariff (commercial at 900 kWh)	U.S. cents			18.83	
Power tariff (industrial at 50,000 kWh)	U.S. cents			14.24	

Source: Eberhard and others 2008. Derived from AICD electricity database (www.infrastructureafrica.org/aicd/tools/data**).**
Note: kWh = kilowatt-hour; MW = megawatts.
— = Not available.

The Botswana Power Corporation (BPC) has achieved relatively high efficiency in the power distribution sector. Botswana was able to secure for many years relatively inexpensive power purchase prices in the past importing most of its power from South Africa. While South Africa was able to provide power, Botswana's good governance practices allowed it to build up a national power utility with full operational autonomy and the country established sound power regulation policies and incentives. This scheme of buying power to South Africa and focusing in increasing access and quality of distribution, worked well for years until the generation crisis hit South Africa and the power supply from Eskom was reduced significantly. This external shock made it evident that Botswana needed to secure its own generation capacity and could no longer postpone the needed generation and transmission investments.

Table 10. Performance of the electricity sector in select African countries

Country	**Botswana (2006)**	Lesotho (2009)	Madagascar (2009)	Malawi (2006)	Mauritius (2009)	Mozambique (2007)	Namibia (2006)	South Africa (2007)	Zambia (2007)	Average
Number of power outages in a typical month	**1.7**	7.2	13.7	6.4	3.6	3.1	1.7	2.2	4.2	4.9
Average duration outages (hours)	**2.5**	5.5	2.3	2.3	3.2	4.3	2.7	4.5	2.9	3.4
Lost due to outages (% of sales)	**1.4**	6.7	7.7	22.6	2.2	2.4	0.7	1.6	3.7	5.4
Percentage of firms owning or sharing generator	**16**	31	29	49	24	13	13	18	14	23
Percentage of electricity from generator	**18**	—	19	3	3	11	6	11	19	11.3
Delay in obtaining an electrical connection (days)	**25**	14	92	98	19	13	9	16	97	42.6
Percentage of firms identifying electricity as a major constraint	**7**	44	55	60	43	25	6	21	12	30.3

Source: Enterprise Survey Database (www.enterprisesurveys.org).
Note: Year of the survey is in brackets.

In this context, the BPC was able to attain high efficiency and profitability while providing low-cost service. Collection-to-billings ratio has been nearly one to one. System losses have been also quite good—barely above the 10 percent efficient power utility benchmark. Tariffs are somewhat below cost recovery levels with the gap having widened slightly in recent years (table 11).

The BPC is one of the most efficient utilities in southern Africa, as measured by the hidden costs of its inefficiencies in past years (box 2). These inefficiencies represent about 14 percent of the BPC's revenues, just around one-seventh of those of Zambia (figure 12a).

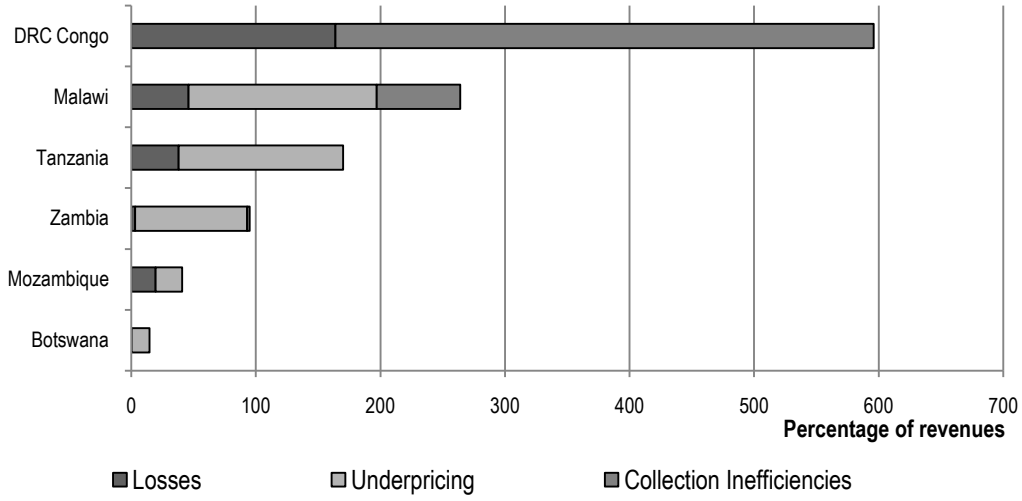
Table 11. Evolution of hidden costs associated with the Botswana Power Corporation (BPC)

