AICD
AFRICA INFRASTRUCTURE COUNTRY DIAGNOSTIC

BACKGROUND PAPER 16

An Unsteady Course: Growth and Challenges in Africa's Air Transport Industry

Heinrich C. Bofinger

JULY 2009

1818 H Street, NW
Washington, DC 20433 USA
Telephone: 202-473-1000
Internet: www.worldbank.org
E-mail: feedback@worldbank.org

A publication of the World Bank.

The World Bank
1818 H Street, NW
Washington, DC 20433 USA

Rights and permissions

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

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

AICD was commissioned by the Infrastructure Consortium for Africa after the 2005 G-8 summit at Gleneagles, which recognized the importance of scaling up donor finance for infrastructure in support of Africa's development.

The first phase of 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 is expanding to include as many other 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” will be used throughout this report as a shorthand for “Sub-Saharan Africa.”

The World Bank is implementing 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 AICD is provided by a multidonor trust fund to which the main contributors are the U.K.’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 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. Inquiries concerning the availability of data sets should be directed to the editors at the World Bank in Washington, DC.

Contents

Tables and figures

Summary

The air transport market in Sub-Saharan Africa presents a strong dichotomy. In southern and East Africa the market is growing. Three strong hubs and three major African carriers dominate international and domestic markets, which are becoming increasingly concentrated. In contrast, in Central and West Africa the sector is stagnating due to the collapse of Côte d'Ivoire and the demise of several regional airlines, including Air Afrique. Throughout Africa, subsidies enable many small, otherwise unviable state-owned operations to have a monopoly over domestic markets. Although there have been some promising signs—air traffic is on the rise, the number of routes and the size of aircraft are being adapted to the market, and a number of large carriers are viable and expanding—overall connectivity has been declining. As oil prices rise, the role of air transportation will be looked at even more critically. Africa is a poor continent, and some countries face the potential of further isolation as the cost of flying increases.

Infrastructure is not at the heart of the sector's problems: the number of airports is stable, and there are enough runways to handle traffic; what is required is better scheduling and relatively modest investment in parallel taxiways and some terminal facilities. Safety continues to be a problem, however: while aircraft are generally safe, pilot capabilities and safety administration are lacking and air traffic control facilities are poor. Although revenues from airports and air traffic are probably high enough to finance the necessary improvements, the sector has failed to capture them.

To inform the ongoing debate over Africa's infrastructure requirements, this report seeks to provide a more complete inventory of air transport capabilities than was previously available. It focuses on industry organization within Africa, overall accessibility, and the quality of oversight and infrastructure installations countrywide and at selected airports.

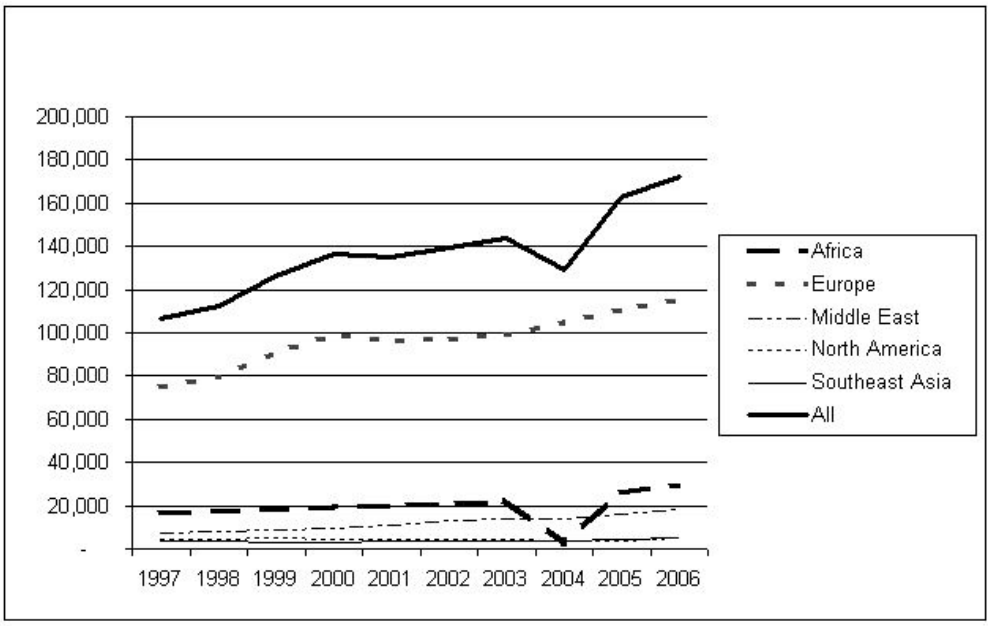
In addition to data collected from questionnaires sent directly to the civil aviation authorities (CAAs) in each country, this report relies on data collected through a variety of other sources—especially from the providers of flight schedules to global reservation systems—to ensure that its analysis of trends is independent and unbiased.

A continental divide in air traffic

Following a significant global decline in 2001, Africa's air transport industry grew at a healthy 5.76 percent per year between 2001 and 2007 (figure A). Traffic rose 10.68 percent between 2004 and 2007 to roughly 123 million seats annually. The aggregated figures for Africa, as measured in seats offered, show growth in all types of scheduled air travel: intercontinental traffic, international traffic within Africa, and domestic travel (figure B).

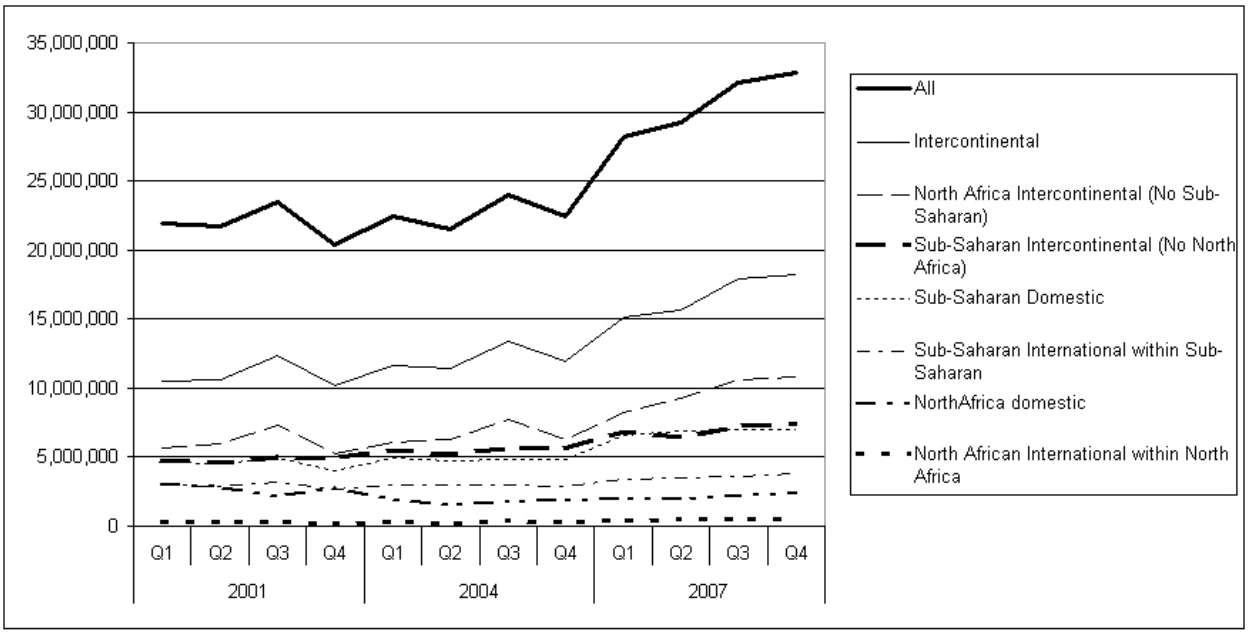
The countries' markets can be categorized by size: those with more than four million passengers are the largest, those with one million or more (but fewer than four million) are in the middle, and those with fewer than one million seats are at the low end (figure C). A swath of nations with small markets extends from Western Sahara in northwest Africa to the Democratic Republic of Congo (DRC). This group of nations reappears on maps showing regional growth zones in international traffic and the quality of safety oversight and even somewhat in ones depicting the nature of airline ownership.

Figure A Overall traffic, measured in seat kilometers, in Africa



Source: Boeing Commercial Aircraft.

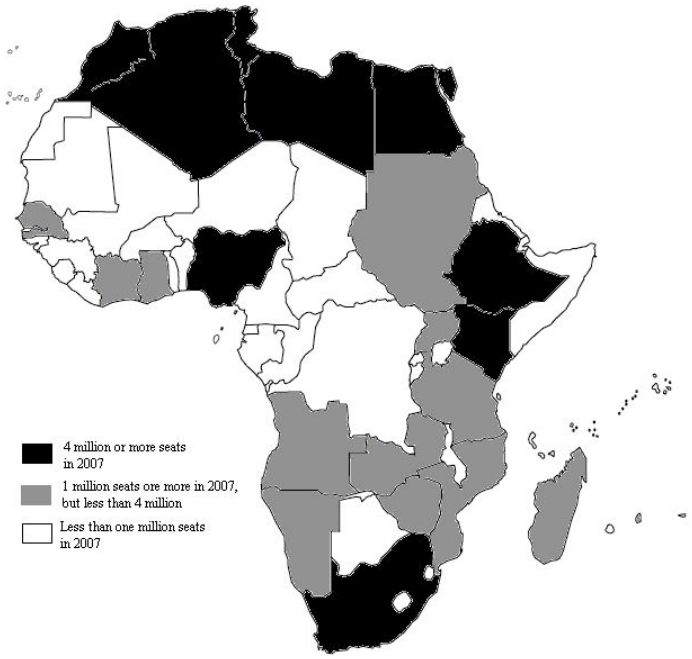
Figure B Overall traffic, measured in seats, in Africa



Source: Analysis of data provided by Diio's SRS Analyser.

Intercontinental traffic in the region relies heavily on the three major hubs of Johannesburg, Nairobi, and Addis Ababa. It has grown at an average annual rate of 6.2 percent between 2001 and 2007. While the South African routes to the United Kingdom and Germany are still the most heavily trafficked, there has been a significant rise in services to the Middle East from all of the main hubs. North African intercontinental traffic grew 8.3 percent during the same period, with routes between France and Morocco, Algeria, and Tunisia being the most dominant. In addition, Egypt is an important entry point from Germany, the Russian Federation, and the Middle East.

Figure C Markets segmented by size (in seats available, 2007)



Source: Analysis of data provided by Diio's SRS Analyser.

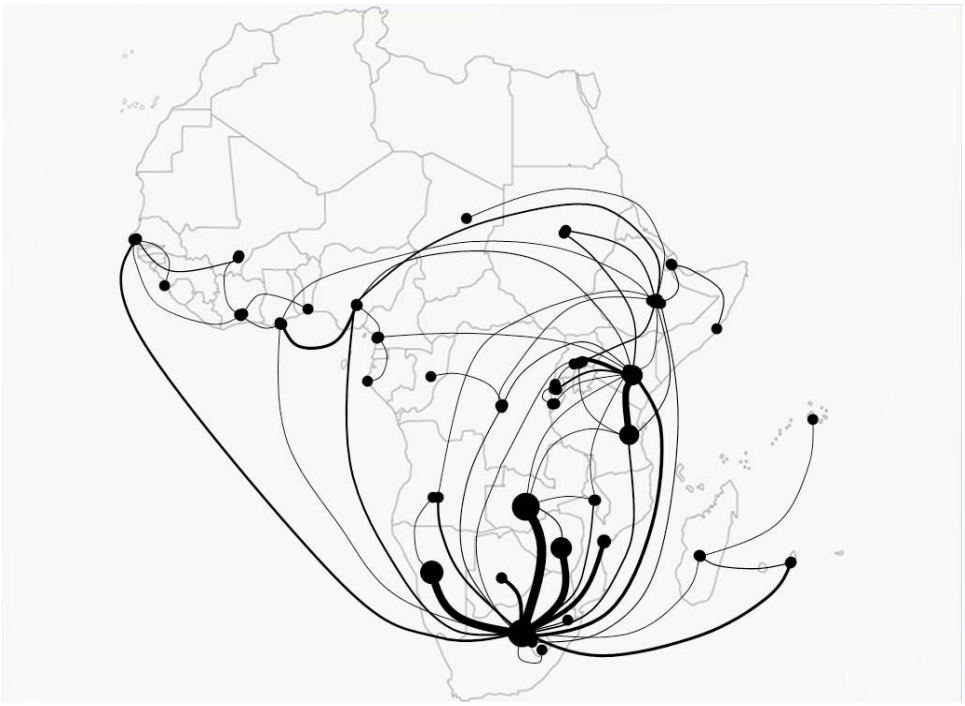
Note: Cape Verde, not on the map, falls in the middle tier. The swath of countries with small markets from Western Sahara/Mauritania to the DRC is easily visible.

International traffic within Sub-Saharan Africa grew more rapidly than intercontinental traffic, at an average of 6.5 percent per year between 2001 and 2007. In addition, traffic between the region and North Africa increased by 25 percent per year. The same three major hubs—Johannesburg, Nairobi, and Addis Ababa—handled 36 percent of international traffic (figure D). Traffic within Sub-Saharan-African was dominated by national carriers: South African Airways, Kenya Airlines, and Ethiopian Airlines accounted for 34 percent, 74 percent, and 86 percent, respectively, of the international Sub-Saharan traffic through their hubs in 2007. Both Kenya Airways and Ethiopian Airlines have developed new routes on which they are the sole carrier. On the other hand, South African Airways competes with one or more carrier on most of its international routes.

East Africa has a more developed air travel network than West and Central Africa, where only Nigeria has a significant number of connections, both intercontinental and international, with Senegal coming in second. With the recent collapse of many national and regional carriers, West and Central Africa have suffered an absolute decline in service. Meanwhile, North African international travel showed gains of more than 9.5 percent per year between 2001 and 2007.

Even though there has been an overall growth in air traffic, the number of city pairs served in Sub-Saharan Africa dropped by 229 between 2001 and 2007. Excluding South Africa, Nigeria, and Mozambique, the number of city pairs has declined by 137 routes between 2004 and 2007, corresponding to an average decline of 1 percent per year.

Figure D Top 60 international routes in Sub-Saharan Africa



Source: Analysis of data provided by Diio's SRS Analyser.

The impact of the Yamoussoukro Decision (YD) of 1999, an effort to liberalize international air travel within Africa, is best measured by the amount of fifth-freedom and beyond traffic within Africa.[1] The percentage of international flights conducted by carriers not part of either country being served is highest in countries with the highest YD score (table A). Except for the Arab Maghreb Union (AMU), which is not a party to the YD, all countries have shown an increased market proportion of these airlines between 2004 and 2007.

Table A Percentage of flights between countries by airlines that are not based in either country being served

	AMU (%)	BAG (%)	CEMAC (%)	COMESA (%)	EAC (%)	SADC (%)	WAEMU (%)
Seats 2001	7.6	45.3	38.0	25.4	33.0	18.7	47.7
Seats 2004	8.3	36.3	11.8	9.9	12.2	2.3	43.7
Seats 2007	4.1	43.3	28.5	14.1	16.4	5.7	43.8
YD score	1	4	5	3	3	2	5

Source: Analysis on data provided by Diio's SRS Analyser.

Note: YD = Yamoussoukro Decision of 1999; AMU = Arab Maghreb Union; BAG = Banjul Accord Group; CEMAC = Economic and Monetary Community of Central Africa; COMESA = Common Market of Eastern and Southern Africa; EAC = East African Community; SADC = Southern African Development Community; WAEMU = West African Economic and Monetary Union.

[1] See appendix 11 for a brief explanation of the freedoms of the air.

Domestic Sub-Saharan African traffic had the fastest growth rate of all Sub-Saharan African traffic—more than 12 percent per year between 2001 and 2007. Yet this growth was not evenly distributed. For example, annual growth in domestic traffic in Nigeria reached as high as 67 percent, while about half of the countries studied saw an absolute decline. This discrepancy may be explained by the fact that domestic air transport depends on many factors, including topology, income per capita, and types of services available. Ethiopia, for example, is home to one of the most important airlines in Africa but has relatively little domestic air transport, whereas domestic travel in Nigeria has skyrocketed. North African domestic traffic, meanwhile, has declined nearly 4 percent per year between 2001 and 2007. With some notable exceptions, domestic travel in most countries is serviced by the country's flag carrier and features high market concentration.

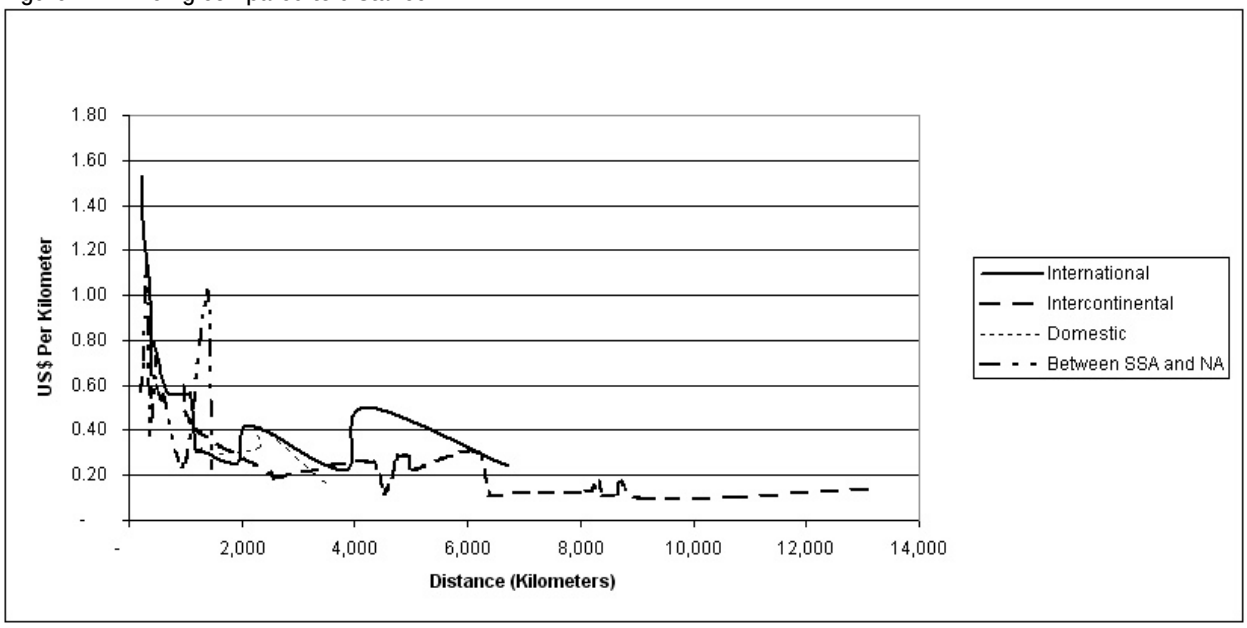
Overall, a striking dichotomy emerges between the eastern and western sides of the continent. On the one hand, East and southern Africa have developed major hubs and are home to the three most important airlines in Sub-Saharan Africa. These airlines spur economic growth throughout the region, which is served by a dense network of routes. Air service in West and Central Africa, on the other hand, experienced steep declines shortly after 2001, followed by modest growth or further decline. The hub system in those regions remains less developed.

The uneven growth patterns in Sub-Saharan Africa were caused in part by the collapse of major carriers—most notably Air Afrique, Air Gabon, Ghana Airways, and Nigerian Airways—in the western portion of the continent. While these collapses brought about a short-term drop in capacity, they have also spurred a much-needed consolidation of the industry in Sub-Saharan Africa. Major carriers in the south and the east are gradually expanding into western markets. Ethiopian Airlines, South African Airways, and Kenya Airways are taking over some of the discontinued routes, and east-west traffic is slowly growing.

Contrary to media reports, Africa's fleet of aircraft used for advertised scheduled services is being renewed and adjusted for the types of markets served. In nearly all regions, wide-bodied aircraft have been replaced with newer, smaller jets—such as the Boeing 737—which are more efficient for short to medium distances. Though the accident rates involving older, often Russian-built, aircraft are the highest in the world, the number of seat kilometers flown in these aircraft on regularly scheduled services is now very small.

Air travel within Africa is considerably more expensive per mile flown than intercontinental travel, especially on routes of fewer than 4,000 kilometers (figure E). This is because intercontinental routes serve larger markets than international or domestic ones and thus have more competition among carriers. Domestic fares are kept artificially low by subsidized or fixed pricing on some routes, and a recent study by Intervistas for the International Air Transport Association (IATA) concluded that the price elasticity of air transport within Africa is relatively high.

Figure E Pricing compared to distance



Source: Analysis on data collected by the World Bank.
Note: Includes North Africa.

Airside versus landside infrastructure

As of November 2007, 280 out of an estimated 2,900 airports in Africa were receiving regularly scheduled services. That total includes two massive gateways (Egypt and South Africa) and six additional important entry points (Morocco, Algeria, Tunisia, Senegal, Ethiopia, and Kenya). The number of available runways and their general condition did not seem to be a constraint on traffic, although the condition of the airport infrastructure varied widely. An informal analysis of runway conditions using commonly available satellite images revealed that the 25 percent of runways in marginal or poor condition handle only an estimated 4 percent of Sub-Saharan traffic (table B).

Table B Runway quality in Africa

Rating	North Africa		Sub-Saharan Africa	
	Airports	%	Airports	%
Excellent	28	60	31	17
Very good	17	36	51	28
Fair	2	4	52	29
Marginal	–	–	8	4
Poor	–	–	37	21
Totals	47	100	179	100

Source: Analysis based on data collected by the World Bank.
Totals include double counting for in-region travel.

Runway capacity in Africa is not a limiting factor for traffic. Limiting factors for traffic include the ability to enter or leave the runway via taxiways, the amount of apron space for parking, and the amount of terminal space for processing passengers. North African countries have planned and developed their airports for expected increases in passenger traffic and have the capacity to handle expected increases in the number of travelers. Sub-Saharan airports, on the other hand, exhibit clear capacity constraints even at major airports, such as John Kenyatta International Airport in Nairobi, Kenya. In addition, landside infrastructure requires large capital investments.

The larger airports in Africa are generally financially sustainable in their operations, with excess revenues going either to the airports in the system that are not self-sufficient or to uses other than airports. The revenue stream for airports in Africa is somewhat different from those found in the West. Car rental booths and other concessions supply a larger portion of the revenues in the United States than in Africa, where airports rely heavily on passenger charges. Airport charges are higher in Africa than in the West, but they vary considerably. In some cases excessive charges may be levied to finance construction of a new airport rather than upgrading existing facilities at a much lower overall cost.

Private sector participation in airports is limited throughout Africa, although some interesting examples, such as Airports Company South Africa Ltd, do exist. In most cases, private sector involvement has been limited to some concessions and management contracts, usually involving small investments.

Air navigation services and air traffic control throughout Sub-Saharan Africa is spotty and concentrated in a few centers. South Africa and Kenya have several radar installations for monitoring traffic. Ethiopia, which has the third most important airport in Sub-Saharan Africa, has no air traffic surveillance technology.

The most important airports in the region feature instrument landing systems (ILSs) and basic traditional navigation aids. Away from the centers, navigation aids and communication stations are rare. African airports may not need to invest in radio-based navigation and surveillance infrastructure, such as very high frequency omni-directional radio range (VOR) or radar technology, but they will need to obtain less costly, satellite-based replacements, such as the global navigation satellite system (GNSS) and the automatic dependent *surveillance*-broadcast (ADS-B) technologies.