	Volume of electricity produced / purchased	System losses	Collection ratio	Average total cost	Average effective tariff	Total hidden costs	Total hidden costs
	(GWh/year)	(%)	(%)	($/kWh)	($/kWh)	($ million/year)	(% revenues)
2004	2,642	10.4	100	0.049	0.052	517,923	0.4
2005	2,731	11.5	100	0.048	0.051	1,923,289	1.5
2006	2,917	10.0	98	0.050	0.048	7,889,571	6.4
2007	3,120	11.0	100	0.053	0.048	16,530,222	12.3
2008	3,215	10.2	100	0.055	0.048	20,661,247	14.6

Source: Derived from Briceño-Garmendia, Smits, and Foster (2009).
Note: kWh = kilowatt-hour; MW = megawatts.

Figure 12. Hidden costs

a. Botswana's power utility is comparatively efficient



Source: Derived from Briceño-Garmendia, Smits, and Foster (2009) and Briceño-Garmendia and Shkaratan (2010).
Note: [*] Projection. DRC = Democratic Republic of Congo.

Challenges

The power sector is key to Botswana's sustainable development and currently its major bottleneck. Botswana's energy demand was about 3,660 gigawatt-hours (GWh) in 2008 (with a peak load of 500 megawatts, MW), which is projected to grow at about 6 percent per year to reach 5,300 GWh by 2017 (peak load of 850 MW) and 6,890 GWh by 2026 (peak load of 1,130 MW). The mining sector accounts for about 50 percent of the demand, the commercial sector about 20 percent, and the residential sector about 25 percent. Botswana has been dependent on power exports from South Africa. In 2008 Botswana imported about 2,440 GWh (67 percent of its power requirements) from Eskom, the national electric utility of South Africa, while its own small 25-year-old coal power plant (Morupule A, 4 x 33 MW) provided about 22 percent.

Botswana's generation capacity is set to expand with the construction of Morupule B coal plant that will add 600 MW (4 x 150 MW) by 2012. This addition to generation capacity will make Botswana self-sufficient in power and offset South African plans to stop exporting power to SAPP as early as 2013.

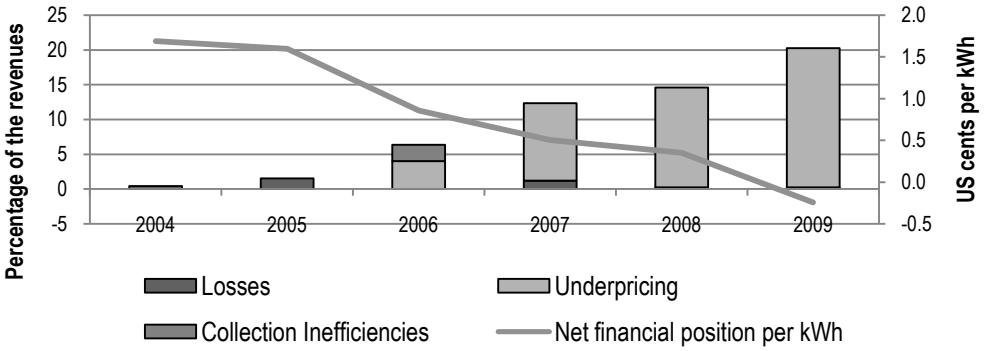
Despite recent network extensions, access remains low. Power supply reaches only around 50 percent of the population, while access for an average upper MIC in Africa stands at 60 percent. While this is a comparatively small percentage, however, it represents a significant improvement from previous years, particularly in the rural areas. But further extension of the network will challenge the financial position of the BPC.

In the strict economic sense, BPC has faced sustained underpricing since 2006, with tariffs that did not allow for cost-recovery (figure 14). BPC's cost recovery capacity deteriorated due to an increase in the South African Eskom's power supply prices. Due to other financial resources available to the BPC,

the full impact of under-pricing was not felt on the company's balance sheet until 2009, at which point the net financial position went into the red (figure 13)

Figure 13. Hidden costs

BPC's economic inefficiencies, driven by underpricing (hidden costs as percentage of revenues, 2004-2009)



Source: Derived from Briceño-Garmendia, Smits, and Foster (2009) and Briceño-Garmendia and Shkaratan (2010).
Note: [*] Projection. Opex = operating expenditure; kWh = kilowatt-hour.

Since 2009, Botswana has made bold efforts to improve the power sector. In tandem with Morupule, the country has implemented important tariff adjustments: 30 percent in 2010, another 30 percent increase in June 2011 with a third increase scheduled for 2012. These decisions are temporarily correcting the misalignment tariffs-costs and set BPC is a very strong path to solid financial viability. Yet, for a permanent solution, particularly after the debt service of Morupule kicks in, Botswana would need to adopt a new electricity tariff policy and ensure its implementation through an independent regulator.

Information and communication technologies

Achievements

Botswana has made enormous strides in providing access to information and communication technologies (ICTs), especially mobile communications. In just over a decade, the number of mobile subscriptions went from zero to exceeding the country's population by the end of 2010. While the real level of access is lower than these numbers suggest, accounting for duplicate and inactive subscriptions and the trend towards dual-SIM card phones,[6] Botswana's mobile penetration of 118 per 100 people in 2010 was the highest in Sub-Saharan Africa (table 12).

Botswana's high mobile penetration is partly due to the early introduction of competition in 1998, when two operators were licensed, Mascom and Orange. This duopoly continued for a decade before a third mobile operator, a subsidiary of the incumbent fixed-line operator Botswana Telecommunications

[6] According to one survey carried out between 2007 and 2008, 59.5 percent of Botswana's population 16 years and older had a mobile phone. This corresponds to some 46 percent of total mobile subscriptions in 2008, giving some idea of the high number of duplicate and inactive subscriptions. Applying the same ratio to the 2009 mobile subscriptions results in an estimate of 87 percent of those aged 16 and older with a mobile phone. The survey data are published in Gillwald and Stork (2008).

Corporation (BTC), was licensed in 2008. The intensified competition from the third mobile operator sustained growth, pushing penetration over 100 percent in 2010.[7]

Table 12. Benchmarking ICT indicators

		Botswana		Botswana	Upper-middle-income group	Sub-Saharan African region
		2000	2005	as of 2009		
GSM coverage	% population under signal	63	85	99	94	56
International bandwidth	bits/person	4	22	220	1,281	34
Internet	users/100 people	1.5	2.7	6.2	34.6	6.5
Landline	subscribers/100 people	8.2	7.2	7.4	22.1	1.5
Mobile phone	subscribers/100 people	12.9	42.0	96.1	100.6	33.3

	2005	2009			2010
	Botswana	Botswana	Upper-middle-income group	Sub-Saharan African region	Botswana
Price of monthly mobile basket	10.2	7.5	9.9	11.8	7.2
Price of monthly fixed-line basket	8.0	15.9	11.7	11.6	15.2
Price of monthly fixed broadband	—	55.5	26.3	100.1	54.7
Price of a call to United States per minute	0.88	0.25	—	0.8	0.24
Price of an inter-Africa call per minute	—	0.80	—	1.0	0.76

Source: Adapted from the BTC, Mascom, AICD, and World Bank ICT At-a-Glance.
Note: 2010 tariff data converted to $ using 2009 annual average exchange rates.
— = Not available.

Botswana has taken most of the steps necessary to create a sustainable ICT sector. Prior to the introduction of mobile competition, the Botswana Telecommunications Authority (BTA) was created as a sector regulator in 1996. In 2006 wide-ranging reforms were introduced including the legalization of Voice over Internet Protocol (VoIP) and a technology-neutral licensing scheme whereby existing operators could provide any telecommunications service. Mascom and Orange launched their own international voice gateways and Internet services while the BTC entered the mobile market. One reform that remained stalled for some time was the privatization of the BTC, but plans are underway for an IPO to sell 49 per cent of its shares of the Botswana Stock Exchange.

Challenges

In contrast to the performance of the mobile sector Botswana's fixed-line sector is stagnant, and the number of subscriptions has fallen since 2008. Internet penetration is also below average considering the nation's status as an upper-middle-income economy. Botswana's fixed-line penetration was some three times less than the upper-middle-income average in 2008, the peak year. Growth has been stagnant, due the popularity of mobile phones as well as tariff rebalancing (raising local call charges and reducing international call tariffs). Although fixed-line competition is legal, in practice there is no strong

[7] See International Telecommunication Union (ITU) Mobile Cellular Statistics, available at: http://www.itu.int/ITU-D/ict/statistics/.

competitor to the BTC. The privatization of the BTC had also been postponed until 2011 due to the uncertainty of the global economy.[8]

Internet penetration is low, some six times less than the upper-middle-income average. According to the most recent survey, carried out between 2007 and 2008, Internet penetration among those aged 16 years and older was 5.8 percent (Gillwald and Stork 2008). Broadband pricing is below the Sub-Saharan Africa average but nonetheless remains high for most of Botswana. The BTC charges Internet service providers (ISPs) a fee to provide broadband service over fixed telephone lines, which is allegedly not cost based. Furthermore, since the BTC also provides retail broadband service there is a perception that it is favoring its own Internet subsidiary, Botsnet.