Institutions and oversight

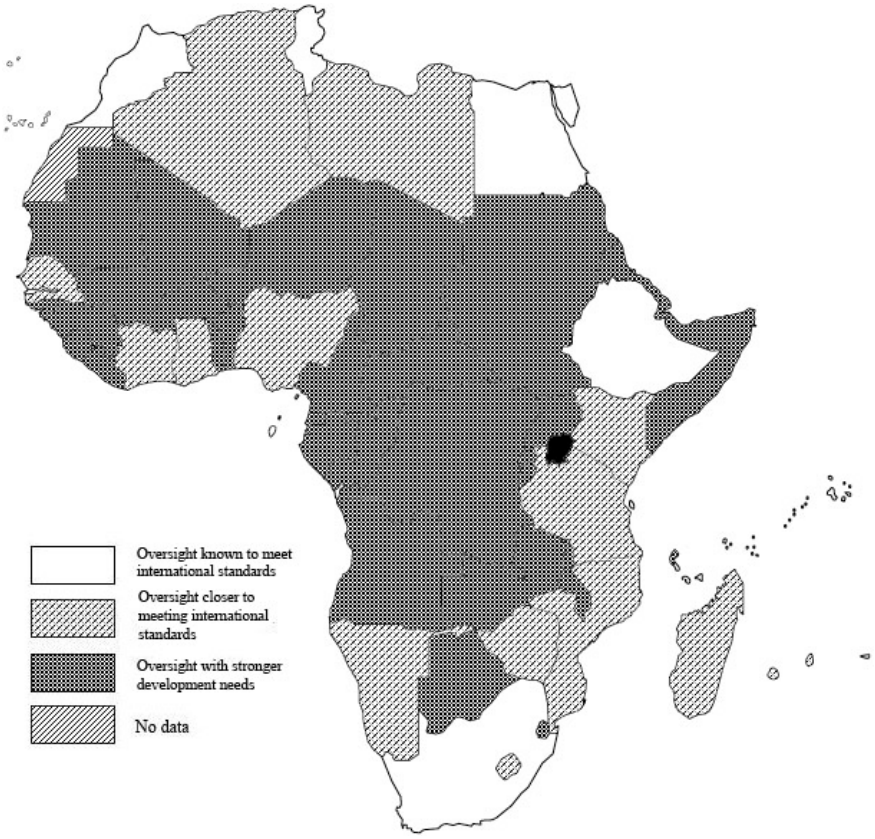
Sub-Saharan Africa's CAAs are generally underfunded. In particular, safety inspectors lack the capacity to fulfill their duty. Anecdotal evidence has shown that political influence hampers authorities that are not autonomous. In many cases, revenues received by the CAAs, such as overflight charges, are handed to the state treasury. The CAAs are therefore dependent on state allocations for financing.

Current accident rates in Africa reflect the lack of institutional capacity. Africa has both the highest accident rate of Eastern-built aircraft and the highest accident rate of Western jets outside the former Soviet Union.[2] The accidents are a result of poor training and the failure (whether unknowing or willful) to follow procedures; they rarely can be attributed to equipment failure alone. For example, a recent accident involved a plane that was less than a year old.

[2] The validity of the calculations for the accident rate in the former Soviet Union is a matter of controversy, but it is commonly accepted that Africa is the least safe continent for air travel.

Figure F shows how African countries rate in terms of their quality of safety oversight. Only a handful of countries—Egypt, Ethiopia, Morocco, South Africa, and Tunisia—are rated as having good oversight, while 24 countries are rated as having poor oversight.

Figure F Quality of African safety oversight



Note: Since this map was produced, Gabon has been added to the list of countries with serious oversight problems. Cape Verde (not shown) carries the U.S. Federal Aviation Administration (FAA) category 1 rating for good oversight and adherence to international standards.

To improve oversight, programs such as the Cooperative Development of Operational Safety and Continuing Airworthiness Projects (COSCAPs) are being proposed and implemented. In some cases, regional organizations pool resources from individual countries and oversight agencies to train and share qualified technical personnel, such as flight inspectors. Those efforts are in their early stages, and their effectiveness is therefore unknown. Regardless, similar programs have been highly effective in other regions, such as Latin America.

Policy recommendations

Based on available evidence, we have six general policy recommendations:

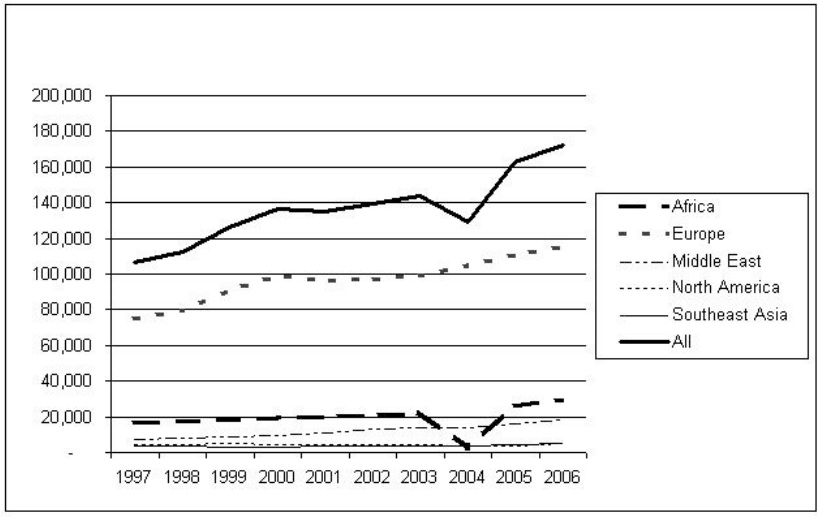
- Increase safety oversight by pooling resources and sharing them regionally.
- Invest in existing airport infrastructure, not new airports.
- Move away from unsustainable state-owned carriers.
- Develop new technology based on air traffic control systems and optimize airspace design for improved fuel efficiency and a smaller environmental footprint.
- Continue the process of liberalization as set forth in the YD.
- Develop and strengthen capacity in data collection for the air transport sector.

1 Airlines and routes

Overview of traffic and intercontinental capacities

Africa, though overall the smallest player in the air transport sector (with less than 3.7 percent of the global market in 2007), saw significant growth during the study period, especially between 2001 and 2004. This growth was found primarily in intercontinental traffic, in certain regions in international traffic, and in certain countries in domestic traffic, such as in Nigeria. As seen in figure 1.1, traffic as measured in revenue passenger kilometers (RPKs) grew steadily between 1997 and 2001. After a slight downturn following September 11, 2001, traffic continued to grow in 2002 and 2003, until the collapse of several African airlines brought about a significant reduction in intra-African traffic in 2004. As new capacity entered the marketplace between 2005 and 2006, however, traffic picked up, even beyond the losses of 2004. Overall traffic figures (using estimated seats as an indicator of overall passenger numbers) are summarized in the first row of table 1.1. The market grew at an annual rate of 5.8 percent between 2001 and 2007, and as of 2007 consists of roughly 122.5 million passenger seats. The growth rate was much lower between 2001 and 2004, and, conversely, the much higher between 2004 and 2007 at 10.7 percent. Growth has been seen in all aggregated figures for Africa in intercontinental travel, international travel within Africa, and domestic travel. Figure 1.2 provides a graphic representation of annual growth rates in various markets between 2004 and 2007. A graphic representation of table 1.1, also showing seasonal swings, is found in figure 1.3.

Figure 1.1 African revenue passenger kilometers (in millions), 1997–2006, select segments



Source: Analysis on data provided by Boeing.
Note: Some markets not included due to missing data.

Market forecasts for the airline industry are difficult to make because of fluctuating fuel prices and the global economic crisis. In 2008 the price of oil rose to $150 per barrel, which caused significant damage to the airline industry. Since then prices have declined by nearly two-thirds, but as the industry recovers from the oil shock it faces declining demand due to the global recession. Without knowing when the global economy will recover or how the oil markets will behave (especially as demand for fuel increases post-recovery), it is difficult to predict global air traffic volumes.

Preliminary data for Africa indicate a pronounced downturn in estimated capacity in the last quarter of 2008. The overall figures for the year, however, seem to indicate a continuation of the growth seen between 2004 and 2007. Even in a downturn, growth can be expected in parts of the developing world; for example, growth may slow but not decline overall. It is too early to conclude if this will be the case in Africa.

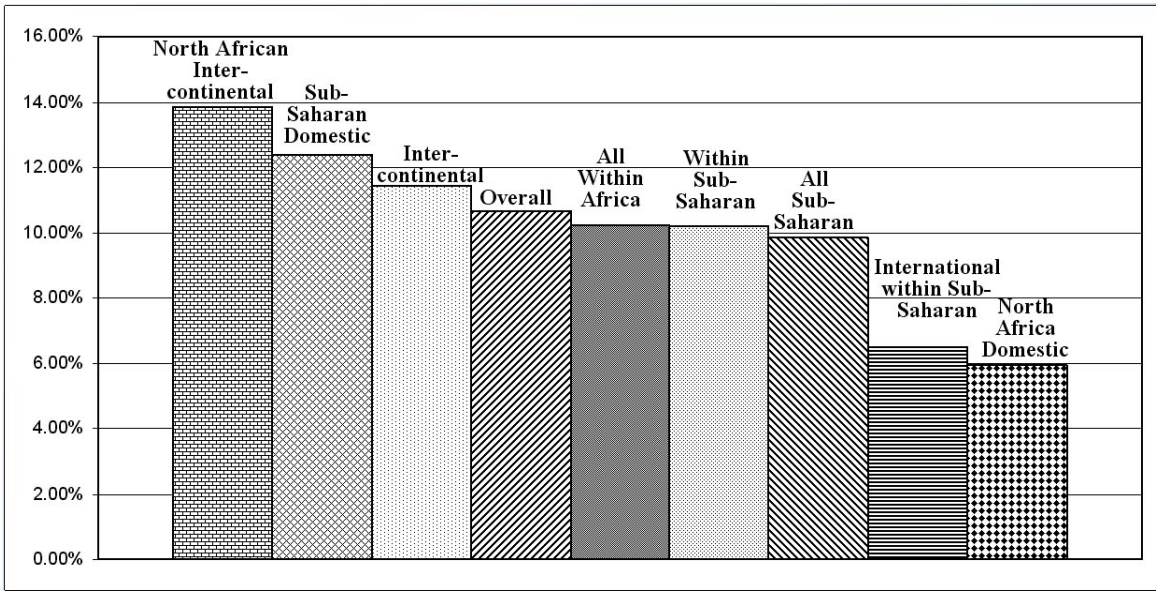
Table 1.1 Estimated seats and growth rates in African air transport markets

Market	Estimated seats 2001 (millions)	Estimated seats 2004 (millions)	Estimated seats 2007 (millions)	Growth 2001–4 (%)	Growth 2004–7 (%)	Growth 2001–7 (%)
All markets	87.5	90.3	122.4	1.1	10.7	5.8
Intercontinental	43.7	48.4	66.9	3.5	11.4	7.4
All Sub-Saharan	50.4	54.5	72.3	2.7	9.9	6.2
All within Africa	42.8	40.9	54.7	-1.5	10.2	4.2
Sub-Saharan domestic	18.2	19.4	27.5	2.1	12.4	7.1
North African international within North Africa	1.1	1.3	2.0	3.2	16.6	9.7
Sub-Saharan international within Sub-Saharan	11.8	11.9	14.3	0.3	6.5	3.4
North African domestic	10.7	7.1	8.4	-12.9	6.0	-3.9
Sub-Saharan intercontinental (no North Africa)	19.5	22.1	28.1	4.1	8.4	6.2
North African intercontinental (no Sub-Saharan)	24.1	26.3	38.8	2.9	13.9	8.3
Between North Africa and Sub-Saharan Africa	0.9	1.3	2.5	11.1	24.8	17.8
Other	1.0	1.1	0.8	1.2	-9.6	-4.3

Source: Analysis of data provided by Diio's SRS Analyser.

Note: Since the markets listed overlap, totals of the different submarkets add up to more than the overall total shown in the first line.

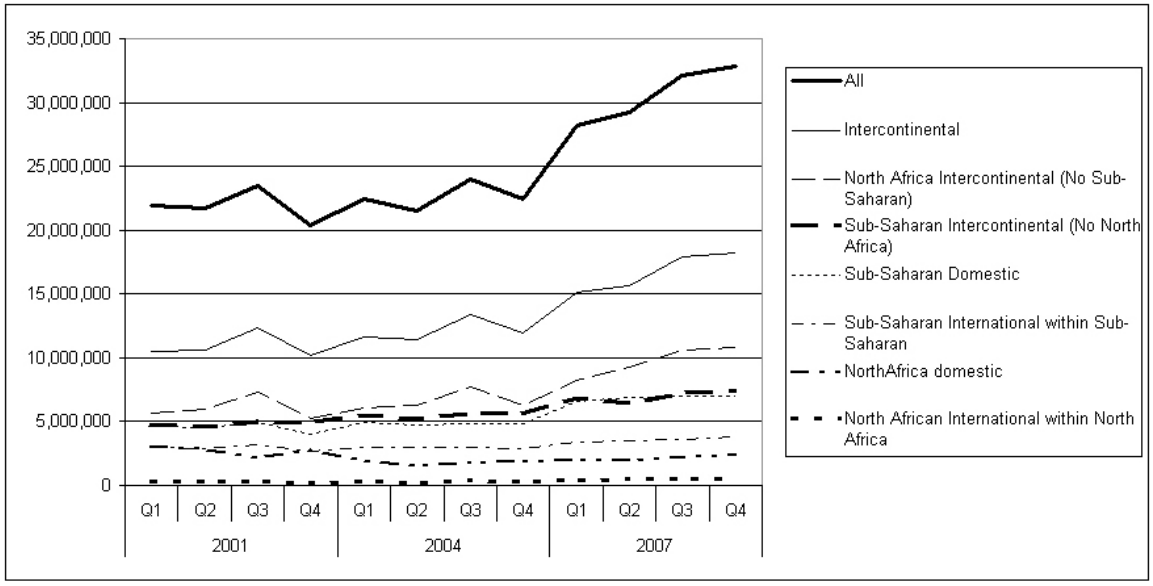
Figure 1.2 Annualized growth rates in seat capacity by travel type, 2004–07



Source: Analysis of data provided by Diio's SRS Analyser.

Note: Growth in Sub-Saharan domestic travel nearly rivals that of intercontinental travel in North Africa.

Figure 1.3 Traffic according to markets, measured in estimated seats



Source: Analysis of data provided by Diio's SRS Analyser.

Note: The greatest seasonality can be seen in intercontinental travel, with particular peaks in late summer (July–September). But recent overall growth in intercontinental travel has masked the phenomena.

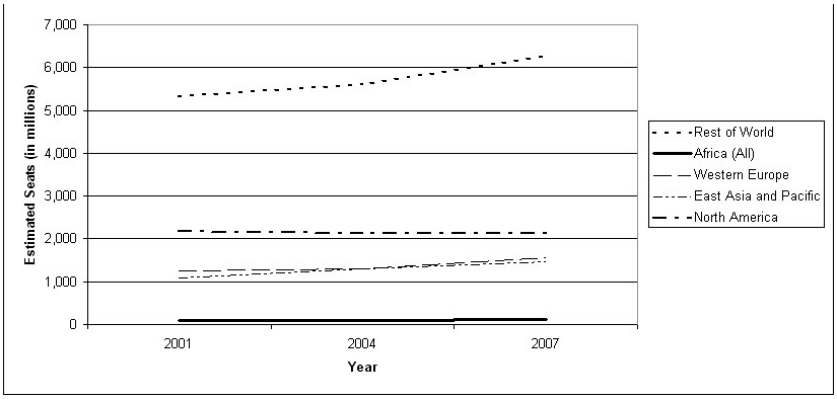
Box 1.1 A comparison of Sub-Saharan air transport with that of other world markets

Although this report is focused on the distribution of various kinds of traffic within the continent, comparing the African air transport market to those outside the continent can put its capacity into perspective.

The traffic for all of Sub-Saharan Africa (roughly 72.3 million seats in 2007) was just ahead of the air traffic volumes reported by the Spanish capital, Madrid (estimated at 68.5 million in 2007). The combined domestic traffic for all of Sub-Saharan Africa (27.5 million) was just over twice the overall traffic for the French city of Nice (13.1 million in 2007). The North and Sub-Saharan African markets combined total about 122.4 million seats, compared to about 103.9 million in the U.S. city of Atlanta in 2007. Overall traffic in John F. Kennedy International Airport in New York alone exceeded intercontinental traffic in all of Africa for both 2001 and 2004.

In terms of growth rates, however, Africa is outpacing the rest of the world. While the rest of the world had an overall traffic growth of 18 percent between 2001 and 2007, total African traffic gained nearly 40 percent and Sub-Saharan traffic as much as 46.5 percent during the same period. The two figures below show the overall size of African markets versus the rest of the world and related growth.

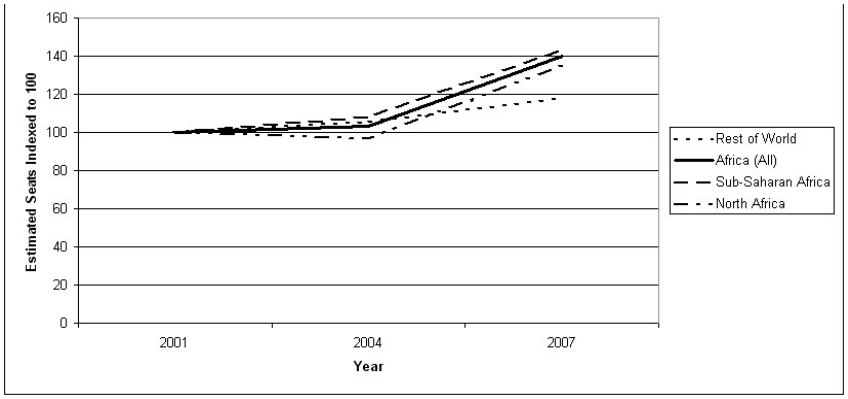
Sub-Saharan air traffic in seats relative to world



Source: Analysis of data provided by Diio's SRS Analyser.

Growth in Sub-Saharan air traffic relative to rest of world

Indexed to 100

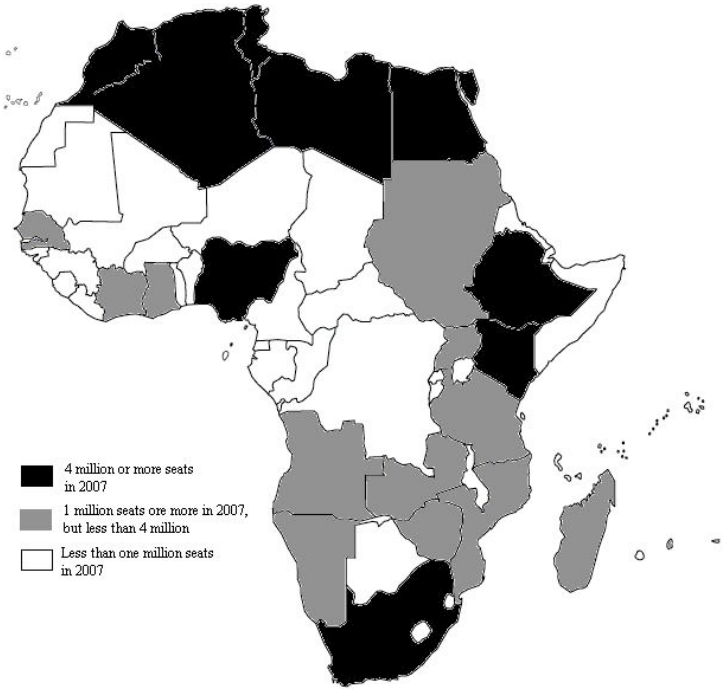


Source: Analysis of data provided by Diio's SRS Analyser.

Although the overall growth rate of air transport in Sub-Saharan Africa has been significant, it has also been highly uneven. In fact, the distribution of traffic is so concentrated in some areas that by some measures the combined traffic of Egypt and South Africa represents about 50 percent of the entire traffic in Africa (Airports Council International 2007: 4). West and Central Africa underwent a significant decline following the collapse of several significant airlines, including Air Afrique, and have not yet fully recovered. East and southern Africa, on the other hand, have benefited from the growth and development of three key players: South African Airways, Ethiopian Airlines, and Kenya Airways. One of the weakest points in connectivity lies between the better-developed network in East Africa and countries in West and Central Africa. As liberalization gains a foothold throughout Africa, however, that gap is slowly being filled by the major carriers from East Africa.

The African market can be split into three general categories: those with 4 million or more seats in 2007, those with 1 million or more seats, and those with fewer than 1 million seats (figure 1.4). Except for Nigeria, the countries with the largest markets are found in the north and south of the continent, with medium-size markets mainly concentrated in the east (with the exceptions of Ghana, Côte d'Ivoire, and Senegal). Out of 15 land locked countries, almost 75 percent have fewer than 1 million seats, compared to 50 percent in countries with coasts. This geographic pattern will reappear, with variations, in later discussions concerning regional growth and safety oversight.

Figure 1.4 Air transport market size in Africa (by seats available in 2007)



Source: Analysis of data provided by Diio's SRS Analyser.
Note: Cape Verde, not on the map, falls in the middle tier. Note the swath of countries with small markets, visible from Western Sahara/Mauritania to the DRC.

Today, 15 airlines constitute 59.1 percent of the total market share of all seats in Africa, down from a combined total of over 63.9 percent in 2001. Particularly noticeable are the loss of market share by South African Airways, —from roughly 16 percent in 2001 to 14 percent as of November 2007—and the decline of British Airways. Meanwhile, Ethiopian Airlines and Qatar Airways are growing at a healthy rate. The most significant growth in capacity, however, is shown by Emirates, which increased more than threefold from 960,000 to over 3.6 million seats between 2001 and 2004, and now accounts for almost 3 percent of the entire market. South African's Comair, an old and established airline with franchise agreements with British Airways, has also shown significant growth. Table 1.2 shows the top 15 carriers with their respective overall share in a market with a capacity of 130

million seats and 319 billion seat kilometers as of 2007. The overall market is split roughly 50-50 between African and non-African carriers.[3]

Table 1.2 Top 15 airlines in the African passenger air transport market

Rank	Airline	Estimated total seat kilometers 2007 (millions)	Market share 2001 (%)	Market share 2007 (%)
1	South African Airways	34,112	15.7	10.7
2	Air France	22,707	7.7	7.1
3	EgyptAir	21,636	7.0	6.8
4	British Airways P.L.C.	17,150	9.7	5.4
5	Emirates	14,504	1.1	4.5
6	Royal Air Maroc	13,772	3.4	4.3
7	Ethiopian Airlines Enterprise	12,493	2.1	3.9
8	Kenya Airways	11,602	2.4	3.6
9	KLM	10,688	3.4	3.3
10	Air Mauritius	8,598	3.3	2.7
11	Deutsche Lufthansa AG	7,676	2.5	2.4
12	Air Algerie	5,851	2.1	1.8
13	Virgin Atlantic Airways Limited	5,171	1.4	1.6
14	Tunisair	5,035	1.9	1.6
15	Qatar Airways (W.L.L.)	4,623	0.2	1.4

Source: Analysis of data provided by Diio's SRS Analyser.

Note: The total scheduled seat capacity of an estimated 168 airlines was roughly 130 million in 2007, for a total of 319 billion seat kilometers.

Of the 53 African states discussed, 25 have a national airline with at least 51 percent state ownership. The financial conditions and operating abilities of the majority of those (mostly small) airlines are cause for concern; in most cases, they are subsidized operations incurring large losses. Operating costs are higher in Africa, in part because of the higher costs of fuel, maintenance, and insurance. In all too many cases the airlines are not able to manage those difficulties in very limited markets.

The state or "flag" carriers can be divided into two main groups: dominant, healthy players, of which there are only five or six on the continent (Royal Air Maroc, Kenyan Airways, South African Airways, Ethiopian Airways, Egypt Air, and perhaps Air Tunisia); and the rest, which often run large operating deficits. Although the role of successful private airlines may be growing, the behemoths of the region are all in effect state-owned carriers, even if they operate as separate corporate units. This makes the argument against state carriers more difficult. When the elimination of failing flag carriers is recommended, inevitably one hears that their problems are not due to being state run—as proven by successful cases—but rather the unfairness of prevailing market conditions.

The effectiveness of flag carriers is therefore a question of the tradeoff between market size and sustainability. Key operational factors affecting sustainability include the ambition of the flag carrier (overly ambitious carriers experiment with new routes that are often not sustainable and increase losses), the choice of fleet (often carriers choose a mix of aircraft that is less than optimal), and the number of employees per aircraft. Though a thorough study extends beyond the scope of this report, in general flag

[3] See totals in table 6.1 and table 6.2 of appendix 6.

carriers serve small domestic markets, which they try to subsidize with international routes. At times this leads to "route experimentation" and financial disaster, when international routes could have been served by the existing large airlines and the smaller markets by the small, private regional airlines. Privatization of flag carriers—instead of liquidation—often leads to even larger sustained losses (box 1.2).

Box 1.2 Flag carriers—the path to change

Not only in Africa but in much of the developing world, the national flag carrier plays a visible role, though one whose economics are often questionable. In most cases, the state-owned and operated flag carrier was established decades ago. The carrier grows at first, partly because competition is prohibited on some or all of its routes. Over time, service quality declines and losses mount, until a change in government forces a rethinking of policy. Proponents of maintaining the carrier argue as follows: (i) without it, little-traveled, subsidized domestic routes would be dropped, creating regional isolation; (ii) the carrier can potentially create revenues for the government, especially from foreigners traveling within the country; and (iii) a flag carrier must be maintained as a matter of national pride.