Despite a relatively high level of international bandwidth (figure 14), connectivity remains a challenge due to Botswana's landlocked situation. The BTC has a national fiber backbone with connections to the SAT-3 undersea cable. Greater redundancy is planned through connections to the Eastern Africa Submarine Cable System (EASSy) and West Africa Cable System (WACS). The BTC's control over almost all fixed Internet infrastructure has resulted in high wholesale costs, with a number of ISPs using alternative VSAT[9] connections (Kende and Gibb 2009). The liberalization of the sector should see mobile operators creating alternate international gateways to support their recently launched wireless broadband services. It is expected that this will inject greater wholesale and retail competition into the broadband market.

Other factors contributing to low Internet penetration are exogenous to the ICT services sector. Home computer penetration is only 7 percent (Central Statistics Office 2009), the level of digital literacy is low, and there is a lack of local content. Another problem is a lack of electricity in certain areas.

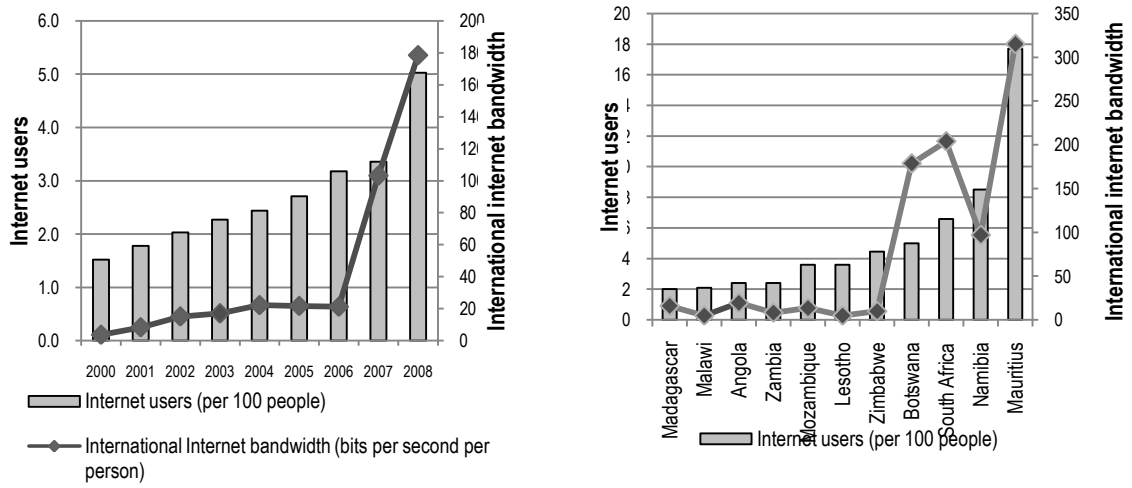
Although mobile performance has been impressive, there is still room for improvement. Mobile tariffs have not decreased substantially in local currency terms. While mobile coverage is relatively high, there are still pockets of rural areas that do not have a signal. The government's Nteletsa project aims to remedy this by providing subsidies to mobile operators to extend coverage in rural areas.

[8] "The privatization effort, initiated in 2006 was postponed in 2008, due to unfavorable capital markets. Deteriorating global capital markets mean privatisation transactions can not take place at the present time" (BTC 2009). An IPO began in 2011 (see: http://investing.businessweek.com/research/stocks/private/snapshot.asp?privcapId=13775542).

[9] Very small aperture terminal.

Figure 14. Botswana's Internet market benchmarked against its southern African peers

a. Internet service trends, Botswana, 2000–08 **b. Internet service trends, southern Africa**



Source: AICD. Information and Communications for Development database

Financing Botswana's infrastructure

To meet its most pressing infrastructure needs and catch up with developing countries in other parts of the world, Botswana needs to expand its infrastructure assets in key areas (table 13). The targets outlined in table 13 are purely illustrative, but they represent a level of aspiration that is not unreasonable. Developed in a standardized way across African countries, they allow for cross-country comparisons of the affordability of meeting the targets, which can be modified or delayed as needed to achieve financial balance. Admittedly, for middle-income countries in Africa, the proposed targets might look relatively modest to what the country can and has assumed as policy targets. For example, achieving the Millennium Development Goal in water and sanitation looks like a modest goal for Botswana; whose access policy is to attain universal access to piped water by the end of 2016. Therefore, the spending needs proposed here can be regarded very much as a lower bound spending needs for Botswana.

Meeting these illustrative infrastructure targets in the country would cost $785 million per year over a decade. Capital expenditure would account for 55 percent of this requirement. Meeting growing demand for power—the sector with the highest spending needs—would require an estimated $462 million per year to install almost 2,141 MW of new generation capacity and expand electrification. The water and sanitation sector is the area with the second-highest spending needs: about $141 million will be needed each year to meet the MDGs, split evenly between capital and current expenditure needs. Another $107 million per year will be required by the transport sector. While less than the amounts needed for other sectors, requirements for ICT are also high in absolute terms, amounting to around $70 million a year (table 14).

Table 13. Illustrative investment targets for infrastructure in Botswana

	Economic target	Social target
ICT	Install fiber-optic links to neighboring capitals and submarine cable.	Provide universal access to GSM signal and public broadband facilities.
Irrigation	Develop additional 25,243 hectares of large-scale and 553 hectares of economically viable small-scale irrigation.	n.a.
Power	Develop 2,141 MW of new generation capacity and 2,120 MW interconnectors.	Increase electrification to 80 percent of the population.
Transport	Achieve regional (national) connectivity with good-quality 2-lane (1-lane) paved road.	Provide rural road access to 79 percent of the highest-value agricultural land, and urban road access within 500 meters.
WSS	n.a.	Achieve Millennium Development Goals, clear sector rehabilitation backlog.

Source: Mayer and others 2009; Rosnes and Vennemo 2009; Carruthers, Krishnamani, and Murray 2009; You and others 2009.
Note: WSS = water supply and sanitation; ICT = information and communication technology; GSM = global system for mobile communications. n.a. = Not applicable.

Table 14. Indicative infrastructure spending needs in Botswana, 2006–15

$ million per year

Sector	Capital expenditure	Operations and maintenance	Total needs
ICT	38	32	70
Irrigation	5	—	5
Power	261	201	462
Transport	57	50	107
Water supply and sanitation	70	71	141
Total	431	354	785

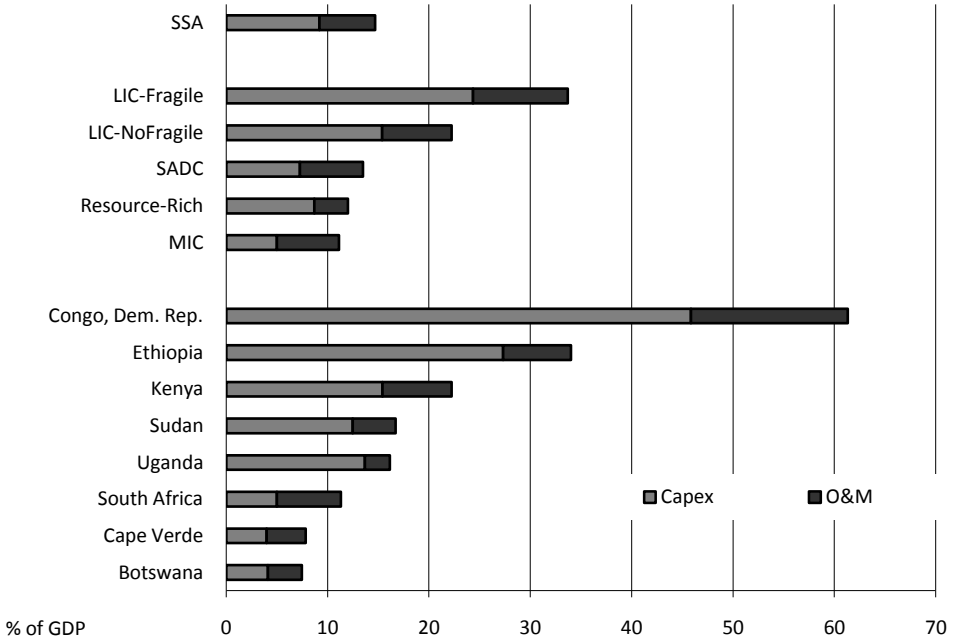
Source: Mayer and others 2009; Rosnes and Vennemo 2009; Carruthers, Krishnamani, and Murray 2009; You and others, AICD 2009. Derived from models that are available online at www.infrastructureafrica.org/aicd/tools/models.
Note: WSS = water supply and sanitation; ICT = information and communication technology.

Botswana's infrastructure spending needs are comparatively low in GDP terms. Botswana's burden of needs, at 7.5 percent of GDP, is among lowest in the region (figure 15) and seems very affordable for the country. Investment would absorb around 4 percent of GDP, less than a quarter of what China invested in its infrastructure during the mid-2000s.