Eventually, however, advisers recommend the sale of the airline. To attract potential private sector buyers, the airline must first be restructured and made viable. During that process, the carrier realizes that routes are only profitable if it remains a state-sanctioned monopoly and that its aircraft do not meet the demands of the public. In addition, the carrier identifies new potential routes for expansion.

With additional investment from the government, the carrier buys new aircraft and brings new routes into service, while maintaining its monopoly on current routes. Over time, it becomes apparent that the new aircraft are too expensive to operate and have a load factor too low to be profitable on the routes for which they were bought (incurring losses of staggering proportions). The private sector is even less interested in the airline as a result of the restructuring. Barring liquidation, the process will start all over again.

Generally, the best solution is to completely liquidate the carrier and have a successful outside operator provide international services. A flag carrier from another country could potentially play this role. Compromises could be made, such as painting the outside operator's aircraft in the flag carrier's colors and hiring crew for passenger services within the country. For domestic routes, it makes sense to let small, local operators develop from the private sector.

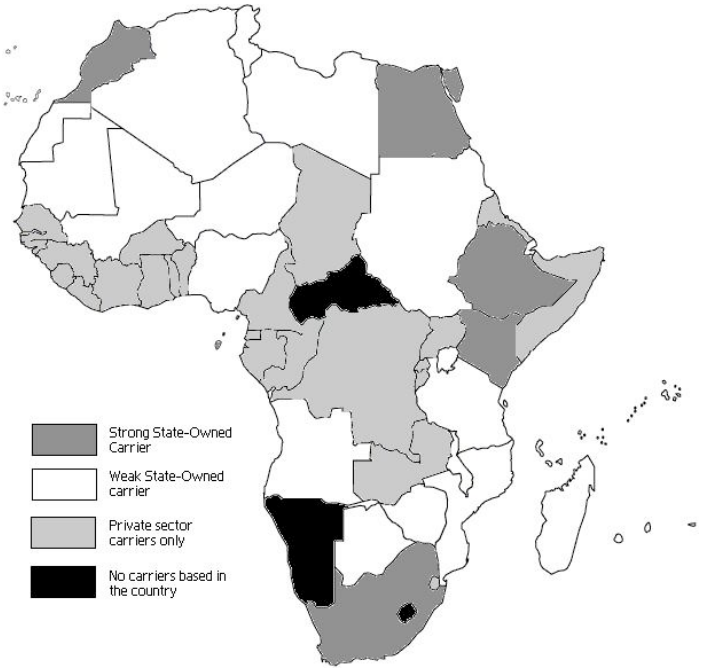
Figure 1.5 shows the geographic distribution of countries in Africa with flag carriers as well as their relative strength. The relationship between small market size and having an inefficient flag carrier is not as clear here as with the market sizes portrayed in figure 1.4, though some of the larger countries in West and Central Africa with thinner markets still appear (see appendix 10 for a list of countries and the types of ownership of their air carriers).

It is particularly challenging to address the fallacy that a flag carrier will eventually produce income for a government, because many state-owned airlines are successful. Nevertheless, those success stories represent only a small minority of flag carriers worldwide.

Intercontinental traffic

Intercontinental traffic in Africa enters primarily in the north (Morocco, Algeria, and Tunisia) via flights from France. In fact, North Africa dominates intercontinental traffic figures for the continent to such an extent that it is best to analyze traffic patterns in Sub-Saharan Africa independently (figure 1.6 and figure 1.7). Growth in intercontinental traffic has been strong in both North and Sub-Saharan Africa. Intercontinental capacity in Africa grew by 10.7 percent annually between 2004 and 2007 and 56 percent overall between 2001 and 2007, with an estimated 67 million seats. France to Morocco has become the top intercontinental route, surpassing France to Algeria. Egypt plays an important role as a gateway to the Middle East, and the Egypt-Germany route is also one of the top European connections.

Figure 1.5 Countries with flag carriers



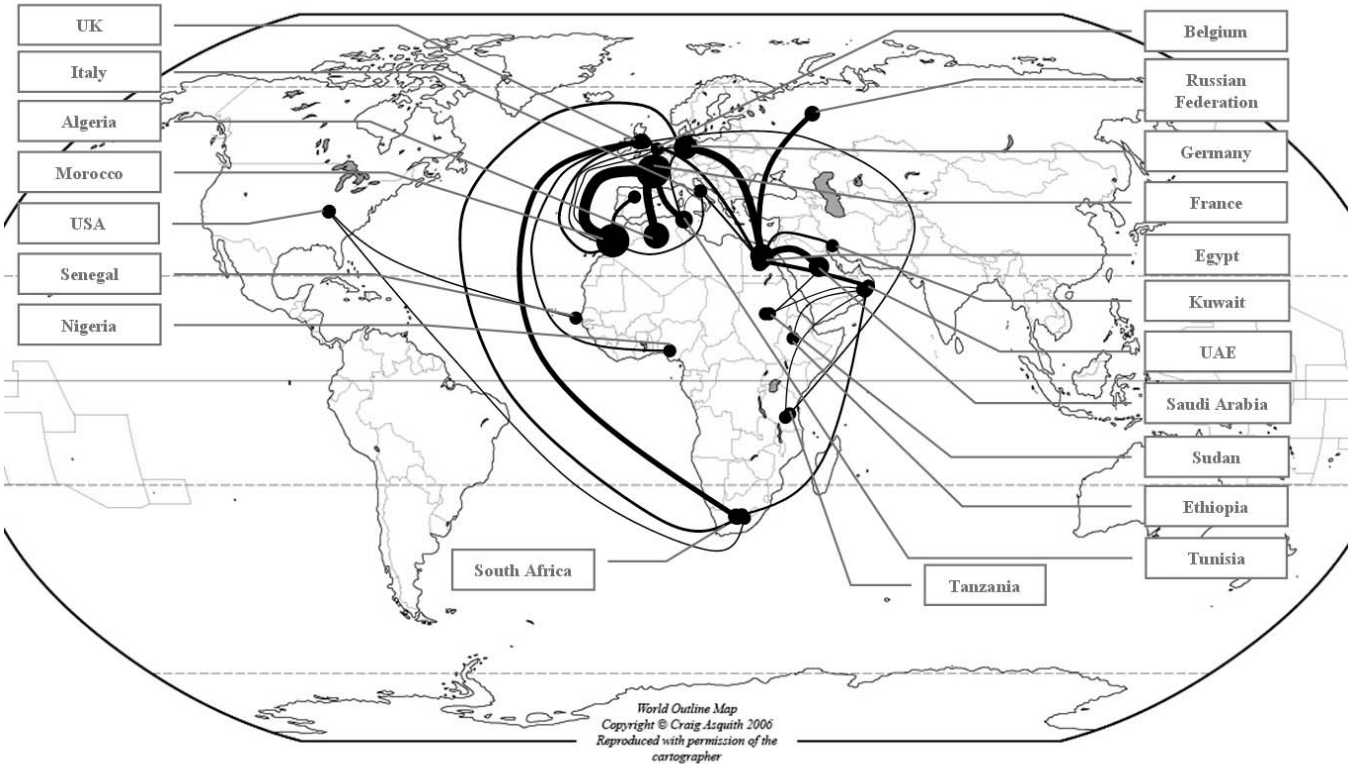
Source: Analysis based on data found in Schlumberger (2008: 287–88).

Note: Though not marked as such, Tunisia's flag carrier, a smaller niche operator, is considered relatively sound. Cape Verde (not shown) has a weak state-owned carrier.

Though not as strong as overall African growth, intercontinental capacity in Sub-Saharan Africa also grew, although not as strongly as overall African growth—43.6 percent from 2001 to 2007, an annualized growth rate of 6.2 percent. Sub-Saharan intercontinental traffic relies heavily on the three major hubs of Johannesburg, Nairobi, and Addis Ababa. The U.K.-Johannesburg route is the most heavily traveled. Senegal is an important stop in West Africa.[4] Between 2001 and 2007 the continent saw a significant rise in traffic from the Middle East. The United Arab Emirates (UAE) was in only two of the top 30 country pairs in 2001. By 2007 it had five of the top routes. In addition, traffic to East Asia and the Pacific nearly doubled between 2004 and 2007, to 1.6 million seats.

[4] South African Airways generally flies the U.S.–South African route nonstop coming from the United States. Due to high-altitude winds, however, it makes a fifth-freedom stop in Senegal on the South Africa–U.S. route. The U.S. carrier Delta Airlines is now flying to both Johannesburg and Cape Town via Senegal, with new flights added via the same stop to Nairobi, Kenya, in early 2009.

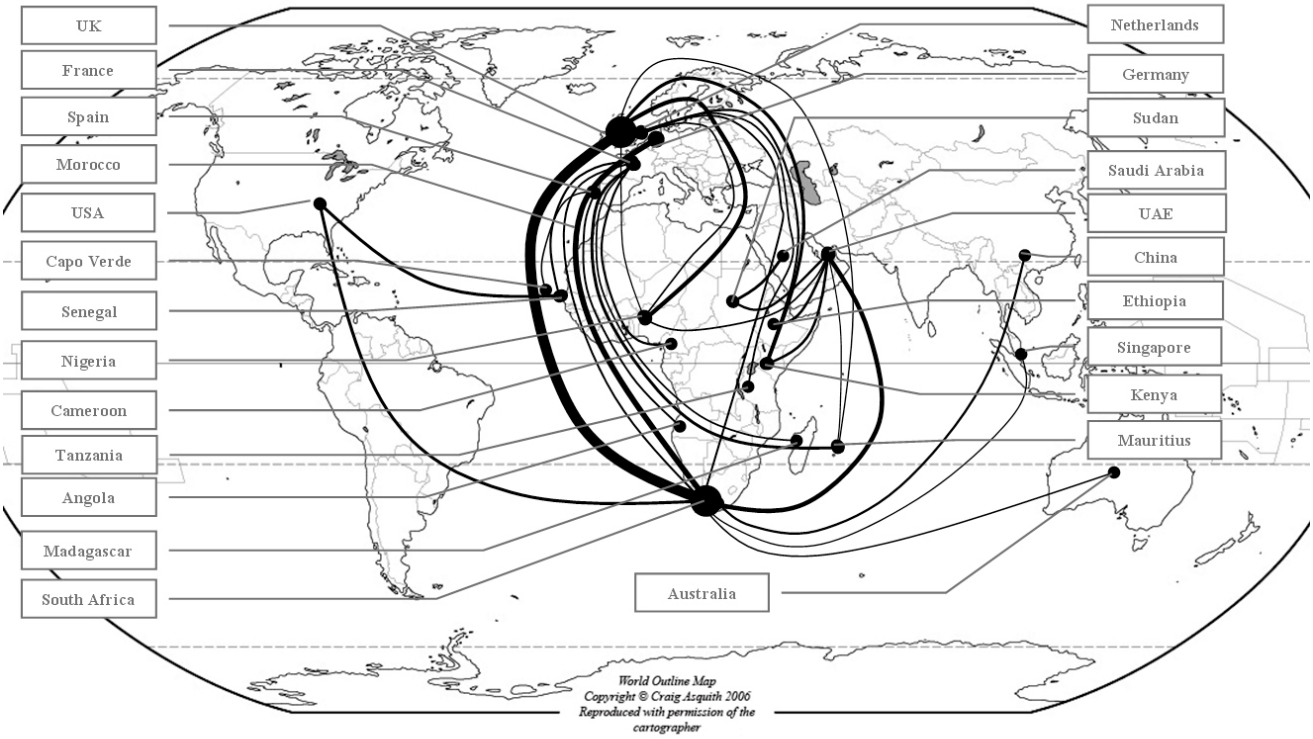
Figure 1.6 Top 30 intercontinental routes for Africa (in seats available per week as of November 2007)



Source: Analysis of data provided by Diio's SRS Analyser.

Note: Routes are displayed as country pairs, though the pair often represents service from more than one airport in a country. The thickness of the connecting lines is in proportion to the volume of traffic. The most important routes are between the North African countries of Morocco, Algeria, and Tunisia and France. The most important Sub-Saharan route is between the United Kingdom and South Africa. Cairo is a key entry point for Europe (mainly Germany) and the Middle East.

Figure 1.7 Top 30 intercontinental routes for Sub-Saharan Africa (as of November 2007 and excluding traffic from North Africa)



Source: Analysis of data provided by Diio's SRS Analyser.

Note: Johannesburg is the most important entry point, with the three largest partners being the United Kingdom, Germany, and the UAE (excluding North Africa).

There is more competition for intercontinental traffic than for international traffic in Africa because the traveler has the flexibility to choose among various entry points. There is also more competition on each intercontinental route. Overall, a total of 158 carriers provided intercontinental services in Africa in 2007 (up from 111 in 2001). Furthermore, an average of 5.7 airlines competed in each of the top 20 intercontinental markets. The growth and turnover in airlines between 2001 and 2007 was also healthy—33 left the market, while 80 entered, nearly doubling capacity. The most dramatic loss in capacity was caused by the demise of Air Afrique, Swissair, and Ghana Airways.

Routes to the Middle East had some of the highest growth rates among major routes, particularly between the UAE and South Africa and Egypt; the traffic from France to Morocco also showed strong growth. The only major routes that declined between 2001 and 2007 were between the United States and South Africa, Mauritius and France, and Tunisia and Germany. Among routes in the bottom 30th percentile relative to overall traffic volume, routes to China exhibited strong growth rates. For example, the routes between Egypt and China (nonexistent in 2001 and still only about one-tenth of those between Egypt and Germany) grew more than thirteen-fold between 2004 and 2007.

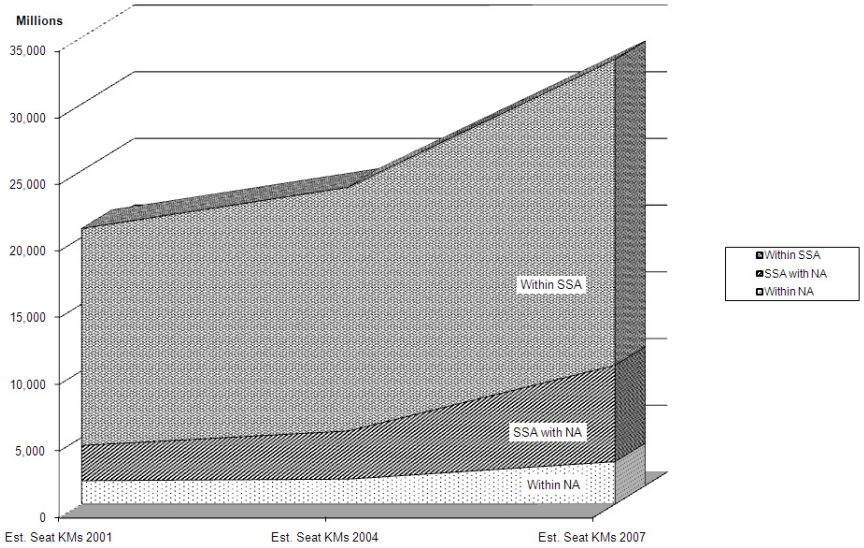
Table 2.1 in appendix 2 summarizes the growth and competitiveness of the main intercontinental country-pair routes. Table 1.4 in this section provides a list of Sub-Saharan Africa's top international

airports, and table 2.2 in appendix 2 its top international airlines. While there are outliers in the data—for example, the route between South Africa and the UAE, which is growing rapidly but has only two carriers—the routes with the highest growth rates were generally served by more carriers; that is, they had the most competition. The top five airlines—South African Airways, Air France, British Airways, EgyptAir, and Emirates—hold more than 30 percent of market share. In total, there are eight African carriers, including South African Airways, in the top 20 airlines.

International capacity within Africa

International capacity within Africa grew 9 percent annually between 2004 and 2007. The highest growth was between Sub-Saharan Africa and North Africa (26 percent annually), followed by a much smaller proportion in international traffic within North Africa (19 percent annually). International travel within Sub-Saharan Africa, which accounts for the bulk of intra-African international travel, grew at 7.9 percent per year. Figure 1.8 shows the growth of overall capacity between 2001 to 2007, and table 1.3 provides a more detailed breakdown.

Figure 1.8 Estimated international passenger capacity between 2001 and 2007, measured in seat kilometers



Source: Analysis of data provided by Diio's SRS Analyser.

Note: Though travel between North African countries presents a small portion of the total capacity (about 10 percent), it has nearly doubled since 2001, with the highest growth between 2004 and 2007.

The North African international markets—particularly routes involving Libya and Morocco—have shown significant growth. North African traffic consists of ten country pairs, which has been the case for many years. On the other hand, competition within the top routes (with the exception of the route between Egypt and Libya) has declined somewhat. There are only five leading carriers: EgyptAir (the leader with 627,000 seats in 2007), Royal Air Maroc (578,000 seats), Jamahiryan Libyan Arab Airlines (440,000 seats), Tunisair (310,000 seats), and Air Algerie (35,000 seats). Although competition has declined overall, no airline has a monopoly on a route. See table 2.3 in appendix 2 for a summary of the market.

Because of its well-developed network and stable carriers, North Africa has the best air service in Africa. Connectivity within Sub-Saharan Africa is of greater concern. The number of country pairs in the region declined from 218 to 190 between 2001 and 2007, a result of the collapse of several airlines,

including Air Afrique and Nigeria Airways.[5] North Africa held steady with 10 country pairs between 2004 and 2007.

Table 1.3 International travel within Africa

International travel with	Est. seat km 2001 (millions)	Est. seat km 2004 (millions)	Est. seat km 2007 (millions)	Country pairs Feb 2001	Country pairs Nov 2007	Net change pairs	Overall growth (%)	Annualized growth 2001–07 (%)	Annualized growth 2004–07 (%)
Within Sub-Saharan Africa	16,265.7	18,271.6	22,925.9	218	190	-28	40.9	5.9	7.9
within North Africa	1,757.3	1,876.7	3,182.9	10	10	0	81.1	10.4	19.3
Sub-Saharan Africa with North Africa	2,643.4	3,610.7	7,226.9	30	45	15	173.4	18.2	26.0
Total	20,666.4	23,759.1	33,335.7	258	245	-13	61.3	8.3	12.0

Source: Analysis of data provided by Diio's SRS Analyser.

Note: Though there has been growth, the drop in city pairs served in Sub-Saharan Africa is significant.

Table 1.4 Top 15 airports for international travel within Sub-Saharan Africa

Country	City/airport	Airport ID	Estimated seats 2007 ('000)	Overall percent
South Africa	Johannesburg	JNB	5,742	20.0
Kenya	Nairobi	NBO	2,901	10.1
Ethiopia	Addis Ababa	ADD	1,706	6.0
Nigeria	Lagos	LOS	1,157	4.0
Senegal	Dakar	DKR	986	3.4
Zambia	Lusaka	LUN	959	3.4
Uganda	Entebbe	EBB	954	3.3
Zimbabwe	Harare	HRE	828	2.9
Ghana	Accra	ACC	813	2.8
Namibia	Windhoek	WDH	791	2.8
Tanzania	Dar es Salaam	DAR	749	2.6
Côte d'Ivoire	Abidjan	ABJ	717	2.5
Mauritius	Mauritius	MRU	544	1.9
Angola	Luanda	LAD	484	1.7

Source: Analysis of data provided by Diio's SRS Analyser.

Note: Over 40 percent of the capacity is concentrated among four airports.

[5] In addition, research for this infrastructure study report (Iches 2003) indicated that Air Gabon and the Ghana Airways Corporation had also collapsed and ceased operations. Overall, 31 airlines have been identified as having ceased operations between 2001 and 2007 in Sub-Saharan Africa, with a total lost capacity of nearly 8 million seats, compared to 34 new market entrants, with a total estimated capacity of nearly 15 million seats. North Africa's numbers are less drastic, but nevertheless new entrants provided 1.4 million seats, nearly twice the seat capacity that had been lost (660,000 seats).

In Sub-Saharan Africa, the network in the east—anchored in South Africa, Kenya, and Ethiopia—is more developed than that of the west. The networks in West and Central Africa have significant gaps because of the loss of capacity from failed carriers between 2001 and 2004. Figure 1.9 shows the top 60 international routes within Sub-Saharan Africa, while figure 1.12 shows the international routes between North Africa and Sub-Saharan Africa.

The main hubs in the region today are Johannesburg, South Africa; Nairobi, Kenya; and Addis Ababa, Ethiopia. Those airports account for 36 percent of all international traffic within Africa (table 1.4). As with Western hub systems, those airports each serve as the hub for a dominant airline—South African Airways, Kenya Airways, and Ethiopian Airlines, which account for 33 percent, 70 percent, and 83 percent of the international traffic at each airports, respectively.

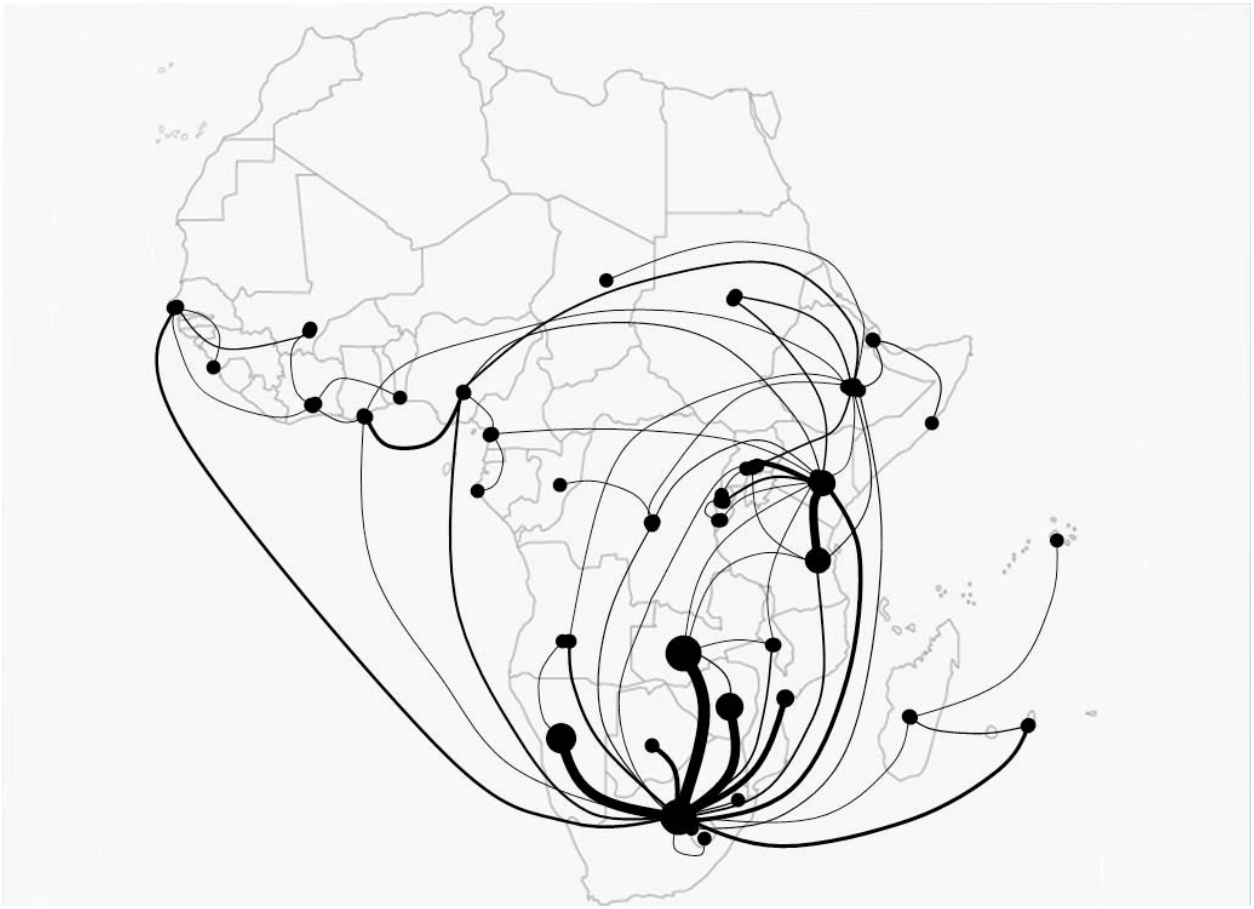
Box 1.3 Air Afrique

Air Afrique was formed in 1961 as an African carrier headquartered in Abidjan, Côte d'Ivoire. It was originally owned by 12 West African countries, Air France, the Union Aéromaritime de Transport (UAT), and the Société pour le Développement du Transport Aérien en Afrique (SODETRAF). The airline progressed from piston-engine propeller operations to wide-bodies such as the Airbus 310 in the 1980s.