Botswana already spends a sizable amount ($815 million per year) to meet its infrastructure needs (table 15). About 53 percent of the total is allocated to capital expenditure and 47 percent to operating expenditures. Operating expenditures are entirely covered from budgetary resources and payments by infrastructure users. Most of capital expenditure funding—around 93 percent—comes out of state coffers. The private sector accounts for another 4 percent of capital spending. Non-OECD finance at 2 percent and ODA flows at less than 1 percent also play a smaller, but nonetheless significant, role.

Figure 15. Botswana's infrastructure spending needs are among the lowest in the region, relative to GDP

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



Source: Foster and Briceño-Garmendia 2009.

Note: LIC = low-income country; MIC = middle-income country; SADC = Southern African Development Community; SSA = Sub-Saharan Africa; GDP = gross domestic product; O&M = operations and maintenance; CAPEX = capital expenditure.

Botswana's existing spending amounts to around 7.8 percent of GDP (figure 17). This is close to the average for middle-income states and for the Southern African Development Community (SADC). Relative to its peer group, Botswana is more heavily reliant on the public budget for ICT, transport, and water and sanitation investments. Botswana's spending effort on transport and water and sanitation is substantially higher than the respective average for MICs (figure 17). Consequently, the largest share of infrastructure spending goes to water and sanitation (40 percent), followed by transport (35 percent) and ICT (18 percent).

The composition of infrastructure financing in Botswana differs markedly from African peers. In particular, infrastructure is funded almost exclusively by public investment, reflecting the country's strong public finances. Particularly striking is the low level of private participation in infrastructure; even in the ICT sector where such funding typically dominates.

Table 15. Financial flows to Botswana's infrastructure, average 2001 to 2007

$ millions per year

	O&M	Capital expenditure					
	Public sector	Public sector	ODA	Non-OECD financiers	PPI	Total CAPEX	Total spending
ICT	80	56	0	0	19	76	155
Irrigation	—	—	0	0	0	0	0
Power (*)	101	35	1	0	0	35	137
Transport	106	140	0	9	0	149	256
WSS	95	172	1	0	0	172	268
Total	383	402	1	9	19	433	815

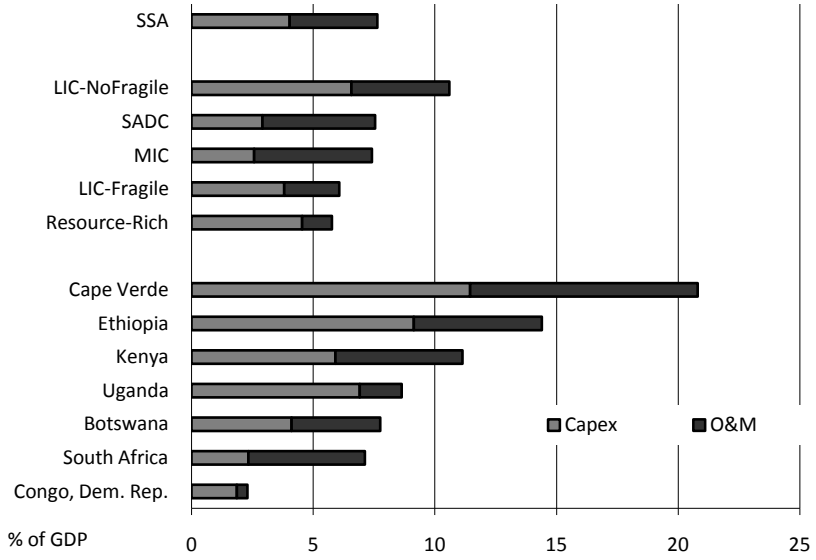
Source: Derived from Foster and Briceño-Garmendia (2009).

Note: O&M = operations and maintenance; ODA = official development assistance; PPI = private participation in infrastructure; CAPEX = capital expenditure; OECD = Organisation for Economic Co-operation and Development; WSS = water supply and sanitation; ICT = information and communication technology.

— = Not available.