As with flag carriers, the airline became a regional symbol of pride and independence. Even in the best of times, however, the quality of service was sometimes compromised. For example, the failure of reservation systems sometimes made seat assignments impossible. In the airline's last days, passengers found themselves increasingly stranded. It was said that seating priority was often given to "nonrevenue passengers of importance" and schedule integrity had diminished. Efforts by the airline's president to restructure it in 2001 by cutting jobs were vehemently opposed by employees, who at one point refused to fly an airplane with the president on board. The airline collapsed in 2001 after being sold to private investors and Air France for $69 million, with debts of $500 million. Much of the debt was accumulated when the CFA franc collapsed in the 1990s. Governance issues were also commonly cited as a cause of the collapse. When it ceased operating, Air Afrique reportedly had 4,200 employees, but only 7 aircraft flying.

The airline flew primarily within Africa, but also to the Middle East, Europe, and the United States. Its collapse removed a capacity of nearly 5 billion seat kilometers, similar in magnitude to Kenya Airways.

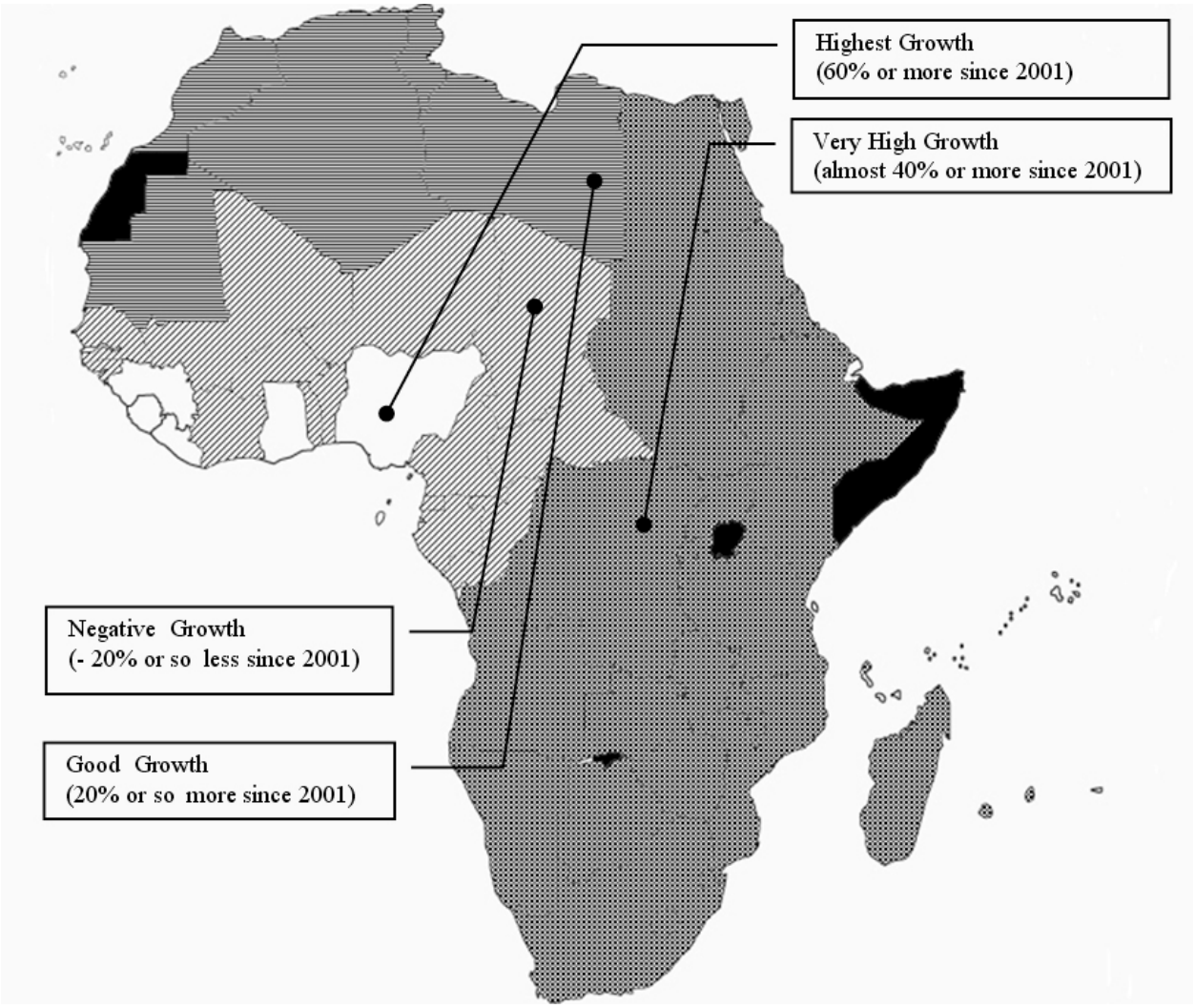
Figure 1.9 Top 60 international routes within Sub-Saharan Africa



Source: Analysis of data provided by Diio's SRS Analyser.
Note: The highest activity is in the east.

The Banjul Accord Group (BAG) countries, including Nigeria, have shown the highest growth in international travel within Africa, followed by the more developed but still growing regions of East and southern Africa and North Africa (figure 1.10). As a result of the collapse of Air Afrique and Nigeria Airways, a swath of nations surrounding the BAG countries has experienced negative growth. The lack of development in those countries is the most serious concern of the air transport industry in Africa. Together, they form the largest block of countries in Africa, with fewer than 1 million passengers per year (see figure 1.4).

Figure 1.10 Regional growth zones in seats offered for all types of air travel



Source: Analysis of data provided by Diio's SRS Analyser.

Note: The BAG countries have seen the highest increase, surrounded by neighbors with very little or negative growth. East Africa and North Africa both showed high, if not very high, growth.

The number of carriers providing international service within Sub-Saharan Africa has fluctuated between 67 and 78 between 2001 and 2007. There were 76 in 2007, serving roughly 206 country pairs (down from 238 country pairs in 2001).[6] The decline in country pairs was accompanied by an increase in market concentration by dominant players—13 of the top 60 routes in 2007 were served by only one carrier, up from four in 2001. Of the 173 country pairs that remained unchanged between 2001 through 2007, the number served by only one carrier increased from 41 to 70. In addition, 26 of the 33 new country pairs are served by a single carrier. Ethiopian Airlines and Kenya Airways are dominant in those new markets.

[6] This figure comprises the loss of 65 country pairs and the addition of 33 country pairs and includes both non-stop and one-stop flights.

The top 60 country pairs account for 80 percent of the total estimated 14.3 million seats[7] flown in Sub-Saharan Africa. Of those 60 pairs, 30 are dominated by the three major carriers—South African Airways, Kenya Airways, and Ethiopian Airlines. The remaining markets are led by smaller carriers. Links to South Africa are among the fastest-growing markets; in particular, travel with Sudan and Nigeria exhibits significant growth.

Fifteen airlines provide more than 82 percent of all international travel within Sub-Saharan Africa, with the top three (South African, Ethiopian, and Kenyan) accounting for more than 57 percent (table 1.5).

Table 1.5 The top 15 airlines providing international service within Sub-Saharan Africa

Airline	Seat kilometers 2001 (million)	Seat kilometers 2004 (million)	Seat kilometers 2007 (million)	Annual growth 2001–07	Annual growth 2004–07
South African Airways	4,113	5,292	4,784	2.6	-1.7
Ethiopian Airlines Enterprise	1,335	2,119	4,235	21.2	12.2
Kenya Airways	1,780	2,366	4,163	15.2	9.9
Air Mauritius	488	545	730	6.9	5.0
Delta Air Lines, Inc.	–	–	639	–	–
Virgin Nigeria	–	–	598	–	–
Air Namibia	336	523	564	9.0	1.3
Zambian Airways	63	14	559	44.0	85.3
Air Senegal International	131	417	442	22.5	1.0
SA Airlink d/b/a South African Airlink		201	406		12.4
TAAG Angola Airlines	368	391	405	1.6	0.6
Bellview Airlines Ltd.	87	220	399	28.8	10.4
Air Zimbabwe (Pvt) Ltd.	402	175	383	-0.8	13.9
Comair Ltd.		291	366		3.9
Nationwide Airlines (Pty) Ltd.	31	117	263	43.1	14.4

Source: Analysis of data provided by Diio's SRS Analyser.

Note: Of an estimated 1.8 billion seat kilometers flown, these 15 airlines constitute over 82 percent of the market. Among the major airlines, Ethiopian Airlines shows the highest growth, while Zambian Airways shows the fastest growth among smaller carriers.

On sole-carrier routes, the total number of seats has increased six percent annually. One airline in particular stands out: Ethiopian Airlines, with nearly 1.2 million seats, serves 45 percent of all seats in the sole-carrier markets. Kenya Airways is a distant second with 22 percent of seats. For comparison, South African Airways accounts for only about 1 percent of the sole-carrier market. One might conclude that Ethiopian Airlines has been entering markets in which it can perform very strongly. Indeed its sole-carrier seats grew from 327,400 in 2001 to 1.2 million in 2007, an annual increase of 27 percent. Of the 21 country pairs in which it has a monopoly, however, only six are new routes that did not exist in 2001, while two are routes that a competitor left, and the remaining 13 are monopoly routes it already held. Kenyan Airways has followed a similar strategy, often by beating out existing competitors. Its growth

[7] The aim of this section is to compare the capacity and choices offered between country pairs. Markets are therefore measured by number of seats rather than by seat kilometers. When the relative strength of airlines is discussed, seat kilometers are used.

rates have been even higher than those of Ethiopian Airlines, although its overall capacity is lower (see table 2.4 in appendix 2 for a summary of the airlines in sole-carrier markets).

According to traditional measures, intercountry pairs tend to be oligopolistic, as is expected in less dense markets. For example, a value of 1,800 on the Herfindahl index[8] indicates a concentrated market, which can raise concerns regarding competitiveness. The index of international markets in Sub-Saharan Africa—excluding the monopolies—fluctuates between 2,000 and 5,000, which indicates a highly concentrated market.

Liberalization and breakdown of international traffic within economic regions

The Yamoussoukro Declaration of 1988 and the Yamoussoukro Decision (YD) of 1999 sought to bring about the liberalization of international air transport within Africa. In 1997 the Banjul Accord further affirmed the declaration with a plan for accelerating implementation. This multilateral air services agreement between the seven states in 2004 focused liberalization efforts on free pricing, the lifting of capacity and frequency restraints, and the ability to fly fifth-freedom routes.

Although implementation has varied significantly from region to region, liberalization has generally been successful (table 1.6). Two-thirds of African countries have applied the standards to some extent. The highest level of implementation has come in the regions hardest hit by airline failures: the Economic and Monetary Community of Central Africa (CEMAC) and the West African Economic and Monetary Union (WAEMU). Table 1.7 summarizes international traffic within individual regions.

External shocks between 2001 and 2004 and the varying degrees of implementation among countries makes an analysis of the impact of liberalization difficult. Nevertheless, a significant percentage of the routes in regions implementing the YD were found to consist of country pairs for which the carrier was not based in either country. Those numbers prove the existence of fifth-freedom operations at a minimum and in some cases seventh-freedom operations—beyond even the ambitions of the YD. Table 1.8 shows the dramatic impact liberalization has had on carrier origin for international services within a region. Further analysis has shown that extraregional African carriers (such as an East African carrier traveling between two countries within the WAEMU) often replace capacity lost when carriers go out of business. At the same time, European carriers that once flew similar routes (such as Air France) have almost completely disappeared, which suggests that these markets are becoming more concentrated, with services being consolidated by the larger, healthier carriers. There have been reports of declining fares for third- and fourth-freedom operations because of the YD. Without a readily available analysis of historical fares, however, it is impossible to make definitive conclusions.

As with most air transport liberalization efforts, resistance to implementing the YD comes from countries wishing to protect their (usually unhealthy) flag carriers. Typically, one or two very large carriers, regardless of the type of ownership, dominate a region. Smaller national carriers in Africa, some consisting of less than three aircraft, fly the only profitable routes between their country and outside hubs and use the proceeds to sustain an otherwise unprofitable network. As liberalization increases, so does competition on the profitable routes, usually from the dominant carrier based in the regional hub. The overall network of the flag carrier therefore becomes completely unsustainable as competition cuts into its

[8] The Herfindahl index is computed by summing the squares of the market share of each market participant.

profits. Protecting a flag carrier deprives the public of choice in air transit, which propagates the cycle of poor service and high prices.

Table 1.6 Grading of the level of the implementation of the Yamoussoukro Decision

Community	General status of YD implementation	Status of air services liberalization	Overall implementation score
AMU	No implementation.	No liberalization within the AMU initiated, but need is recognized.	1
BAG	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
CEMAC	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
COMESA	Full liberalization decided ("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
EAC	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
SADC	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
WAEMU	The YD is fully implemented.	All freedoms, including cabotage, have been granted. Tariffs have been liberalized.	5

Source: Schlumberger 2008: 311.

Note: Scores range from the lowest level of implementation (1) to the highest (5). Grading provided by Charles E. Schlumberger.

AMU—Arab Maghreb Union; BAG—Banjul Accord Group; CEMAC—Economic and Monetary Community of Central Africa; COMESA—Common Market of Eastern and Southern Africa; EAC—East African Community; SADC—Southern African Development Community; WAEMU—West African Economic and Monetary Union.

Table 1.7 International travel capacity within regional communities

Regional community	Seats			Country pairs		City pairs	
	Total 2007	Annual growth 2001–07 (%)	Annual growth 2004–07 (%)	As of November 2007	Net change from February 2001	As of November 2007	Net change from February 2001
AMU	1,294,189	4.55	8.65	9	–	14	2
BAG	568,306	0.32	13.87	13	–	15	1
CEMAC	152,984	-18.88	-35.58	6	(6)	9	(9)
COMESA	4,484,675	7.12	17.66	49	(4)	71	(3)
EAC	1,751,811	2.02	5.81	9	1	18	(2)
SADC	5,663,632	4.27	10.00	34	(4)	72	5
WAEMU	763,472	-5.42	-5.56	20	(2)	21	(3)

Source: Analysis of data provided by Diio's SRS Analyser.

Note: The CEMAC and WAEMU both show a strong decline in estimated seats, and the CEMAC shows a 50 percent drop in connectivity as measured in city pairs and country pairs served. Most other regions show consistent growth, and the BAG managed a positive turnaround.

Table 1.8 Flights being served between country pairs by airlines not based in either country

	AMU	BAG	CEMAC	COMESA	EAC	SADC	WAEMU
Seats 2001 (%)	7.6	45.3	38.0	25.4	33.0	18.7	47.7
Seats 2004 (%)	8.3	36.3	11.8	9.9	12.2	2.3	43.7
Seats 2007 (%)	4.1	43.3	28.5	14.1	16.4	5.7	43.8
YD score	1	4	5	3	3	2	5

Source: Analysis of data provided by Diio's SRS Analyser.

Note: With the exception of the AMU, which is not part of the YD, all countries showed an increased market proportion of these airlines between 2004 and 2007. The data for 2001 are skewed because several regional airlines with large market shares, such as Air Afrique, collapsed that year. The bottom YD score shows a clear relationship between the levels of implementation and the proportion of fifth- and seventh-freedom flights within the regions.

The state of air transport in the low-volume countries of West and Central Africa

There has been much discussion about international connectivity in countries with less than 1 million passengers per year, especially in West and Central Africa, where a large band of such countries surround Nigeria and the smaller markets of Côte d'Ivoire and Ghana. In most cases, air transport in these countries is below the level of sustainability, yet it is vital to their growth potential in the global economy. All too often, they have flag carriers with fleets not suitable for their purpose and ad hoc and suboptimal networks. Their plight stands in stark contrast to countries in more developed regions in North, East, and southern Africa, which all have their own regional hubs that serve as gateways to intercontinental travel.

Figure 1.11 Countries potentially served by commuter-style turboprop aircraft from a hub in Lagos

Source: Author.

Note: The inner ring represents the range of an ATR 42-300, about 1,100 km. The middle ring of roughly 2,000 km represents the range of a standard Fokker 50, while the outer ring, with a radius of 2,500 km, shows the range of a newer Bombardier Dash-8 Q400.

The use of commuter propeller aircraft on international routes has increased slightly in low-volume markets, although reliance on Boeing 737–type jets is still common. A proposal to develop a network using commuter propeller aircraft (such as the Fokker 50 or ATR) around a hub in Lagos is feasible, but it would reportedly require much investment at the terminal facilities. Figure 1.11 shows the range that could be served from a hub in Lagos with three turboprop-type transport aircraft—the Fokker 50, the ATR 42-300, and the Bombardier Dash-8 Q400. Senegal and the Gambia would be out of range, although they could be served by longer-range turboprop aircraft. With the Fokker 50, the southern range of the hub would reach Luanda in Angola. Even the shorter-range ATR could serve at least eight countries. Beyond creating a central gateway, such a system would increase per-aircraft load factors for regional travel. It could even increase the frequency of service to countries with very little traffic, since repeating multi leg flights out of Lagos could serve several countries in one circular route.

Implementing the YD is a vital step toward such a system, allowing for fifth- and sixth-freedom operations. Experience has shown that private operators are particularly successful in developing shorter routes with turboprop aircraft, such as Precision Air in Tanzania.

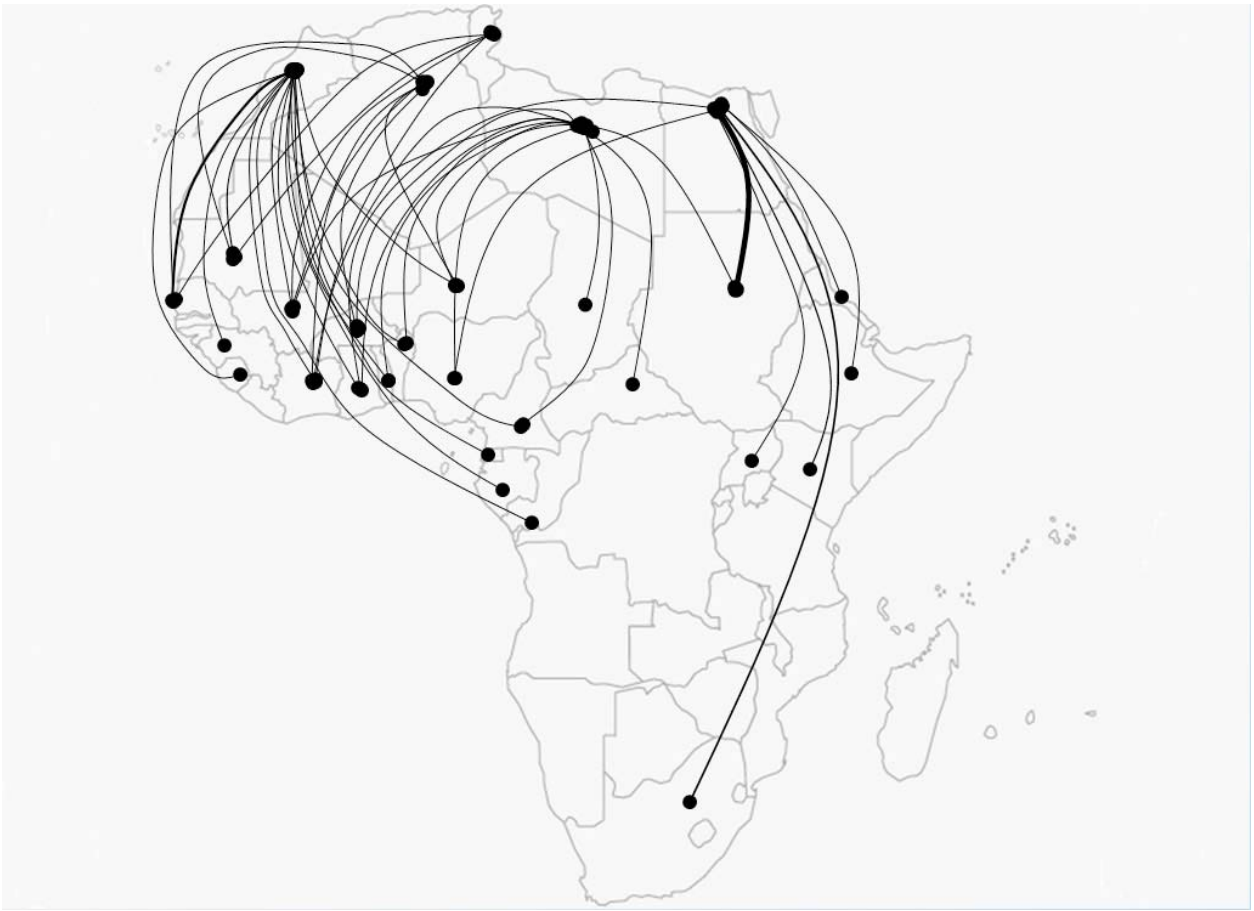
Travel between Sub-Saharan Africa and North Africa

Eighty-one percent of the travel between Sub-Saharan Africa and North Africa is dominated by two airlines: Royal Air Maroc and the slightly larger EgyptAir. Afriqiyah Airways, Air Algier, and Tunisair provide the remaining 19 percent of the service, with Libya's Afriqiyah Airways the strongest of the three. The distribution follows a clean geographic layout: Egypt dominates traffic along the east side of the continent (with some exceptions, such as the Egypt-Nigeria route), and Morocco dominates the western side. The top routes with North Africa include Sudan, Senegal, South Africa, Kenya, Mauritania, Côte d'Ivoire, Mali, Nigeria, Ethiopia, and Gabon. These routes have been growing dramatically, with some increasing more than 26 percent a year from 2001 to 2007, and more than 44 percent a year from 2004 to 2007 (see table 1.5). Overall, the growth rate for traffic between North Africa and the lower part of the continent was more than 18 percent annually between 2001 and 2007, and almost 26 percent annually between 2004 and 2007. Seventeen country pairs have been added since 2001, bringing the country pair total to 45. Of those routes, 41 have a single-carrier monopoly, including all of the new ones, most of which go to Morocco and Libya.

Morocco is an important hub not just for international travel between North Africa and Sub-Saharan Africa, but also for travel within Sub-Saharan Africa (figure 1.10**)**. Indeed, the newest routes are served by Royal Air Maroc. Afriqiyah Airways, the relatively new Libyan market entrant, provides a similar network. EgyptAir's route with Sudan, which comprises nearly a fifth of all north-south travel, appears

very strong in figure 1.12. Beyond this market, however, EgyptAir does not play as significant a role as Royal Air Maroc. Figures 1.10 and 1.6 together suggest that a developing hub system in North Africa is filling the vacuum created by the absence of a strong Sub-Saharan carrier on the west side of the continent.

Figure 1.12 International routes between Sub-Saharan Africa and North Africa



Source: Analysis of data provided by Diio's SRS Analyser.

Domestic air transport

Domestic air travel in Sub-Saharan showed significant growth between 2001 and 2004, increasing more than 12 percent annually. During the same period, North African domestic air travel declined by more than 3 percent. The North African domestic market size is about one-fifth that of Sub-Saharan Africa as measured in seat kilometers.[9] In both regions, the number of city pairs has been declining, indicating that traffic is consolidating among key routes and that some locations have been dropped from domestic networks (see table 2.6 in appendix 2 for a breakdown of city pairs by market). The most

[9] Some caution must be applied when using reservation and scheduling systems data for domestic travel in developing countries, because domestic travel is much more likely to also include scheduled airlines that are not part of an electronic reservation system. For example, in Tanzania, Coastal Air is an important carrier for domestic travel, using Cessna Caravans that seat up to 15 passengers. The airline issues paper tickets and is not found in any scheduling or reservation dataset, such as the OAG or Diio's SRS Analyser.

dramatic drop in city pairs occurred between 2001 and 2004**,** with an overall loss of 207 routes in Sub-Saharan Africa and 32 in North Africa. Many of these losses are attributable to the collapse of major regional carriers.

North Africa's domestic market is much more mature than that of Sub-Saharan Africa and consequently less dynamic. Once again, state flag carriers play the major role. Algeria's national flag carrier, Air Algerie, enjoys a monopoly on all published routes. Egypt, Libya, and Morocco have new entrants, although their market share is very small. In Morocco, the private Regional Air Lines provides service to 13 city pairs. On some routes, it has completely supplanted Royal Air Maroc, which previously had a monopoly on all city pairs. A summary of airlines providing scheduled domestic service in North Africa can be found in table 2.5 of appendix 2.

Domestic growth in South Africa, Nigeria, and Mozambique accounts for most of the overall growth in Sub-Saharan Africa. Excluding those countries, the domestic market shrank by 0.84 percent between 2004 and 2007, with a net loss of 137 routes. South Africa and Nigeria account for 72.5 percent and 10.5 percent of all known scheduled domestic services in Sub-Saharan Africa, respectively.

Conditions that affect a country's domestic air transport market include topology, population density, per capita gross national income (GNI), and, in many cases, tourism. With such wide variation in conditions between countries in Africa, however, it is impossible to make blanket statements about the domestic market. For example, island nations such as Madagascar, Cape Verde, Comoros, and the Seychelles have scheduled domestic services as a necessity regardless of their population. Ethiopia, on the other hand, has an extensive airline but much less domestic travel than the island nations and not much recent growth.

In general, Sub-Saharan African domestic air services are highly concentrated. Of the 286 routes in 2007, only 54 were served by more than one provider. Usually the service is provided by the state carrier. At times, flag carriers subcontract out thinner routes to private operators.[10] Among the larger countries, two stand out for allowing competition—South Africa (which is not surprising since it has the most advanced air transport industry in Sub-Saharan Africa) and Tanzania. In South Africa competition exists only on the heaviest routes. By comparison, each of Tanzania's 17 domestic routes has more than one service provider.[11]

Because of their geography and a thriving tourism industries, island nations depend heavily on air transport. Nevertheless, the industry remained highly concentrated. As of 2007, Cape Verde, Sao Tome & Principe, and Seychelles each only had one service provider (Cape Verde had two in 2001). On the other hand, in Comoros, Mauritius, and Madagascar, the number of airlines serving the domestic market has increased. Regardless, of those three countries, all but two domestic routes (one in Madagascar and one in Mauritius) were served by a single for all of 2007. In other words, although those countries were served by multiple carriers, they were not competing on the same routes. A summary of domestic routes in Sub-Saharan Africa can be found in table 2.6 in appendix 2.

[10] In Malawi, for example, Air Malawi, which has scheduled flights on the Lilongwe-Blantyre route, will at times use a small operator, using single-engine aircraft, to fill in for flights with a low load factor.

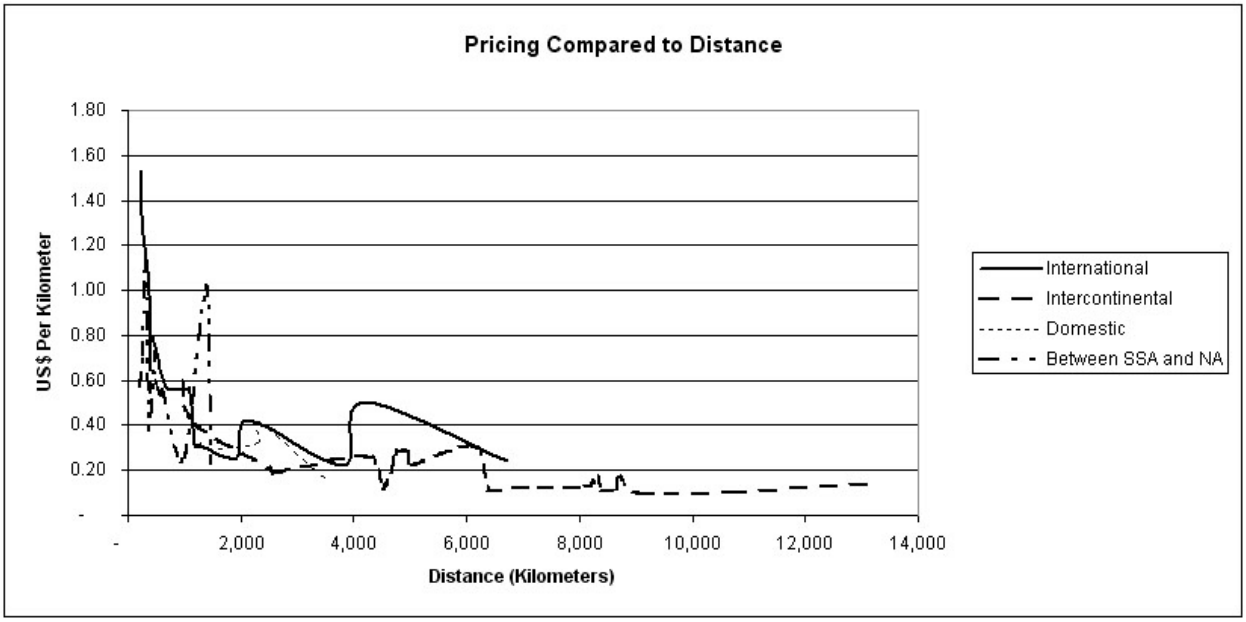
[11] The competitiveness of Tanzania's domestic routes may now be strongly affected by the health of its flag carrier, Air Tanzania.

Pricing and connectivity

To compare the pricing of flights in Africa, we sampled 23 international routes, 29 intercontinental routes, and 21 domestic routes of various lengths and traffic densities. In addition, thirteen tariffs were found for the domestic routes, which, unlike the international routes, are not commonly found on web reservation tools. We then determined the lowest-cost flight using standard booking websites such as expedia.com and opodo.com. Using these samples, we plotted the per-nautical-mile cost of flying various distances (figure 1.13). Based on this information, the per mile cost of air travel within Africa appears to be considerably higher than intercontinental travel, especially on routes of less than 4,000 kilometers. This result is understandable considering the greater competition among intercontinental routes (see appendix 4 for the pricing samples used in the study).

A recent study by Intervistas for the International Air Transport Association (IATA) concludes that the price elasticity of air transport within Africa is relatively high, which can be attributed to the fact that those who can travel by air are well off and relatively immune to higher ticket prices (Intervistas Consulting 2007).

Figure 1.13 Cost of flights intercontinental flights and international flights within Africa (per kilometer flown)



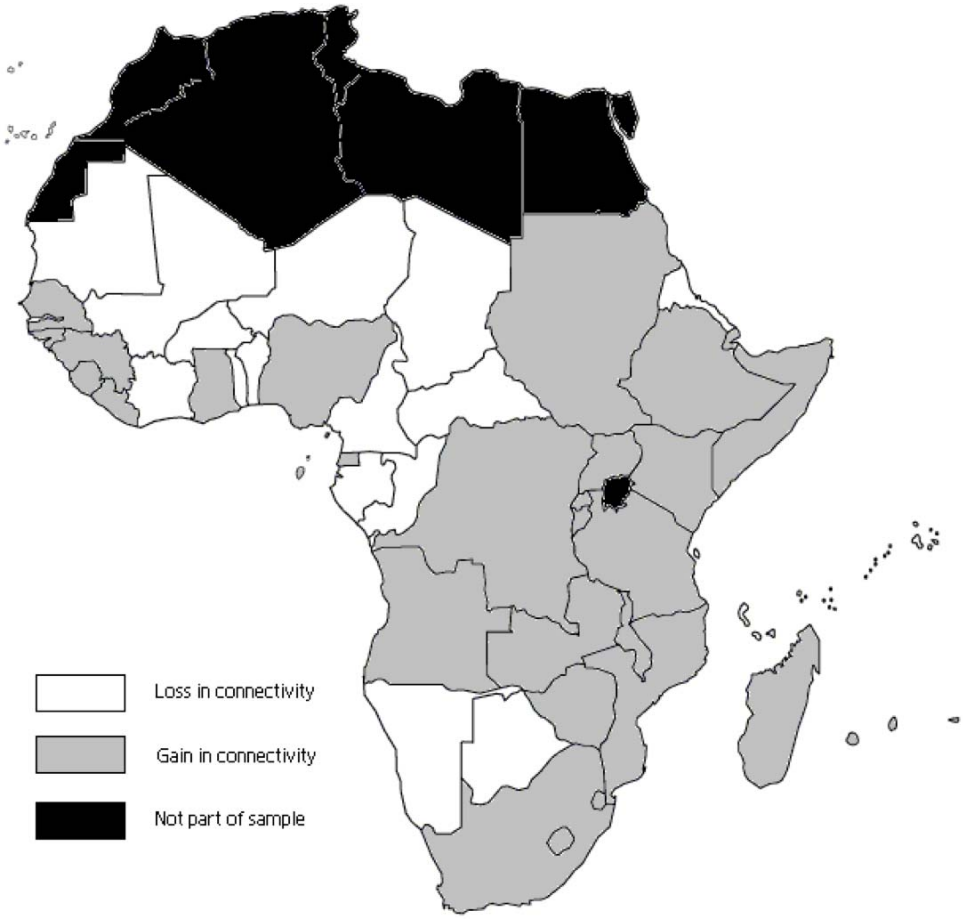
Source: Analysis on data collected by the World Bank.

Note: Higher prices over lower distances reflect fixed costs being spread over fewer kilometers. Domestic pricing is most likely skewed by subsidized or fixed prices, which keeps them artificially low on some routes.

Travelers frequently complain that travel from one African country to another often requires a connection through Europe (see appendix 5 for a matrix of connectivity between the African countries measuring the validity of this complaint). Connectivity for many countries throughout West and Central Africa decreased between 2004 and 2007, with some countries practically dropping out of the network (figure 1.14). Most worrisome are the Central African Republic (only one flight per week in November 2007), Mauritania, Chad, Eritrea, and the Seychelles, which are now only minimally connected. Based on a comparison of figure 1.14 and figure 1.4, much of the same swath of countries with declining markets—

the landlocked countries from Mali to the Central African Republic, and many of the other smaller-market coastal countries in the region, such as the Gambia, Benin and neighboring Togo, Cameroon, the Republic of Congo, and Gabon—is also losing international connectivity.

Figure 1.14 Gainers and losers in international connectivity in Sub-Saharan Africa



Source: Analysis of data provided by Diio's SRS Analyser.
Note: Cape Verde, not shown, belongs to the gaining category.

Airline fleet composition in Africa

In both North Africa and Sub-Saharan Africa, carriers have been downsizing aircraft toward the city-jet size (such as Boeing 737 or Airbus 319) and renewing their fleets. These trends apply to international and domestic travel within Africa. Yet complaints about the aging fleet in Africa are still common. Though this is a cause for concern, the situation must be placed into perspective.

Tables 1.9 and 1.10 provides a breakdown of aircraft and their approximate age and size. The data are depicted graphically in figures 1.15 and 1.16. The trends to newer, smaller aircraft is clear from the data and has been confirmed by examining state registration changes in aircraft fleets, using JP Fleets data. For domestic travel, seat kilometers flown in older Western aircraft doubled between 2001 and 2007 from 2 percent to 4 percent. This increase is probably a result of the need to increase capacity quickly and

inexpensively to keep up with growth and may be responsible for the increasingly heavy criticism of air travel safety in Africa.

Table 1.9 Breakdown of aircraft age for analysis

Age rating	Aircraft
Western very old vintage	DC3, for example. Effectively out of use for scheduled services.
Western very old	1960s–70s (for example, 727s and 737-100s).
Western old	1970s–80s.
Western somewhat recent	1980s–90s (for example, Boeing 757).
Western recent	Generally from the mid-1990s onward.
Eastern-built	Do not play a large role.

Source: Analysis of data provided by Diio's SRS Analyser.
Note: In the subsequent analysis, subcategories such as "Western somewhat recent/Western recent" are necessary.

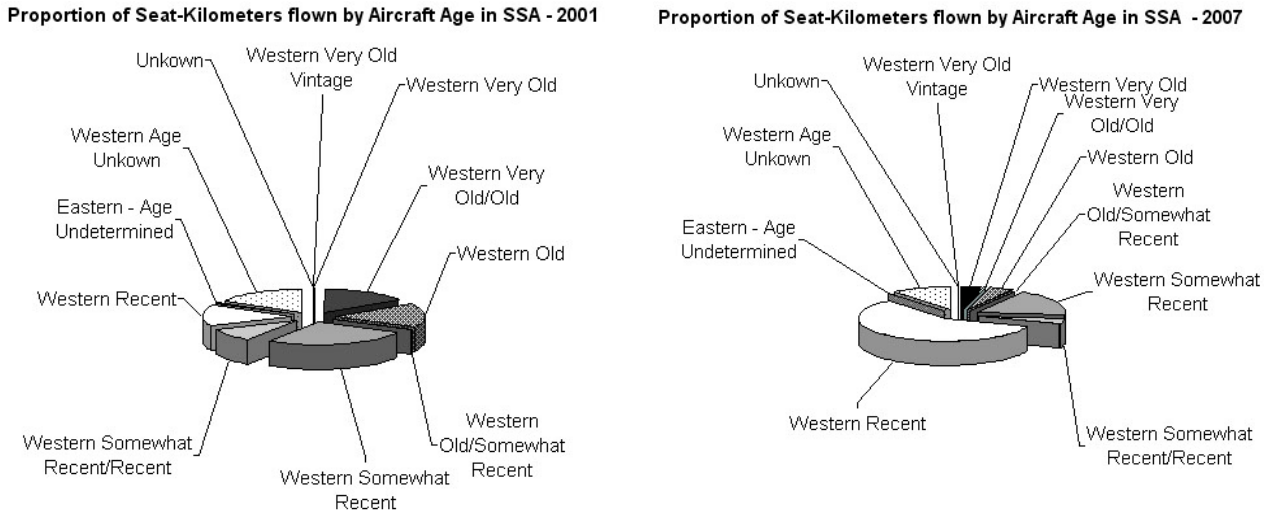
Table 1.10 shows the types of aircraft used in international travel within Africa at each country's major airport (measured in number of flights). Market are divided into three sizes, and data from a single week in November 2001 are compared to one in November 2007. The share of commuter propeller aircraft for international flights has grown from 33 percent to 40 percent for the countries with the least traffic. That figure may be higher if Eastern-built aircraft are taken into account. The only aircraft type whose share of flights has been declining is the wide-body, which once again demonstrates the increase in shorter routes.

Table 1.10 Breakdown of aircraft size for analysis

Year	Overall market size	Intl. flights 1 week November	General aviation (%)	Commuter prop (%)	Commuter jet (%)	City jet (%)	Large jet (%)	Wide-body (%)	Eastern built, unknown type (%)
2001	> 5 million	6,236	–	13	1	65	0	20	1
	> 1 million	2,169	–	27	1	34	5	34	1
	< 1 million	3,081	0.04	33	2	38	2	20	1
2007	> 5 million	10,638	–	14	7	61	1	17	0
	> 1 million	3,363	–	17	5	52	2	22	1
	< 1 million	3,167	–	40	3	39	3	11	4

Source: Analysis of data provided by Diio's SRS Analyser.

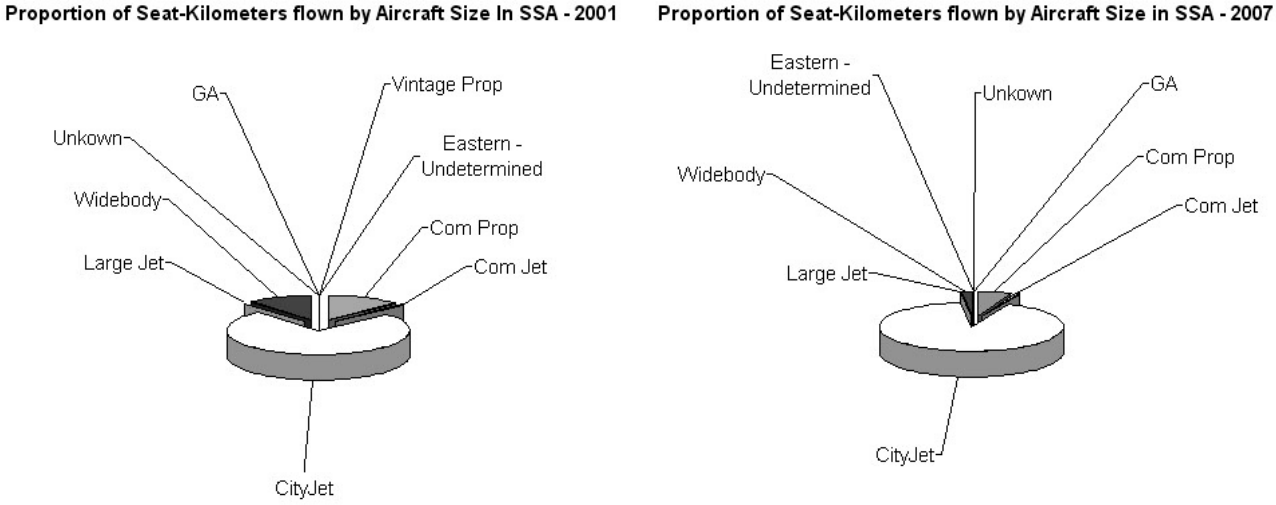
Figure 1.15 Overall fleet age in Sub-Saharan Africa



Source: Analysis of data provided by Diio's SRS Analyser.

Note: The shift to newer aircraft, as measured in percentage of overall seat kilometers flown, is pronounced. This shift, in differing magnitudes, can be observed throughout the various markets in Africa, including the domestic markets, and particularly in North Africa (not shown). Figure 1.16 shows that this shift is part of a trend toward smaller, city-jet-sized aircraft in place of both wide-bodies and commuter propeller aircraft.

Figure 1.16 Size of aircraft in Sub-Saharan passenger fleets



Source: Analysis of data provided by Diio's SRS Analyser.

Note: Capacity has shifted toward the city-jet-sized (Boeing 737 or Airbus 320) aircraft and away from both the wide-body and commuter propeller aircraft.

2 Airports and airside infrastructure

Airports—overview[12]

Airport infrastructure in Africa varies widely by the type of traffic the airport receives and the economic situation of the country. Africa has significant runway capacity, but in many cases it is unusable because of a lack of necessary infrastructure. Databases reveal that there are at least 2,900 airports in Africa.[13] Only a small fraction of those airports receive scheduled services, however, and that figure fluctuates greatly, in part due to seasonality. In November 2007, an estimated 280 airports throughout Africa received scheduled services (figure 2.1). If all the airports that had any scheduled service at any point during the year were included, however, that total would be significantly higher.

The number of airports with scheduled services declined considerably between 2001 and 2007 (table 2.1). Except for the Banjul Accord Group (BAG) of countries (Ghana, Nigeria, Cape Verde, Gambia, Liberia, and Sierra Leone), that figure decreased from 20 to 40 percent between 2001 and 2007. (See table 2.2 for annual totals of airports with scheduled services. Figure 2.2 shows the number of airports receiving scheduled services in each given month—these totals are less than the annual count, as explained above.)

Table 2.1 Airports receiving scheduled services in Africa for a given year

Region	2001	2004	2007
North Africa	77	73	70
Sub-Saharan Africa	318	276	261
Total	395	349	331

Source: Analysis of data provided by Diio's SRS Analyser.

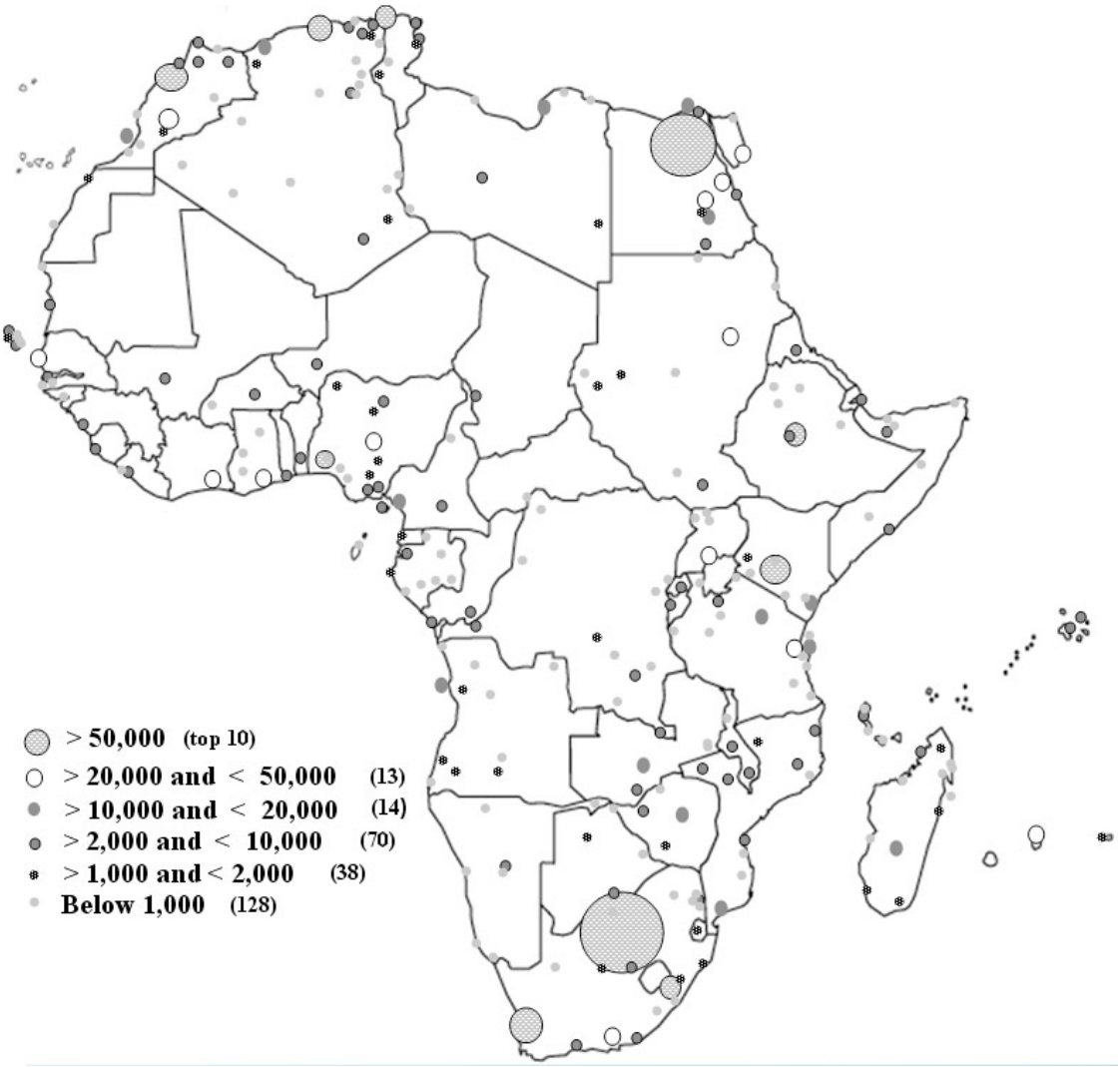
Note: The annual number is higher than the snapshot number at any given time, such as the one for November 2007 in figure 2.1.

Nearly all airports that received scheduled services in November 2007 (the last data snapshot in this report) had at least one paved major runway. Only around a dozen were unpaved, and most of these were in countries that were having or had recently had military conflicts. One exception is Tanzania, which had five airports with scheduled services and with alternatively surfaced runways (the World Bank is currently involved in projects resurfacing these runways).

[12] This study was initially designed to examine only those airports serving more than 60,000 passengers annually. Because of the nature of travel in Africa, however, some parts of this report will cover all airports that receive traffic on published schedules.

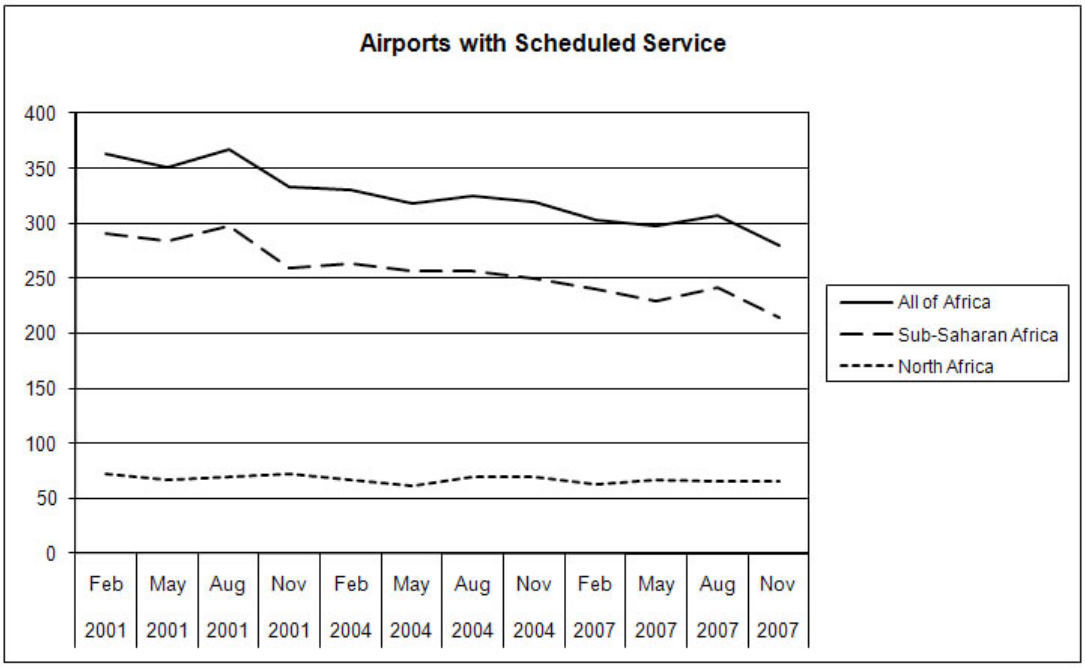
[13] www.aircraft-charter-world.com/. A list of airports was composed by combining this website's list of airports for every country in Africa. However, this number is much of an undercount. When querying individual authorities the count of airfields rises drastically. However, nearly all if not all of these uncounted airports are small, do not have regular traffic, have minimal infrastructure, and may even be operated privately as a simple airstrip.