(*) Table only considers period 2001-7, therefore it excludes the recent spending on Morupule

Figure 16. Botswana's existing infrastructure spending level is adequate



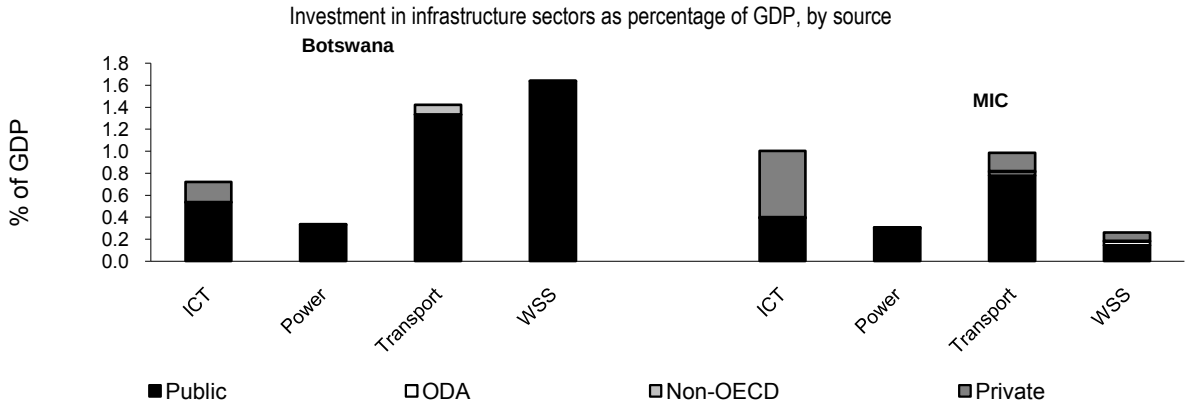
Source: Derived from Foster and Briceño-Garmendia (2009).

Note: LIC = low-income country; MIC = middle-income country; SADC = Southern African Development Community; SSA = Sub-Saharan Africa; GDP = gross domestic product; O&M= operations and maintenance; CAPEX = capital expenditure.

Despite its strong economy and good investment climate, during the mid-2000s, Botswana captured private investment commitments worth around only 0.2 percent of GDP, predominantly in the ICT sector. Most of Botswana's peers, many of them with much less favorable economic fundamentals, have done significantly better in this area. Countries such as the Democratic Republic of Congo, Liberia, Nigeria, Uganda, Kenya, and Senegal have all captured between 1.8 and 2.5 percent of GDP, while the most successful country in this regard—Guinea-Bissau—has captured in excess of 3.0 percent of GDP.

The recent experience of the Morupule coal-fired generation project, half of which has been funded with private resources, illustrates Botswana's considerable to raise private finance for other areas of infrastructure; such as power.

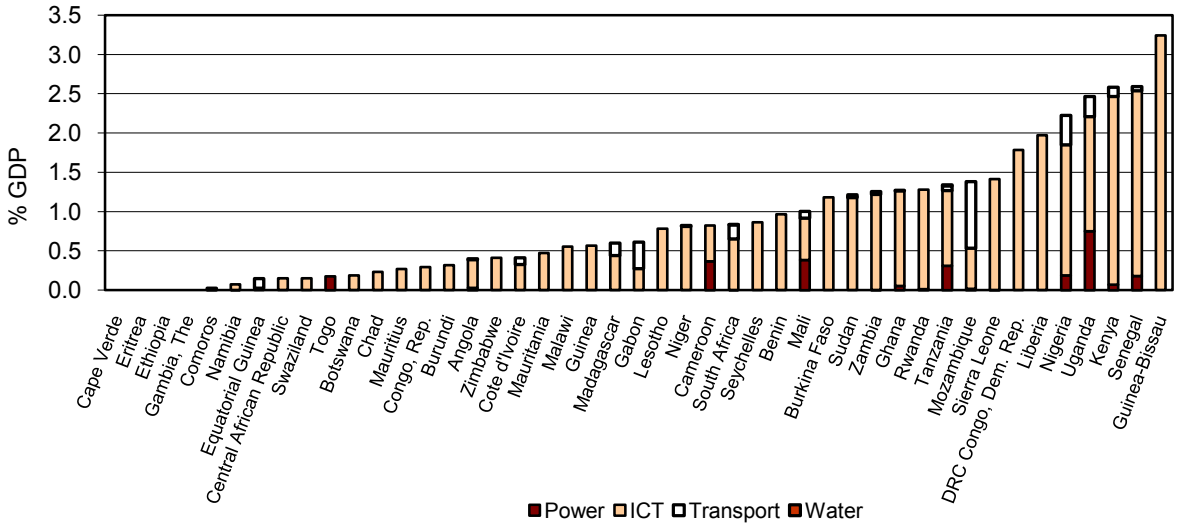
Figure 17. Botswana's pattern of capital investment in infrastructure differs from that of comparator countries



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

Note: Private investment includes self-financing by households. ODA = official development assistance; OECD = Organisation for Economic Co-operation and Development; ICT = information and communication technology; GDP = gross domestic product; WSS = water supply and sanitation; MIC = middle-income country.