Figure 2.1 Airports receiving scheduled services in November 2007 (size based on seats per week)



Source: Analysis of data provided by Diio's SRS Analyser.

Figure 2.2 Airports with scheduled services within Africa



Source: Analysis of data provided by Diio's SRS Analyser.

Both airside and landside services should be included in any discussion about the quality of airport infrastructure. Airside services include all issues related to flight, such as runway length and condition, air traffic control, taxiways, and apron space. The most important landside services are passenger terminal capacity and access to the terminal. As air transport has expanded worldwide, terminal capacity has been constrained, especially at major hubs. This is also an issue in Africa, although statistics are difficult to obtain.

Data regarding airside infrastructure is more easily accessible than data for landside infrastructure due to the nature of the information: to make airports accessible to air travel, the installations need to be listed in a country's Aeronautical Information Publication (AIP) and in publications widely distributed among pilots, such as *Jeppesen's*. In reality, however, a distinction needs to be made among the published installations, the installations that are actually operational, and those that have been installed but never been published. Most information in this report is based on publicly available information, but an accurate assessment of the quality of installations would require on-site evaluations. For example, anecdotal information available at the time of writing this report suggested that the instrument landing system (ILS) at Maseru International Airport in Lesotho had become so unreliable that the schedule integrity of the only airline being serviced by the airport, South African Airlink Express, had been compromised. In other cases, the modern global navigation satellite system (GNSS) had been designed and financed but had not yet entered the publication process and was therefore not in the public inventory of airside services and installations.

In general, the quality of airside infrastructure is higher in airports serving greater volumes of traffic. In major hubs such as Johannesburg, Cairo, Tangier, and Nairobi, the airside installations are fairly

standard with respect to runway length, ILSs, and so on. For airports with lower traffic volumes, however, significant differences in the quality of the infrastructure are apparent. Though overall volume to airports without paved runways is relatively small, the number of airports with poor runway conditions is fairly high in some countries.

Data were collected on 226 of the 278 airports receiving scheduled services in Africa in November 2007. Measurements were made not by observing the sites directly but by examining commonly available satellite images with adequate resolution—of 278 airports, 52 could not be evaluated due to poor image quality. The basic criteria were the appearance of the runway and other visible issues, such as serious security deficiencies due to footpaths over the runway extending beyond the airport perimeter. Of the 47 airports sampled in North Africa, 60 percent were in excellent condition, 36 percent in good condition, and four percent in fair condition. By comparison, a dramatic 21 percent of the 179 airports sampled in Sub-Saharan Africa were in poor condition, and an additional four percent were in marginal condition (table 2.2). Fortunately, the marginal and poor airports only handled about four percent of the traffic.

Table 2.2 Runway quality and seat capacity by runway rating in Africa

Rating	North Africa				Sub-Saharan Africa			
	Airports	% of Airports	Seats ('000)	% of Seats	Airports	% of Airports	Seats ('000)	% of Seats
Excellent	28	60	53,963,169	90	31	17	69,666,792	63
Very good	17	36	5,686,311	10	51	28	26,574,283	24
Fair	2	4	15,392	0	52	29	9,285,100	8
Marginal	–	–	–	–	8	4	2,291,844	2
Poor	–	–	–	–	37	21	2,419,054	2
Totals	47	100	59,664,872	100	179	100	110,237,072	100

Source: Analysis on data collected by the World Bank.
Note: Totals include double counting for in-region travel.

ILSs can be found in nearly all airports with an estimated capacity of one million seats or more but are rare in smaller airports. In many smaller, older airports, non-directional beacon (NDB) systems, which are now very old and outdated, are still prevalent. Although those ground-based navigation systems could be replaced by satellite technology at relatively little cost, in many cases either no plans have been made or no funding obtained for their replacement.

Passenger capacity and constraints

The growth in air transport has strained airport capacity worldwide, an issue widely raised by Airports Council International. The potential constraints may be temporarily mitigated by the global economic slowdown, however, as clear signs of global drops in passenger traffic are now apparent. Nevertheless, those trends may not necessarily apply to the whole of the African continent.

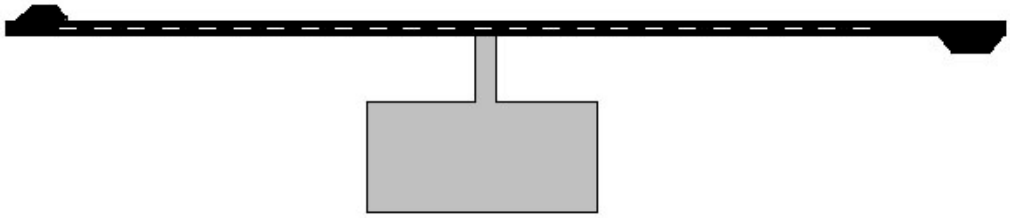
Runways

Traffic in Africa does not appear to have runway capacity constraints. For example, given a five-minute separation between flights on a single runway, an airport could accommodate 144 flights in a 12-

hour period (equivalent to more than 1,000 flights a week), which is equivalent to more than 17,000 passengers a day given an average passenger load of 120. Even if planes took off and landed at 20-minute intervals, the airport could accommodate more than 4,300 passengers a day. Africa therefore has sufficient airport capacity in Africa to accommodate current traffic volume, and there is no need to build new airports. Instead there is a need to optimize existing facilities. In light of present traffic and projected growth rates, upgrading existing airports is almost always more cost-effective than new construction. For example, building a new airport with minimal facilities and a 3,000-meter runway would cost in excess of $100 million. By comparison, upgrading a facility by adding a parallel taxiway, resurfacing the existing runway with asphalt, and extending the runway from 2,000 to 3,000 meters would cost roughly a third of that (see appendix 3 for a simple model showing the cost differences).

On the other hand, taxiways, aprons, and jetways can present capacity constraints for airports. For example, runway capacity depends heavily on how quickly an aircraft can leave or enter the runway. Many African airports employ a low-cost design: instead of leaving the runway via a turnoff after landing, an aircraft must taxi to the turning bay, turn around, and taxi back down the runway to the apron usually found in the center (figure 2.3). Such a design not only ties up the runway for an extended period but can effectively halt airport traffic if parking space on the apron is limited. Low-volume airports can usually accommodate such limitations, but high-volume airports cannot and require parallel taxiways with multiple turnoff ramps from the runway.

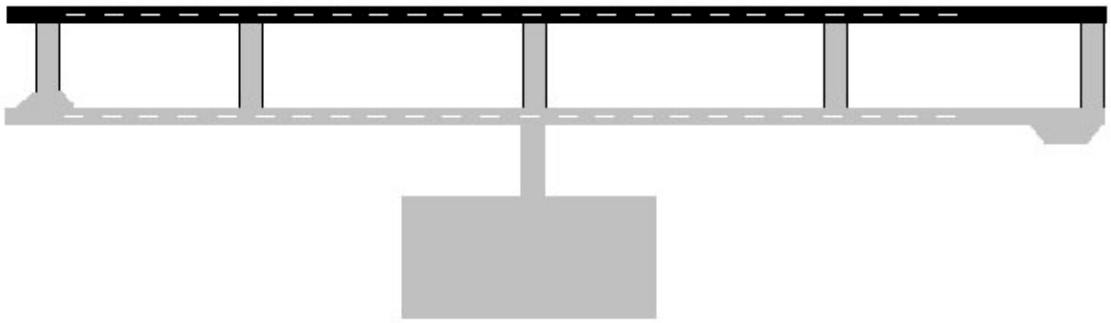
Figure 2.3 Abstract of a typical African airport design



Source: Author.

One way to solve the problems created by this low-cost design is to construct a new runway parallel to the old one and use the old runway as a taxiway or a spare runway if the new runway requires maintenance (figure 2.4). This solution has been widely implemented in North Africa and is now also being adapted elsewhere.

Figure 2.4 A common variant of the typical layout



Source: Author.

Note: The old runway remains, but a new parallel runaway has been added. The old runway now is a parallel taxiway or a spare runway if the new runway is out of service.

Terminals

Though data on passenger capacity are not easily accessible (the International Civil Aviation Organization, ICAO, for example, does not measure passenger terminal capacity), there is widespread evidence that passenger terminals in Africa are operating at or above capacity (table 2.3).[14] Despite wide gaps in passenger reporting, table 2.3 indicates that many terminals in Sub-Saharan Africa are at or above capacity, while North African terminals seem to have already been expanded in anticipation of a future increase in passengers.

Some airports are addressing their capacity issues. For example, Nairobi's passenger terminal is going through an extensive upgrade that will enable it to accommodate more than nine million passengers annually. Elsewhere, the particular circumstances of the airport must be carefully examined. In some cases flights can be rescheduled to alleviate passenger terminal crowding. Other airports, such as Malawi's airport in Lilongwe, are clearly in need of upgrades, but their size is not a limiting factor in passenger capacity. The needs of airports should therefore be assessed on a case-by-case basis.

Because of wide variations in how traffic flows and bottlenecks form in typical terminal designs found on the continent, formulas used by airport planners to estimate terminal capacities are generally inaccurate for African airports. If complaints about terminal constraints are raised on an individual basis, however, an easily quantifiable measurement would be the balancing of the terminal usage over time by examining flights schedules to see how many flights arrive and depart at the same time. An examination of the distribution of arriving and departing flights for November 2007 at the primary airport of each of the 53 study countries reveals that the lower the maximum number of flights per hour, the less evenly distributed the scheduling becomes. For example the high-density airport in Addis Ababa shows a more even distribution of flights than the low-density airport in Cotonou, Benin, where the highest number of flights per hour was four and the average over the week was one flight every two hours. In at least 26 of the 53 airports examined, the schedule of arriving and departing flights could be revised to maximize the

[14] Table 2.3 was assembled using the database at www.azworldairports.com, which is compiled by the publisher of the website. Discussions with the publisher revealed that the data were provided through individual contact with the relevant airports, as no central reference source was available.

usage of the airport. At 12 airports, traffic never exceeded two flights per hour, generally making the distribution analysis a moot issue. Arrivals and departures are treated equally in this analysis, though they involve different parts of the airports. In other words, two flights per hour may mean one departing flight and one arriving flight, so in fact only one flight at a time is being handled in the respective terminal areas. Appendix 9 shows a list of the main airports per country, with a general grade for their schedule distribution.

Table 2.3 Terminal capacity versus reported passengers and estimated seats at selected airports

Country	City	Airport	Reported capacity (million)	Reported passengers (million)						2007 Estimated seats (million)
				2000	2003	2004	2005	2006	2007	
South Africa	Johannesburg	JNB	11.9						19	25.3
Morocco	Casablanca	CMN	7.0					5.7		8.8
Kenya	Nairobi	NBO	2.5				4.3			6.3
Algeria	Algiers	AGL	10.0							6.1
Tunisia	Tunis	TUN	4.5			3.4				5.2
Mauritius	Mauritius	MRU	1.5					2.2		3.0
Senegal	Dakar	DKR	1.0							2.5
Tanzania	Dar es Salaam	DAR	1.5							1.9
Egypt	Sharm el Sheik	SSH	8.0				5.0			1.9
Zambia	Lusaka	LUN	0.4					0.6		1.3
Kenya	Mombasa	MBA	0.9					1.0		1.1
Zimbabwe	Harare	HRE	0.5							1.1
Morocco	Agadir	AGA	3.0					1.4		1.0
Seychelles	Mahe Island	SEZ	0.4		0.3					0.9
Tunisia	Djerba	DJE	4.0			2.2				0.8
Mali	Bamako	BKO	0.4					0.5		0.7
Tunisia	Monastir	MIR	3.5				4.1			0.6
Djibouti	Djibouti	JIB	0.5				0.1			0.6
Morocco	Tangier	TNG	0.8					0.3		0.5
Morocco	Fez	FEZ	0.5					0.2		0.5
Rwanda	Kigali	KGL	4.4	0.1						0.5
Nigeria	Kano	KAN	0.5	0.3						0.4
Morocco	Oujda	OUD	0.3					0.2		0.4
Morocco	Rabat	RBA	0.7				0.2			0.4
Malawi	Lilongwe	LLW	0.2			0.2				0.4
Seychelles	Praslin Island	PRI	0.4			0.3				0.4

Sources: Various, including www.azworldairports.com and the World Bank.

Terminal planning is highly dependent on growth assumptions. The air transport industry in Africa may shrink rather than grow if fuel prices rise again or the world economy contracts. Many projections in recent months darkened as fuel costs soared, and though this crisis has eased, the impact of the economic

slowdown will be significant.[15] Evidence indicates, however, that growth continued throughout 2008. If growth remains strong, additional terminal capacity will need to be planned for.

Topological distribution and Investments in Airports

Overall, African airports have enough runways to accommodate current traffic levels. Nevertheless, estimates of minimum runway needs per population center based on projected growth throughout Africa reveals a significant need for future investments in new runways and airports. The assumption is binary in that each population center would be assigned a local airport according to its size, regardless of the expected frequency of flights either to or from the airport. Assuming that the current distribution of airports is adequate, at an urban population growth rate of 4 percent, the annual investments needed in the sector between 2005 and 2015 are close to $800 million for Sub-Saharan Africa. In the model applied for this calculation, two cases are presented: a base case that shows the amount that would be required to completely address total needs, and a pragmatic case that shows how much would be required to cover basic needs (table 2.4). The results should be read with caution, however, since the model incorporates assumptions that may not be entirely true. One of the assumptions is that current terminal capacity is not strained, despite anecdotal evidence on the ground that suggests differently. In addition, the estimates do not reflect special circumstances and sources of growth, such as the terminal expansion needs in Cape Town for the World Cup.

Table 2.4 Estimated annual spending needs for runways and terminals in Sub-Saharan Africa for the period 2005–15

US$ millions

Item		Base case	Pragmatic case
Runways	Improvements	25.3	25.3
	Upgrade	22.5	22.5
	New	12.2	12.2
	Maintenance	61.2	49.9
	Runways total	121.2	109.9
Terminals	Improvements	5	6.2
	Upgrade	–	–
	New	18.0	9.1
	Maintenance	653.8	102.6
	Terminals total	676.8	117.9
	Grand total	798.0	227.8

Source: Carruthers, Krishnamani, and Murray 2009; Briceño-Garmendia, Smits, and Foster 2009.

Note: The model assumes an urban growth rate of 4 percent.

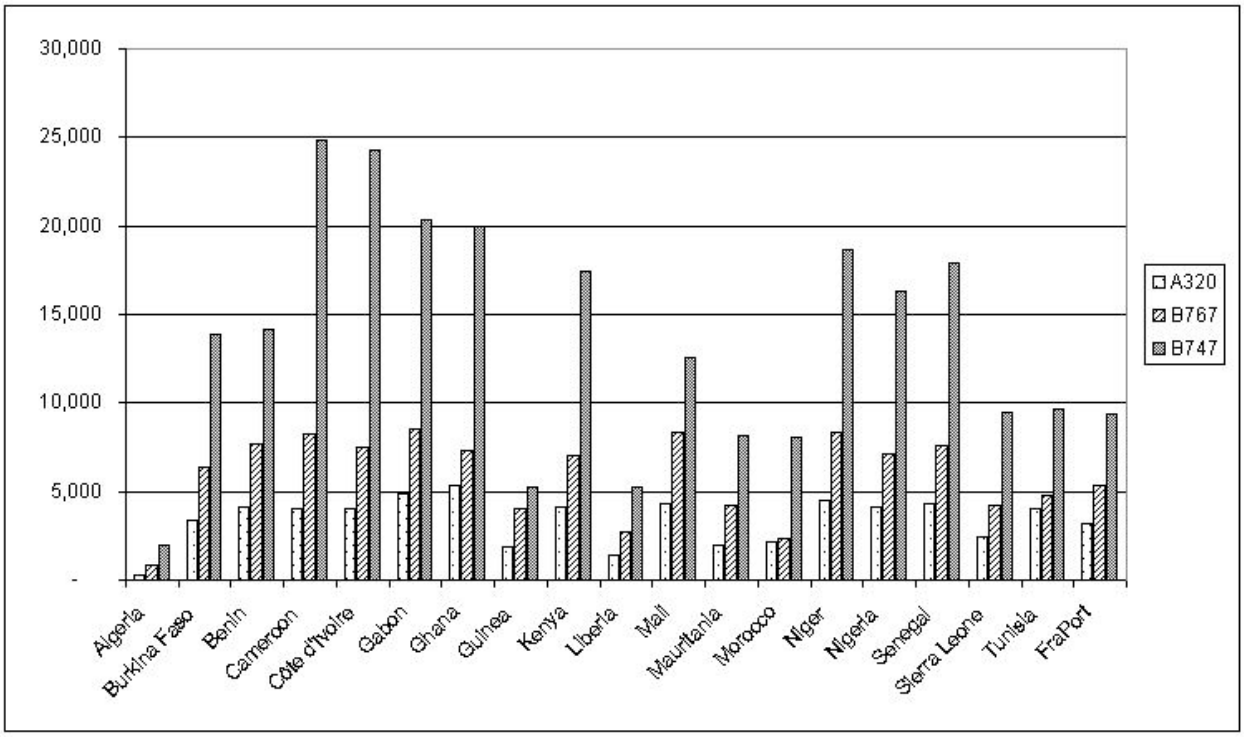
Airport charges and finance

Airport charges in Africa vary widely, with particularly high charges in Cameroon, Ghana, and Côte d'Ivoire. For this study, we compared airport charges at 18 African airports to charges for the same

[15] At the height of the fuel crisis, fuel costs accounted for about 50 percent of the cost of a ticket.

aircraft at Frankfurt am Main International Airport (FraPort; figure 2.5).[16] The average charges at the African airports are 30 to 40 percent higher than those at FraPort. After adjusting for the outliers (Cameroon, Côte d'Ivoire, and Ghana), they are 29 percent higher. These higher charges are not unexpected, since few, if any, airports in Sub-Saharan Africa have access to other revenue streams, as developed countries do. In the United States, for example, concessions such as car rental stands are one of the most important sources of revenue for airport authorities. By comparison, African airports are highly dependent on airside and passenger charges. Also, charges increase dramatically with aircraft size, suggesting that intercontinental travelers are charged more, perhaps because these flights are seen as a source of foreign currency revenue.

Figure 2.5 Airport charges overall by aircraft type for 18 African airports and FraPort



Source: ADPI Architectes & Ingénieurs (2008: 21); and FraPort.

Anecdotal evidence suggests that two countries in West Africa (intentionally not specified) are charging much higher passenger fees than other countries—sometimes in excess of $80 per passenger. In one country those charges were imposed to finance a new airport, a project that is most likely ill-advised and unnecessary. Although their condition may be questionable, the supply of runways and airports in Africa is more than adequate for current traffic levels. As mentioned earlier, in most cases it is much more cost effective to expand capacity through runway and taxiway improvements than by building new airports.

[16] These were computed using FraPort's online airport charges calculator.

Table 2.5 Planned and started investments exceeding $500 million in Africa (as of December 2007)

Location		Project	US$ billions
South Africa	Johannesburg	World Cup 2010, A380 preparation	1.180
South Africa	Durban	New airport by 2010	0.932
Sudan	Khartoum	New airport planned	0.750
Senegal	Dakar	Rehabilitation or new airport	0.580
Egypt	Cairo	Terminal 3, third runway	0.554
Tunisia	Enfindha	New airport for 7 million annual passengers	0.500
		Total for Africa	4.496

Source: Airports Council International 2007: 42.

Table 2.6 Worldwide planned and started investments exceeding $500 million, as of December 2007

Region	Planned or started (US$ billions)	Percentage (%)
Europe	79.835	20
Middle East	39.000	10
North America	139.724	36
Latin America and the Caribbean	7.706	2
Africa	4.496	1
Asia-Pacific	119.401	31
Total	390.162	

Source: ICAO.

Note: Africa has only a 1 percent portion of larger airport investments.

Private sector participation in airports

Most airports in Africa are not truly sustainable if they are examined by volume alone. Airports in Africa rely much more on passenger and airside charges for revenue than airports in developed countries, where concessions for items such as car rentals contribute significantly to airport revenues. In addition, there is the "cash cow" syndrome that manifests itself not only in Africa but in poorer countries in other regions as well: airports are seen as a source of revenue and foreign currency. In some cases, even though airports have operational surpluses, they do not reinvest revenues in necessary maintenance or upgrades (Button 2008: 198). Generally, airports are seen as public infrastructure, and even ones that are corporatized (such as South African's ACSA) are still under the majority ownership of the state. Though additional private sector participation in airports has been discussed, little has been done in this regard, except perhaps for the outsourcing of some managerial duties or certain types of operations (Button 2008: 213).

Most African governments view airports as potentially monopolistic enterprises to be regulated and controlled. By comparison, in the developed world and other areas with growing traffic, airports seek out airlines to serve them. At the annual World Routes Forum, for example, airports create booths and exhibits to woo airlines into their facilities. Sparsely traveled countries, such as many in Sub-Saharan Africa, however, usually have only one point of entry, and though this point of entry is barely sustainable,

it has an inherent monopoly over the country's air traffic. As a result of these limitations, few countries in Africa have private participation in airport ownership and operation (figure 2.6).

Table 2.7 provides a list of the few documented public-private partnership (PPP) transactions in the airport sector in Africa. Those attempts at private sector participation that have taken place have happened in all market sizes—from Cameroon, a thin market with below 1 million seats a year, to Tanzania, with more than 1 million seats, to South Africa, the largest market in Sub-Saharan Africa.

Figure 2.6 Countries with private sector participation in airports

Source: PPIAF database.

Note: The gray countries are the only countries with recorded deals in the Public-Private Infrastructure Advisory Facility (PPIAF) database, and span all market sizes.

Globally, airports have been fully privatized only on rare occasions. Privatization is most likely to be successful at large airports with very high passenger figures. In fact, some estimates indicate that only airports with more than a million passengers a year are financially sustainable. Yet even in systems with airports that large, profitable airports are often used to subsidize unprofitable ones that are seen to fulfill important social needs within a country. One commonly mentioned example of full privatization is the British Airports Authority, but it has its critics, who argue that prices have soared while service has declined. There are also complaints that not enough of the profits are being reinvested in basic airport infrastructure—a familiar refrain around the world.[17]

In Africa, the largest-scale privatization attempt is ACSA, the company that holds 10 of South Africa's airports. Of the $136.5 million privatization package, 20 percent was bought by Aeroporti di Roma in 1998, which sold its stake in 2005. ACSA, however, is not fully privatized—control of the company still rests with the South African government, which had stated that the company would be listed on the exchange after 2004, although that had yet to happen by 2009.

Is full privatization the model to follow for airports in Africa? Evidence is mixed. In the United States airports are clearly not in the private sector. In China, some assessments have concluded that partially privatized airports perform worse than ones under full government control, although those findings have been used by those who want full privatization rather than ones who support full or partial government control (Zhang and Yuen 2008). Globally, it appears that airport privatization is slowing down, with noticeably fewer transactions occurring in 2007 after a peak in 2006 that had been part of a longer trend since 1998 (Airports Council International 2007).

[17] "OFT Proposes to Refer BAA Airports for a Market Investigation," Mondag Business Briefing, December 21, 2006; and "BAA Face Penalties if London Airports Investment Cut," Alistair Osborne, Telegraph Media, October 5, 2007.

The successful concessioning of all aspects of airport management, including infrastructure needs and operations, depends on the quality of the initial transaction. Failing to choose the right partners or creating agreements with no effective enforcement mechanism may result in a steep decline in airport quality. For example, in one case an airport was handed to a group of investors (which also included the originating government) to operate every aspect of the facility and collect its revenues, provided that the group completed the required infrastructure investments and maintenance (such as resurfacing the apron and taxiways). With estimated passenger seat capacity in excess of 600,000 in 2007, the airport had generally been hailed as the best-run airport in the country's system. In the 10 years following concessioning, however, none of the required infrastructure investment and upkeep had been completed, and conditions deteriorated.

A more workable model for private sector participation in airports may be to split up an airport's functions so that one provider deliver services and another controls and invests in the infrastructure. In one African country, for example, operations ranging from cargo handling to check-in counters were contracted to a company in Europe, which in return hired local employees. That type of contract differs from airport to airport and go out for bidding in regular cycles. Currently airport infrastructure is managed by the state authority, which assumes responsibility for investments in runway improvements, aprons, and taxiways. In time, however, some functions—such as passenger terminal expansions—may include more private sector participation.

Betancor and Reindero (2000) provide an extensive discussion of private sector participation models in airports. In short, four types of ownership and operations schemes predominate: (i) public ownership and public operations with commercial orientation; (ii) regional ownership and operations (with "regional" referring to regions within a country); (iii) public ownership with private operations; and (iv) private operations. The third model, public ownership with private operations, can be split into several subtypes, including joint ventures, partial/majority divestitures, management contracts, and variations of concession contracts.

In *Privatization and Regulation of Transport Infrastructure*, Betancor and Reindero include very little discussion about Sub-Saharan Africa. The only airport listed as having a 15-year joint management contract involving shared risk between the public and private sector is Cameroon, which was co-managed by Aéroports de Paris (34 percent) and the government of Cameroon (24 percent), along with carriers and a bank (Betancor and Reindero 2000: 70–71), from 1993 to 2008; the agreement covered 7 of Cameroon's 14 airports. The PPIAF database, however, shows that most transactions in Sub-Saharan Africa— such as SwissPorts providing passenger counter services in Johannesburg and Dar es Salaam or private contractors fulfilling cargo-handling functions in lesser-known airports such as Mwanza in Tanzania—were of the third type mentioned above; that is, public ownership with private operations. Many more transactions of that type are likely taking place but not recorded. Overall, the practice of farming out specific airport functions to private participants using contracts that regularly go out for public bidding seems to be one of the most promising models of pubic-private partnership in the airport sector.

Table 2.7 Public-private investments in airports in Sub-Saharan Africa

Country	Financial closure year	Project name	Type of PPI	Project status	Location	Contract period	Termination year	Multiple systems	Number of transactions	Government granting contract	Investment year	% private	Government payment committed	Physical assets	Capacity type	Capacity
Algeria	2006	Houari Boumedienne Airport	Management and lease contract	Operational	Algiers	4	2010	No	1	Federal	2006	100			Population (thousands)	3,500
Djibouti	2002	Djibouti International Airport	Management and lease contract	Operational	Djibouti			No	1		2002	0				
Egypt	1998	El Alamein Airport	Greenfield project	Operational	El Alamein	50	2048	No		–	1998	100		88.5		
Egypt	1998	Marsa Alam Airport	Greenfield project	Operational	Marsa Alam	40	2038	No		–	1998	100		35.4		
Egypt	2000	Hurghada Airport Passenger Terminal	Greenfield project	Operational	Hurghada	15	2014	No		–	2000	100		4.4		
Egypt	2001	Borg El Arab Airport	Greenfield project	Operational	–	50	2051	No		–	2001	100		200		
Egypt	2001	Luxor Airport	Concession	Operational	–	25	2026	No		–	2001			70		
Egypt	2005	Cairo International Airport	Management and lease contract	Operational	Cairo	8	2013	No	1	Federal	2005	100			Number of runways	3
Egypt	2005	Five regional Egyptian airports	Management and lease contract	Operational	Sharm El Sheikh, Hurghada, Luxor, Aswan, Abu Simbel	6	2011	Yes	5	Federal	2005	100			Number of runways	1
Tunisia	2007	Enfidha and Monastir International Airports	Concession	Operational	Enfidha and Monastir	40	2047	Yes	2	Federal	2007	100		840		
Cameroon	1993	Aeroports du Cameroon	Concession	Operational	7 airports	15	2008	Yes	7	Federal	1993	71		30.8		
Côte d'Ivoire	1996	Abidjan International Airport	Concession	Operational	Abidjan	15	2011	No		Federal	1996	100		28	Number of runways	1
Kenya	1998	Jomo Kenyatta Airport Cargo	Greenfield project	Operational	Nairobi			No		Federal	1998	100		21.4		

Country	Financial closure year	Project name	Type of PPI	Project status	Location	Contract period	Termination year	Multiple systems	Number of transactions	Government granting contract	Investment year	% private	Government payment committed	Physical assets	Capacity type	Capacity
		Terminal														
Madagascar	1991	Aeroports de Madagascar (ADEMA)	Concession	Concluded	12 airports	15	2006	Yes	12	Federal	1991	34				
Mauritius	1999	Mauritius Airport	Management and lease contract	Concluded	Port Louie	5	2004	No		Federal	1999	100				
Nigeria	2006	Murtala Muhammed Terminal One	Greenfield project	Construction	Lagos	25	2027	No	1	Federal	2006	100		200		
South Africa	1998	Airports Company Ltd.	Divestiture	Canceled	Johannesburg, 11 airports		2005	Yes	11	Federal	1998	20	165.7			
South Africa	2000	Kruger Park Gateway Airport	Divestiture	Operational	Phalaborwa			No		Federal	2000	100		0.8		
South Africa	2000	Rand Airport	Divestiture	Operational	Gauteng			No		Federal	2000	80	2.9			
South Africa	2001	Mpumalanga Airport	Greenfield project	Operational	Nelspruit			No		State/Provincial	2001	90		34	Number of runways	1
Tanzania	1998	Kilimanjaro International Airport	Concession	Operational	Kilimanjaro	25	2023	No		Federal	1998			11.5		

Source: PPIAF database, World Bank.

Note: There are more PPPs, such as the partial privatization of the airports holding company ADL in Libreville, Gabon, in 1996. But most of these are concentrated on management contracts and specified services rather than on full operations of and investments in airports.

Air traffic control and weather information

There are few air traffic control installations in Africa. The North African countries with heavy traffic—Morocco, Algeria, Tunisia, and Egypt—have radar installations in place or in the planning stages. In Sub-Saharan Africa, Kenya and South Africa have the heaviest installations. Nigeria, Ghana, Tanzania, Uganda, and Zimbabwe are also equipped.[18] The rest of the continent—including Ethiopia, which is an important hub—seems to be without coverage. In Malawi and several other countries, some surveillance coverage existed in the past, but the aged equipment was too expensive to repair and is now no longer salvageable.

Even where the equipment exists, radar separation—where the controller uses radar returns to establish the position of the aircraft, and issues directions and headings based on the image of the radar—is not necessarily implemented. In Kenya, for example, only Nairobi has full-time radar vectoring, whereas Mombasa switches from procedural air traffic control (no radar vectors given to pilots) to radar procedures only if weather conditions so demand. Tanzania has a good radar installation in Dar es Salaam, with a secondary radar having a range in excess of 300 kilometers, but the country has no radar vectoring because of a lack of certified controllers. Ugandan radar services were provided by the military but only in an advisory manner, and the technology was old; a new civilian system was installed in 2007.

Radar is only one form of surveillance technology that allows an air traffic control center to locate an aircraft in the center's airspace. Newer and more precise techniques include having the aircraft broadcast its position to a ground station, which then relays the information to the air traffic control center. If the aircraft uses a modern global positioning system (GPS) to assess its position, the accuracy of the position can be as close as 30 meters. This aids both in separation of aircraft (which is not a constraint in areas that are not very busy) and in situational awareness for navigation. In some GPS systems, the aircraft broadcasts its position not only to the ground but also to the aircraft around it, which—if they are properly equipped—can see the transmitting aircraft on a screen in the cockpit.

Radar installations are thus giving way to the more advanced satellite-based (often known as automatic dependent surveillance-broadcast or ADS-B) technologies, which cost a fraction of what radar does, even if aircraft need to be reequipped. Given these developments, the term *surveillance system* is a more accurate term than *radar* when discussing methods of locating aircraft in the sky, especially when considering future infrastructure investments.

While a surveillance system is not essential for all countries in Africa, it is beneficial. Surveillance systems have many benefits, even in areas where traffic is light. A precise surveillance system:

- Provides a controller with an aircraft's position at all times, even if that controller is not communicating with the aircraft;
- Pinpoints the location of an accident much faster and more accurately than traditional radar;

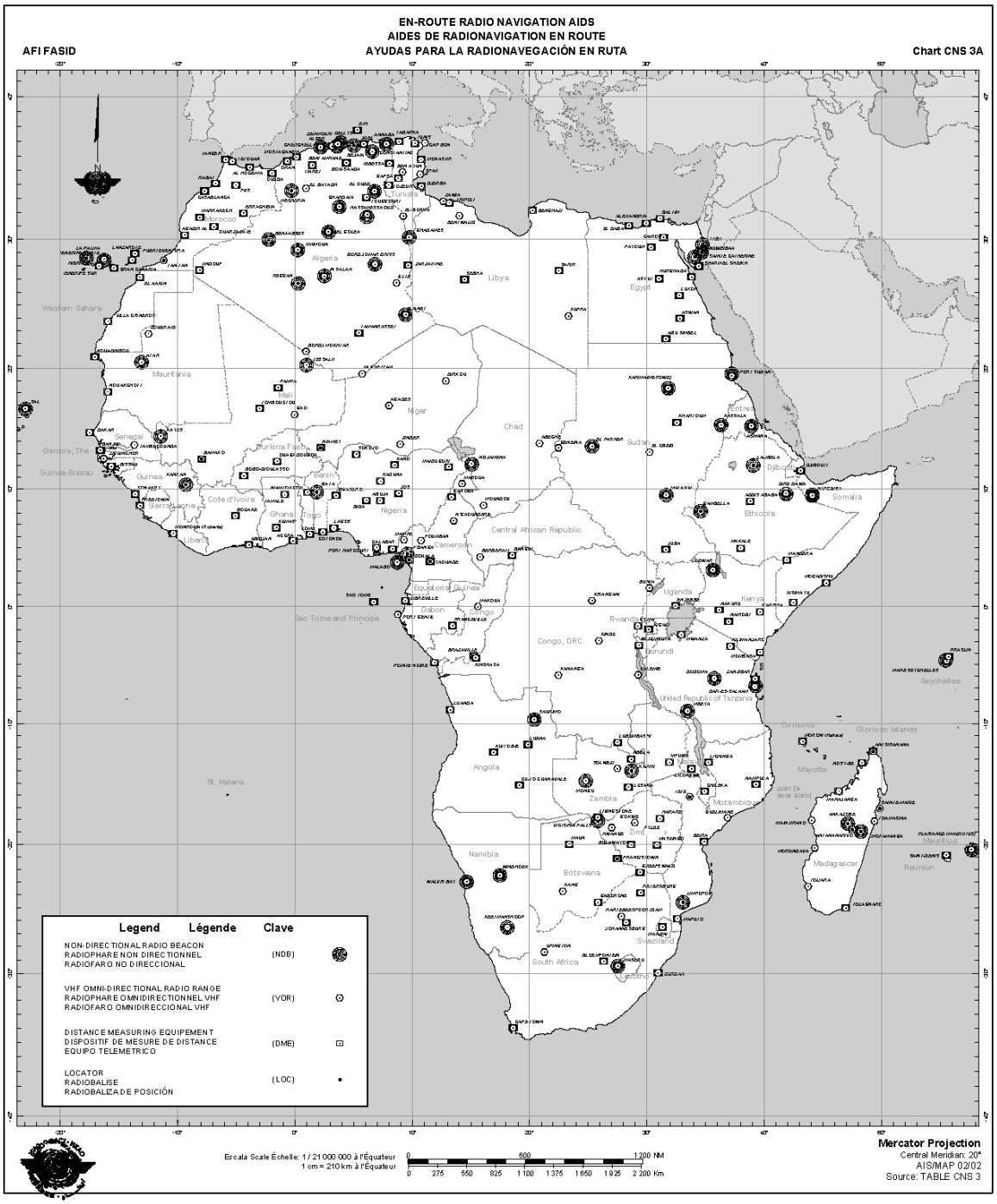
[18] The radar inventory was compiled using several sources. The ICAO's Air Navigation Plan for the African–Indian Ocean regions of 2003 provided key data, which were augmented with returns from the questionnaires and other sources. The current operation of the existing sites has not been verified.

- Allows much denser traffic (from 80 kilometers to roughly 8 kilometers), which gives controllers the freedom to allow aircraft to fly more fuel-efficient paths and approaches;
- Allows flying during bad weather, such as during the rainy season in many countries; and
- Allows the pilot see other aircraft in the vicinity, and provides other information, such as weather updates.

Africa could clearly benefit from additional low-cost surveillance (ADS-B) technology, especially in areas busy with overflights. In fact, South Africa is considering incorporating ADS-B in a planned redesign of the airspace over the Southern African Development Community (SADC) region.

Ground-based navigational installations in Africa are sparse (figure 2.7). North Africa is better equipped with radio navigational aids, as is the main corridor along the east stretching from South Africa to Egypt, with the remaining countries having large gaps in coverage. But radio navigational aids are expensive to install and maintain and are not as precise as GPS. The future of navigation in Africa thus lies with GPS, with aircraft carrying their own infrastructure, and with airports developing approaches that take advantage of the new technologies.

Figure 2.7 Installations of ground-based navigational aids in Africa



Source: ICAO.

Note: The largest dots represent non-directional beacons (NDBs), a very old technology. The smaller circles and squares represent more modern installations that are now also becoming less important as the use of satellite-based technology increases.

3 Legal framework and oversight

The air transport regulatory system in most countries of the world consists of the general aviation law, which establishes and authorizes the regulatory bodies to implement the necessary regulations. Many countries use the standards of the U.S. Federal Aviation Administration (FAA). In fact, the FAA offers a set of model laws and regulations online that are designed to be adapted for other countries.

Box 3.1 The role of the International Civil Aviation Organization (ICAO)

The ICAO, established in 1944 as a result of the Chicago Convention, is the UN organization responsible for the worldwide aviation sector. It is based in Montreal and has more than 180 member states. It sets standards and norms, as agreed to by the member states

The ICAO convention has a set of 18 annexes, most of them technical in nature, defining some of the generally accepted standards in international aviation. In addition, the ICAO issues standards and recommended practices, detailed procedures for air navigation services and supplementary procedures that apply only to specific regions.

The ICAO is not a regulatory body and has no enforcement role or authority. ICAO does, however, perform an important set of safety and security audits. Historically, safety audits have been kept confidential, but as a result of the recent disparities in the quality of oversight, member states have agreed to publicize the audit results to encourage governments to comply with the standards. These audits provide important data for assessing a country's aviation safety.

Generally, two organizations are formed—a civil aviation authority (CAA) and an airport operations authority. Typically, the CAA provides safety oversight, navigation, and traffic control services, while the airports authority handles services that could theoretically be provided by the private sector (though often they are not). Private sector participation in Africa has been exclusively in the airports sector, according to the Public-Private Infrastructure Advisory Facility (PPIAF) database, though other transactions (and attempted transactions) have occurred with state carriers. Airport ownership and management is discussed in further detail in section 2.

Two related elements are critical to the proper functioning of the oversight body: adequate funding and political autonomy. The poor safety record in some parts of Africa can be largely attributed to problems in these two areas and a lack of political will to fix them. Usually there are not enough funds to provide competitive salaries for safety inspectors. Inspectors are highly trained professionals who can command a significantly higher salary working for an airline than for a typical CAA in Africa. There are numerous examples abound of safety inspectors abandoning their oversight career for an airline almost immediately after receiving training (which is funded by donor countries). Political autonomy of inspectors is also an issue. In many cases a politically connected person is given the green light to operate an aircraft that would not have met safety requirements in another country and therefore should not be allowed to fly. The authority's political autonomy is therefore as important as the capacity of its oversight staff.

CAAs in Africa rely on fees to survive. In some instances, countries with a large land mass and key geographic location can collect significant air navigation charges from overflights. The reallocation of those charges can become politically contentious. A truly independent regulatory body would be able to

hold on to these revenues for its own use, but in many cases CAAs have to compete with other agencies for the funds, which end up in the state treasury.

Regional oversight bodies

Regions have begun pooling their resources to address some of their shortcomings in oversight. In East Africa a new central East African Civil Aviation Authority has just been formed, with support from the U.S. Department of Transportation's Safe Skies for Africa program. Though not yet fully implemented, the organization—now headquartered at the East African Community (EAC) in Arusha, Tanzania—would provide a central pool of expensive resources with technical expertise such as ramp and flight safety inspectors for all the EAC countries, increasing their oversight capacity. The organization does not replace the member countries' existing CAAs; instead, it augments their individual efforts. As of late 2009, all five member states, including post-conflict Burundi, are contributing roughly US$200,000 annually to the agency. Additionally, two Cooperative Development of Operational Safety and Continuing Airworthiness Projects (COSCAPs) are being planned for the Southern African Development Community (SADC) and the Economic and Monetary Community of Central Africa (CEMAC) regions, though their progress could not be determined for this report.

Another regional organization, the Agence pour la Sécurité de la Navigation Aérienne en Afrique et à Madagascar (ASECNA), pools air navigation services and other infrastructure. Founded in 1959, ASECNA has 15 member states. The organization also manages eight airports in different countries, though its management is reported to be highly decentralized.

Economic oversight

Proponents of regulation tend to rely on two arguments. First, if services become too predatory and competitive following deregulation, less-traveled and uneconomical routes will be dropped, isolating parts of a country. Second, a country's flag carrier, owned and operated by the government, needs to have market dominance to be economically feasible. The two arguments are therefore inextricably linked: it is socially necessary for the flag carrier to use revenues from more profitable routes to subsidize and service the less profitable or unprofitable ones. The result has been a protected system in which each country's flag carrier guards its routes dearly, allowing airlines from other countries to enter only if it obtains reciprocity.

Much of the world has moved toward increased deregulation of the air transport industry. In the United States the effects are well known—weaker carriers that existed for years have gone out of business, routes have been rearranged, and the now-familiar hub-and-spoke system has evolved. In Europe the rise of low-cost carriers has been one highly visible effect of deregulation.

Africa commenced on its own path toward liberalization with the Yamoussoukro Declaration of 1988 and Yamoussoukro Decision of 1999 (YD). The main goals were to institute free pricing, to lift capacity and frequency restraints, and to gain the ability to fly fifth-freedom routes.[19] Governments say they will complete the implementation process, even at the cost of their own airlines. Interestingly, the process has

[19] See appendix 11 for a brief explanation of the freedoms of the air.

not translated into deregulation of tariffs. As table 3.1 shows, fare oversight continues, but the extent of its impact on prices is not known.

A survey of the African CAAs conducted as part of this report collected information about the age of the civil aviation laws, the autonomy of the authority, and the funding process (table 3.1). The data indicate that the quality of the regulatory bodies varies from country to country.

Table 3.1 CAS survey responses

Country	Sector reform?	Legislation passed within the last 10 years?	Independent regulatory body?	Has any entity been corporatized (usually airports or an airline)?	Oversight on fares?
Botswana	Yes	Yes	No	Yes	Yes
Burkina Faso	Yes	Yes	No	Yes	No
Burundi	Yes	Yes	No	Yes	Yes
Cameroon	Yes	Yes	Yes	Yes	Yes
Cape Verde	Yes	Yes	Yes	No	No
Comoros	Yes	Yes	No	No	Yes
Ethiopia	Yes	Yes	Yes	No	Yes
Gambia	Yes	Yes	No	Yes	Yes
Kenya	Yes	Yes	Yes	Yes	
Lesotho	No	No	No	Yes	Yes
Madagascar			Yes		
Malawi	No	No	No	No	No
Rwanda	Yes	Yes	No	No	Yes
South Africa	Yes	Yes	Yes	Yes	
Swaziland	No	No	No	Yes	No
Tanzania	Yes	Yes	Yes	Yes	Yes
Uganda	Yes	No	Yes	Yes	Yes
Zambia	Yes		No	Yes	Yes

Source: Analysis of returns from the AICD questionnaire.

Note: Though there has been legislative reform of some sort in the past 10 years, for most CAAs that responded, the issue of independence, a cornerstone of effective and unbiased oversight, still needs to be addressed.

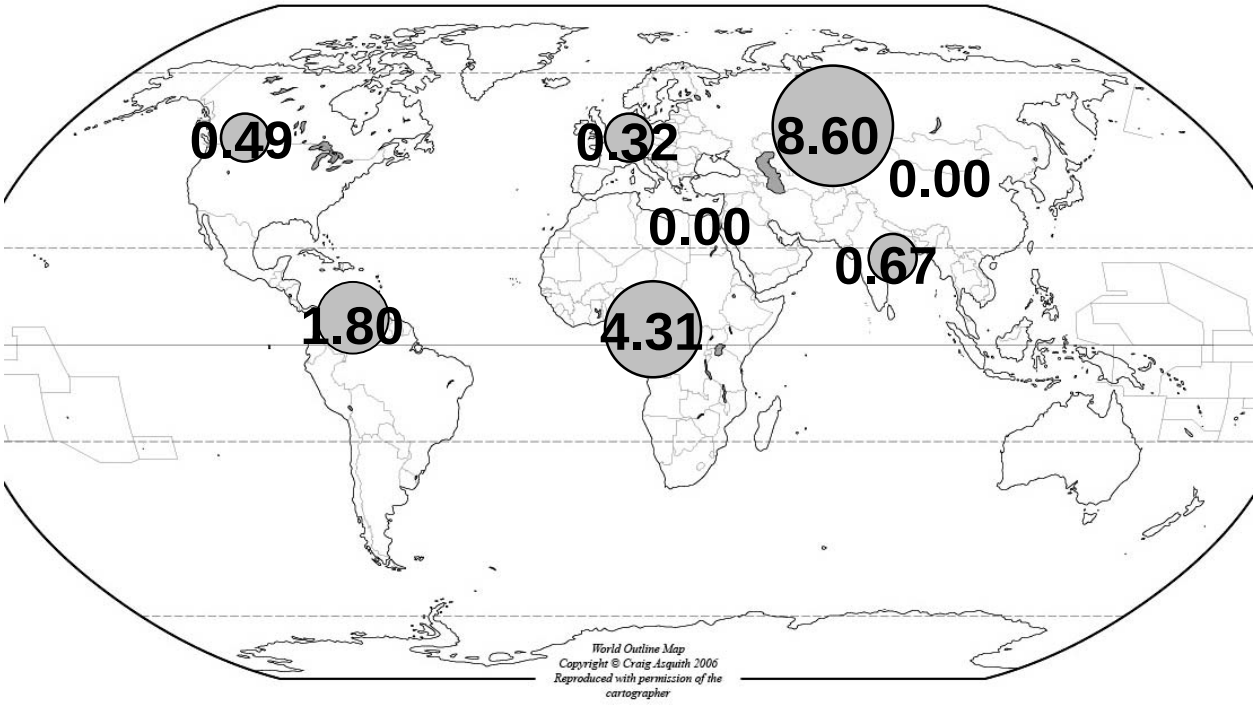
Safety oversight

An oversight agency's effectiveness can be measured in terms of its ability to allow for growth in throughput (that is, passengers) and its safety record of incidents and accidents. On the latter measure, Sub-Saharan Africa is by many accounts at the bottom of the scale. According to the International Air Transport Association (IATA), Sub-Saharan Africa's losses of Western-built jet hulls were exceeded only by those of the newly independent Commonwealth of Independent States in Central Europe (figure 3.1)[20].

[20] Discussions with one manufacturer of Western jets revealed disagreement with the way the IATA computed its 2006 figures, with Africa still being seen as the least safe. Previous reports have consistently ranked the African continent as having the highest hull loss rate. On the other hand, there are also concerns about using hull loss rates as

At the same time, there is controversy within the industry as to the validity of the calculations of the CIS rate, and it is commonly accepted that Africa is the least-safe region.