Figure 18. Many African countries capture more private investment than Botswana



Source: Private Participation in Infrastructure Database (2009).

Note: GDP = gross domestic product; ICT = information and communication technology.

Efficiency gap

As of 2008, around $68 million of additional resources were lost each year by inefficiencies of different kinds (table 16). Budget underexecution was a significant issue in the transport sector, leading to

underspending of about $27.5 million worth of resources allocated to the sector. Lack of cost recovery via tariffs was a significant issue for Botswana's power and water utilities; representing losses of $20.3 million in the power sector and $12.9 million in the water sector annually.

Fortunately the government took rapid action to tackle and correct most of these inefficiencies. Nowadays Botswana reports full execution of capital budgets, while tariffs schedules and levels for the power and water sectors have been aligned with costs. As a result of these sound policy decisions, the country has been able to recoup close to $68 million a year that was being lost to inefficiency in the space of just two years.

Table 16. Botswana's historical losses due to operational efficiency (as of 2008)

	ICT	Irrigation	Power	Transport	WSS	Total
Underrecovery of costs	—	n.a.	20.3	Na.	12.9	33.2
Overstaffing	—	—	n.a.	—	n.a.	—
Distribution losses	—	—	0.4	—	0.0	0.4
Undercollection	—	n.a.	0.0	n.a.	1.3	1.3
Low budget execution	—	n.a.	0.0	27.5	5.5	33.0
Total	—	n.a.	20.7	27.5	19.7	67.9

Source: Derived from Foster and Briceño-Garmendia (2009).

Note: WSS = water supply and sanitation; ICT = information and communication technology.

— = Not applicable.

n.a. = Not available.

Funding gap

As of 2008, no major funding gaps were found for basic infrastructure provision in Botswana. The one exception was the power sector, where spending allocations were falling short of requirements by some $305 million annually. Once again, the government has moved swiftly and decisively to address this funding shortfall for power, by raising capital for the $1.6 billion Morupule power generation project. As a result, the funding gap for that sector has now closed.

Table 17. Funding gaps by sector (as of 2008)

$ millions per year

	ICT	Irrigation	**Power**	Transport	WSS	Total
Spending needs	(70)	(5)	**(462)**	(107)	(141)	(785)
Existing spending	155	n.a.	**137**	256	268	816
Reallocation potential within sectors	0	n.a.	**0**	0	0	0
Efficiency gap	—	0	**21**	27	20	68
Funding gap		**n.a.**	**(305)**			

Source: Derived from Foster and Briceño-Garmendia (2009).

Note: Potential overspending across sectors is not included in the calculation of the funding gap, because it cannot be assumed that it would be applied toward other infrastructure sectors. Figures based on annual averages for the period 2001–07.

— = Not available.

n.a. = not applicable.

Of course, as noted above, the spending needs defined in this study are for a standardized package of basic infrastructure. Given Botswana's strong economy and public finances, delivering this basic package does not look to be a significant problem. The country's aspirations, however, may legitimately go much further.

Nonetheless, Botswana stands out among its African peers, as one of the few countries that faces neither serious efficiency nor funding gaps for infrastructure; and that is in itself a remarkable achievement.

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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 (www.infrastructureafrica.org/aicd/documents), for databases to the data page (www.infrastructureafrica.org/aicd/tools/data), for models go to the models page (www.infrastructureafrica.org/aicd/tools/models), and for maps to the map page (www.infrastructureafrica.org/aicd/tools/maps). The references for the papers that were used to compile this country report are provided in the table below.

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COUNTRY DIAGNOSTIC

About AICD and its country reports

This study is a product of the Africa Infrastructure Country Diagnostic (AICD), a project designed to expand the world's knowledge of physical infrastructure in Africa. The 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 (AFD) in November 2009, synthesized the most significant findings of those reports.

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

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

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

Consistent with the genesis of the project, the main focus is on the 48 countries south of the Sahara that face the most severe infrastructure challenges. Some components of the study also cover North African countries so as to provide a broader point of reference. Unless otherwise stated, therefore, the term *Africa* is used throughout this report as shorthand for *Sub-Saharan Africa.*

The World Bank has implemented the AICD with the guidance of a steering committee that represents the African Union (AU), the New Partnership for Africa's Development (NEPAD), Africa's regional

economic communities, the African Development Bank (AfDB), the Development Bank of Southern Africa (DBSA), and major infrastructure donors.

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

The data underlying 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.