Figure 3.1 Western-built jet aircraft hull loss rate by operator region in 2006

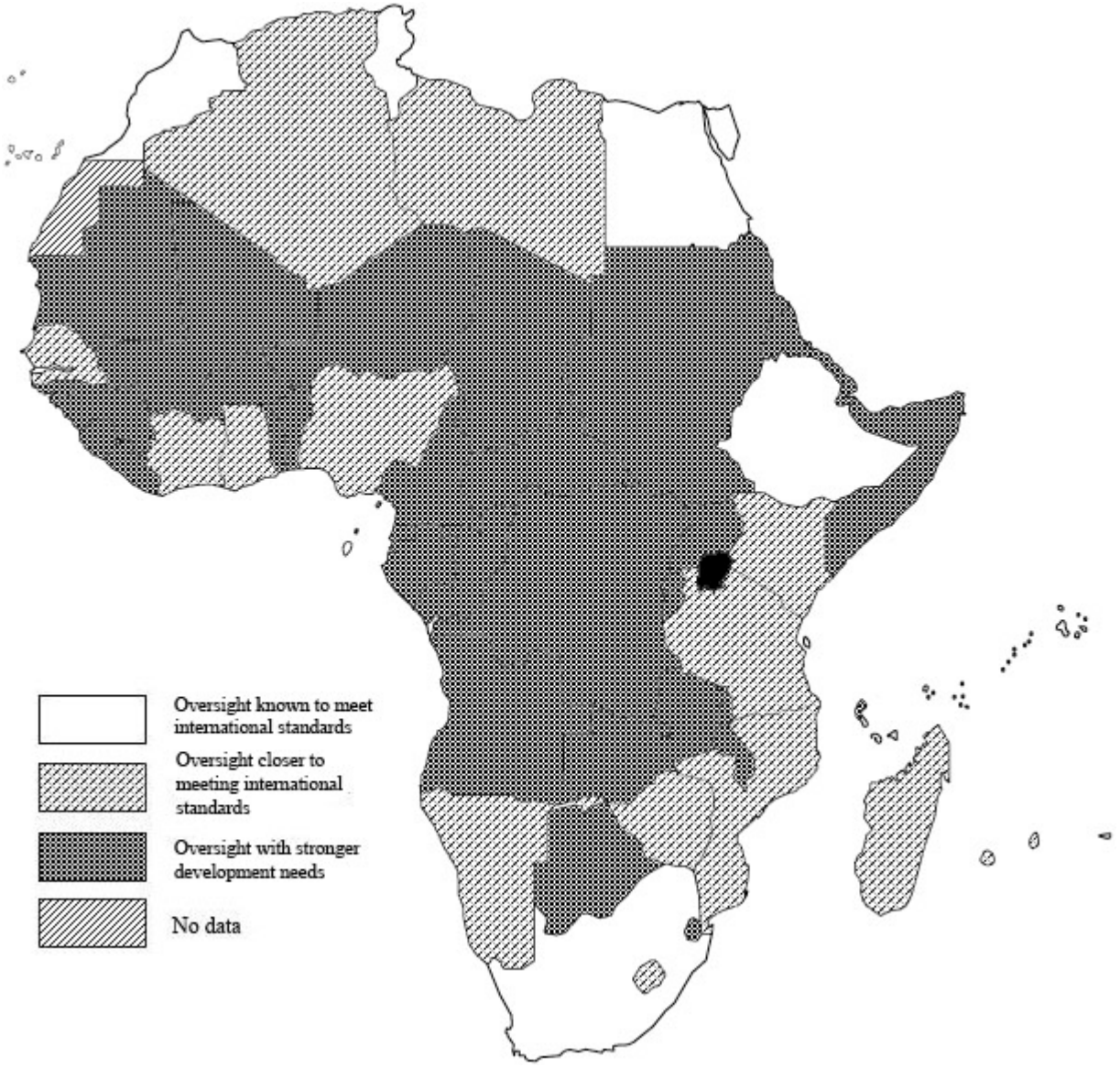


Source: 2006 Safety Report, IATA.

According to the IATA, the greatest threat to safety in Africa is poor regulatory oversight, followed by inadequate safety management systems and inadequate flight crew training and proficiency. Most accidents in 2006 involved Eastern-built turboprop aircraft that were more than 20 years old, but as figure 3.1 (which focuses on Western-built hulls) shows, this is by no means the only concern.

an indicator of safety, since older aircraft are more likely than newer ones to be written off as a complete loss, even if the damage is relatively light.

Figure 3.2 Status of African safety oversight, using several criteria



Source: Map based on data in Schlumberger (2008).
Note: Cape Verde, which has passed the FAA's IASA audit and is rated category 1 in safety oversight, is not shown on this map.

Evidence suggests high levels of institutional weakness in Africa. As shown in figure 3.2, safety oversight in some African countries that serve as major hubs, such as Kenya and Senegal, lags behind that of others, such as South Africa and Ethiopia. One of the main criteria used in figure 3.2 is the overall results of the ICAO audits, which bear a statistically significant correlation to actual accidents.

In conclusion, effective oversight is at least as important as physical infrastructure for the development of Africa's air industry. This will require not only the financial ability to share high-skilled inspectors but also the political autonomy to enforce technical regulations.

Four global safety assessments

Globally, there are four key sources of safety information for air travel. The most dominant private sector safety rating is provided by the IATA through its International Safety Audit (IOSA) program, which audits individual airlines. Originally designed to eliminate duplicate audits that airlines were required to complete before joining alliances, the program is now mandatory for all the IATA members. Non-IATA members subject themselves to it as well to obtain the credibility of its certification.

Beyond the IOSA, two other audit programs target countries rather than airlines: the U.S. FAA's International Aviation Safety Assessment (IASA) audit and the ICAO's Universal Safety Oversight Audit Program (USOAP). The IASA applies to countries with direct flights to the United States. A country needs a rating of category 1 to fly new routes directly into the United States. A country with a category 2 rating is not allowed to increase its capacity, although existing flights may be allowed to continue. Currently, of the 106 countries that have received IASA audits, 17 are category 2. Six of the ten African countries that went through the audit received a category 2 rating (table 3.2).

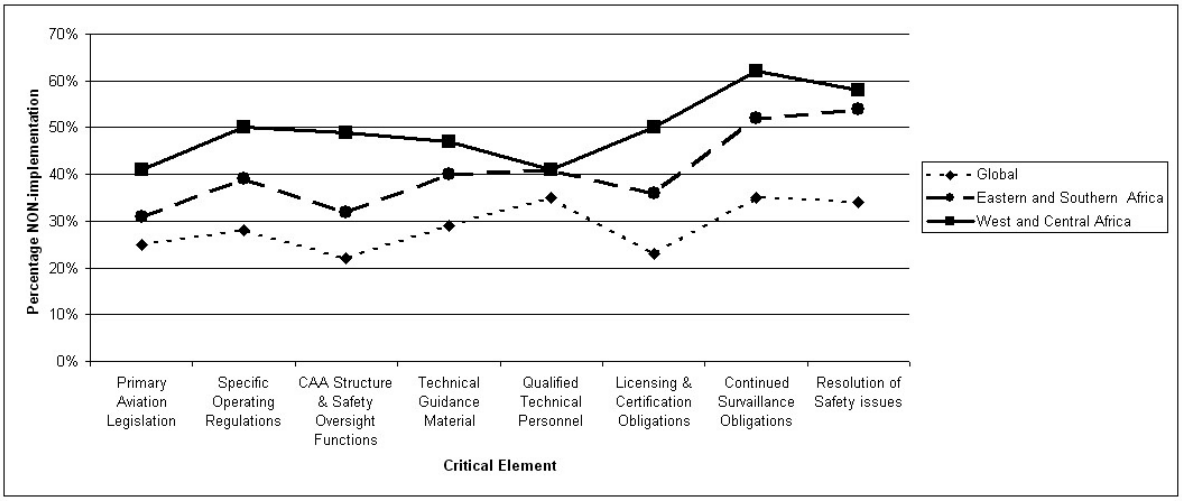
The USOAP audit theoretically is conducted every three years. In practice, however, assessments against standards set in the ICAO annexes and SARPS are conducted less frequently. Figure 3.3 graphs the number of discrepancies from established USAOP safety norms according to technical criteria. Africa has the highest rate of non-implementation of USAOP safety standards .Subtracting non-implementation rates from 100 percent yields implementation rates of safety standards. The acceptable minimum for implementation is at least 75 to 80 percent. Africa's overall safety oversight would reach that standard only when non-implementation falls into the 20 to 30 percent bracket, a level that has not yet been achieved. The audit program's findings generally coincide with actual accident rates (figure 3.4). For example, West and Central Africa, which have the highest audit deficiencies (that is, the poorest safety oversight), also have the highest accident rates.

Table 3.2 Current FAA ratings of African countries

Country	Category (1 = pass, 2 = fail)
Cape Verde	1
Côte d'Ivoire	2
DRC	2
Egypt	1
Ethiopia	1
Gambia	2
Ghana	2
South Africa	1
Swaziland	2
Zimbabwe	2

Source: FAA.

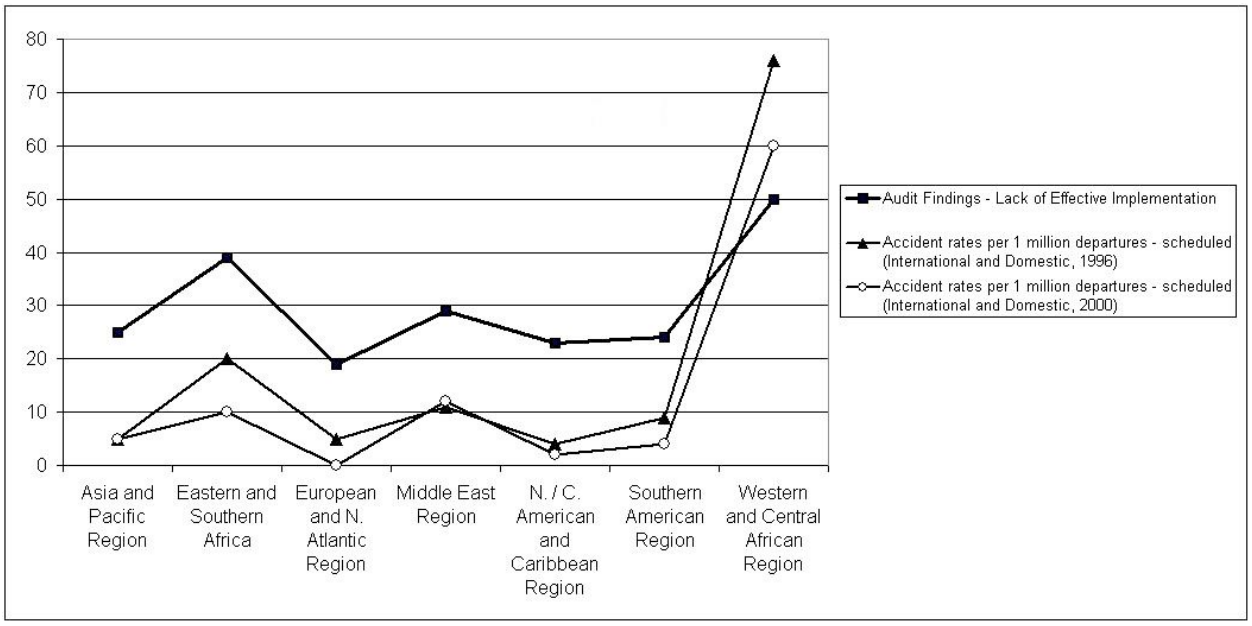
Figure 3.3 Lack of effective implementation of critical elements in oversight



Source: ICAO USOAP audits 2004.

Note: North Africa is not included in this chart.

Figure 3.4 Comparison of USAOP audit findings with actual accident rates in the various regions



Source: ICAO.

A fourth audit program, the well-known European Union (EU) Blacklist, relies on measures such as safety ramp checks for aircraft flying into Europe. An increase in safety-related events and crashes forced the EU to institute the program and assume responsibility for enforcement, prohibiting carriers that do not meet its criteria from entering the region. The program targets both airlines and their country of origin, although it makes exceptions for aircraft of otherwise banned airlines whose maintenance is performed exclusively in Europe. Many African countries and airlines can be found on the list.

Table 3.3 African countries currently on the EU blacklist

Country	Airlines
Sudan	1
Rwanda	1
Angola	1
DRC	All, with specific mention of 51
Equatorial Guinea	All, with specific mention of 7
Liberia	All
Sierra Leone	All, with specific mention of 8
Swaziland	All, with specific mention of 6

Source: European Union.

Note: Other countries found on the blacklist are North Korea, Afghanistan, Iran, Ukraine, Indonesia, and the Kyrgyz Republic.

Programs to improve safety in Africa

The high accident rate associated with the growth of air traffic in Africa has caught the attention of donor countries, development institutions, and industry-related associations and organizations. Numerous safety programs have been implemented, such as the U.S. Department of Transportation's Safe Skies for Africa; the Industry Safety Strategy Group (ISSG), formed by Boeing, Airbus, and several associations; AviAssist from the Netherlands; the French Civil Aviation Authority; and the World Bank's own recent lending program, the Regional Air Transport Safety Project for West and Central Africa. Many of these programs have their own specific activities and goals. For example, the Safe Skies for Africa program has been helping East Africa create its new regional safety oversight organization. The ICAO is helping to create three COSCAPs—one for the West African Economic and Monetary Union (WAEMU), one for CEMAC, and one for the Banjul Accord Group (BAG) countries—which may eventually lead to additional regional flight-safety oversight agencies. The African regional communities themselves are also attempting to pool resources to address safety by setting up bodies such as the African and Malgache Civil Aviation Authorities (AMCAA), which was formed in 2001.

One of the more serious challenges facing those efforts is maintaining an overall policy perspective. To address this, the ISSG's program coordinates donor aid and other aid activity to address deficient areas. Similarly, the ICAO, with assistance from the World Bank, is creating a central repository and database for projects related to air transport, which will then be mapped to other metrics, such as those of the ISSG program.

Though the progress of these combined efforts cannot yet be discerned through accident statistics, there have been concrete accomplishments, such as the creation of a more independent CAA in Nigeria (box 3.2). The continued work of improving Sub-Saharan Africa's aviation safety is crucial for the health of the industry and its effect on the economy, especially as other pressures—such as the current global recession and the potentially higher fuel costs associated with a recovery—are poised to limit growth in the sector.

Box 3.2 Safety oversight in Nigeria

With more than five million passengers annually, Nigeria's aviation market is second only to South Africa in Sub-Saharan Africa. Following the demise of Nigeria Airways, registered commercial carriers in the country proliferated, reaching a peak of more than 40 in 2005. Unfortunately, this rapid growth was not accompanied by an increase in the capacity of the Nigerian Civil Aviation Authority (NCAA) to uphold safety and security standards. The consequences became painfully visible when three domestic flights crashed in 2005 and 2006, killing more than 300 people. In each case, blame was attributed (at least partially) to pilot error linked to inadequate oversight by the NCAA.

Since then, the Nigerian government has taken a number of steps to strengthen the NCAA's oversight of air transport operators and has tightened the operators' technical requirements:

- An amendment to the Civil Aviation Act in late 2006 made the five-year appointment of the NCAA's director general a parliamentary act, strengthening the NCAA's financial and administrative autonomy.
- Minimum capital required for domestic and international airlines were increased by a factor of 25 and 100, respectively, to weed out undercapitalized airlines. As a result, the number of commercial operators dropped from more than 40 in 2006 to fewer than 15 by the end of 2008.
- The NCAA has started to implement a massive retraining program for its technical oversight personnel through government and donor funding.
- An institutional and operational review of the NCAA's modus operandi has been launched.

In spite of the progress, the Nigerian aviation sector still faces major challenges, the most important of which are the following:

- The NCAA's technical oversight capacity is unsustainable in the long term. With more than 90 percent of its annual revenues absorbed by its staff of more than 650, the NCAA cannot finance its long-term training and equipment needs. Unless its recurring costs are lowered, its oversight capacity will continue to rely on erratic government budgetary support.
- The NCAA is still struggling to enforce quality, safety, and security standards on federal agencies operating Nigeria's airport and airspace systems.

4 Policy recommendations

A detailed policy analysis is beyond the scope of this report. Furthermore, countries and regions differ significantly throughout the African continent, so it is important not to make generalizations based on overly simplified assumptions. Nevertheless, several very general recommendations can be made, which are listed in order of importance below.

Priority 1: Improve safety oversight

Africa has the worst overall long-term safety record in the world. Air safety depends on strong oversight, which in many African nations still requires development. In some cases, political will may be a lacking. In addition, budget constraints are often a factor.

To address these limitations, pooled or regional safety oversight organizations could hire technical personnel at more competitive salaries than individual countries and then share them throughout the region, decreasing the airlines' ability to attract trained personnel from the civil service. This would require a budgetary commitment of member governments. In addition, it is vital to establish autonomous civil aviation authorities (CAAs). Government officials have had undue influence in CAA affairs. In a typical scenario, an influential foreign company gets an operator's certificate, which allows it to fly a fleet of aircraft that are not allowed to operate in other countries. The CAA turns a blind eye to the situation, imperiling both the safety of passengers and the legitimacy of the oversight system in the country and beyond.

Priority 2: Focus airport investment on maintaining existing facilities rather than building new ones

In general, Africa's runways meet or far exceed current demand. New airport construction should therefore be considered only in regions that lack an airport but have demand. Existing infrastructure should be improved rather than replaced. For example, runways, taxiways, and aprons should be maintained and expanded when needed; terminals should be updated; and landside access to the airports should be optimized. Over time, many of airside investments will become "smarter" and less expensive. For example, automatic dependent surveillance-broadcast (ADS-B) satellite-based technologies, which are available at a fraction of the price of radar installations, are rapidly becoming more common. Similarly, much of the landside navigational infrastructure that is becoming obsolete can be replaced with satellite-based technologies that are not only considerably less expensive but also more reliable and accurate. If possible, landside investments should be made in conjunction with private sector participation. In particular, services such as check-in, baggage handling, and even cargo-terminal operations can be effectively outsourced to specialized firms.

Priority 3: Stop spending state funds to develop unprofitable flag carriers

With a few outstanding exceptions, state carriers are highly unprofitable. Without protected routes, most small, struggling state carriers would be unsustainable. Even with protectionism, they are fiscal liabilities that often provide substandard services and present safety risks to the flying public . In addition, government ownership of both the flag carrier and the airport infrastructure hurts overall airport and airline economics. Attributable fees, such as landing and parking charges, are not reliably collected, and costs are misallocated.

Plans to privatize unsustainable flag carriers nearly always fail. Those plans are sometimes devised as a form of "governmental entrepreneurship," in which it is assumed that if everything were done right (the correct routes chosen, the operations handled more efficiently, and so on), the airline could make money for the government. Unfortunately, the facts do not bear out this assumption.

In general, the best policy is therefore to liquidate unprofitable flag carriers completely. With liberalization, other operators will continue to serve important routes, and the government can provide subsidies to the private sector to operate unsustainable domestic routes.

Priority 4: Improve air traffic control infrastructure and airspace design

Africa's lack of adequate air traffic control infrastructure not only jeopardizes passenger safety but also negatively impacts operational efficiency and the environment. Since much of Africa has no form of aircraft traffic surveillance, flights rely on inefficient point-to-point routes rather than efficient "great circle" routes. Installing new, inexpensive satellite-based surveillance technologies would improve the efficiency of routing of flights across the continent, which in turn would lower fuel consumption and the associated greenhouse gas emissions.

Priority 5: Move forward with implementing liberalization

Since the implementation of the Yamoussoukro Decision (YD) is already progressing rapidly, it is listed as a lesser priority here. Implementation has already helped provide new services to countries that have lost carriers in the past four years. The increased fifth- and sixth-freedom operations conducted by Ethiopian, Kenyan, and South African airlines, for example, demonstrate the potential for better, more sustainable, and possibly more cost-effective services.

Countries that continue to protect a weak carrier have not followed the same trend of implementation. In this sense, priorities 3 and 5 are intertwined. The overall state of the implementation of the YD is discussed in detail, with more specific policy recommendations, elsewhere (Schlumberger 2008). Nevertheless, implementation of the YD is vital to the overall health of the industry.

Priority 6: Improve data collection

International Civil Aviation Organization (ICAO) members are obligated to collect and submit various types of data to the ICAO, including airline and airport financials. But many of the more complicated types of data are simply not submitted by many countries, even in the developed world.

Making an informed assessment of the sector requires core passenger data, at least by airport if not by route. The level of data submission by African countries is so low that other sources for estimating passenger travel, such as seat capacity, had to be used for this analysis.

Many countries lack the budget for data-collection personnel or for simple computer equipment. Often daily passenger figures are recorded by hand. This situation must be rectified: the health of a country's or a region's air transport system cannot be measured without these submissions. It is therefore necessary to implement systems—managerial, technical, or both—so that vital data are reported to the ICAO on a regular and timely basis.

References

ADPI Architectes & Ingénieurs. 2008. "Analyse Economique et Financière des Capacités de Développement des Aéroports du Mali." October.

Airports Council International.2007. *ACI Airport Economics Survey*. Montreal.

Betancor, Ofelia, and Roberto Reindero. 2000. "Airports." In *Privatization and Regulation of Transport Infrastructure—Guidelines for Policymakers and Regulators*, ed. Antonio Estache and Ginés de Rus (51–111). Washington, DC: World Bank.

Briceño-Garmendia, Cecilia, Karlis Smits, and Vivien Foster. 2009. "Financing Public Infrastructure in Sub-Saharan Africa: Patterns and Emerging Issues." AICD Background Paper 15, Africa Region, World Bank, Washington, DC.

Button, Kenneth. 2008. "Airport Privatization in Developing Countries: Privatization and Deregulation." In *Aviation Infrastructure Performance: A Study in Comparative Political Economy*, ed. Clifford Winston and Ginés de Rus. Washington, DC: Brookings Institution Press.

Carruthers, Robin, Ranga Rajan Krishnamani, and Siobhan Murray. 2009. "Improving Connectivity: Investing in Transport Infrastructure in Sub-Saharan Africa." AICD Background Paper 7, Africa Region, World Bank, Washington, DC.

Iches, Michel. 2003. "Air Transport in Western and Central Africa—Fact and Issues." Interim Version 10. Unpublished report prepared for the World Bank, Washington, D.C. August.

Intervistas Consulting. 2007. "Estimating Air Travel Demand Elasticities." Report prepared for IATA. December.

Jacobs Consultancy. 2007. "New Kigali Airport Business and Financial Analysis." January.

Schlumberger, Charles E. 2008. "The Implementation of the Yamoussoukro Decision." McGill Institute of Aerospace Law, Montreal.

Zhang, Andrew, and Andrew Yuen. 2008. "Airport Policy and Performance in Mainland China and Hong Kong." In *Aviation Infrastructure Performance: A Study in Comparative Political Economy*, ed. Clifford Winston and Gines de Rus (159–192). Washington, DC: Brookings Institution Press.

Appendix 1 A note on the research methodology used in this report

Sources of data on scheduled air transport

Traffic analysis is highly data intensive. Unfortunately, because of the extreme limitations in both budget and capacity, those countries most in need of development aid are also those with the least and least reliable vital data. This is as true in air transport as it is in other sectors, especially in Africa.

The International Civil Aviation Organization (ICAO) is the standard data source for traffic statistics collected by airlines and airports. But because the actual passenger counts (often kept on paper ledgers due to lack of computerization) are in many cases never submitted to the ICAO and monthly reporting is sporadic, exceptionally large data holes (some as large as five years or more) exist. Hence, alternative sources of data must be tapped.

An excellent *approximation* of actual traffic is the capacity offered. Assuming that, over time, airlines fly aircraft only if they are filled enough to be economically feasible, one could hypothesize that 50 to 70 percent of the seat capacity offered on a route closely approximates the actual traffic. In addition, one could hypothesize that even with changes in the load factor, the overall trend in seat capacity over time approximates actual traffic trends.

As such, data published by airlines in reservation systems, a necessary tool for marketing capacity, could substitute for actual travel data. In fact, these data are readily available and highly granular, providing a wealth of information not just on the actual seats but also on the type of aircraft, the frequency of the routes, and the actual scheduled times of the flight.

Today there are two main sources of these data—the Official Airline Guide (OAG) and Diio's SRS Analyser (formerly Seabury ADG). The Diio's SRS Analyser data are collected by Innovata and marketed by the International Air Transport Association (IATA). Both the OAG and Diio's data depend on airlines to report their routes and have captured 99 percent of the scheduled airline data, with about 900 to 1,000 airlines participating. The OAG enjoyed a monopoly in the market of data collection in this sector until the creation of Seabury ADG around 2000. Seabury ADG became Diio's SRS Analyser through a sale. Though the OAG is the more established collector, both companies enjoy an excellent reputation and are endorsed by the IATA.

For the studies on Africa undertaken by the World Bank, the SRS Analyser data were used. A total of 12 snapshots in time were assembled, 4 each for the years 2001, 2004, and 2007. To capture seasonal trends, the four samples for each year consisted of data for one week in the months of February, May, August, and November. For the annualization of these figures, the sum of the four observations for a year was multiplied by 13.[21]

[21] Since these are weekly data, 4 × 13 (52 weeks) better approximates a year than 4 × 12 (48 weeks).

The data consist of one record of each flight occurring during the sampled week, including the origin and destination airports, the changeover airport for the one-intermittent-stop flights, the number of flight kilometers, the flight duration, the number of seats available, the number of times the flight operated in a week and the weekdays it was scheduled on, the aircraft type, information about the marketing operator as well as the actual operator, and various data flags to help processing, such as type of operation (domestic, international).

Using Microsoft Access, the data were normalized and linked to other relevant tables (some of them from other sources) to develop a relational database for extensive summarization and querying. In addition, one important adjustment was made: flights going from one airport to another with a stop in between had equal capacity allocated to each leg. This implies that a flight from airport A to airport C via airport B would have only half the capacity to go from airport A to C, while the other half would deplane at airport B.[22] Accordingly, if a flight had four legs, each of the destination airports would have one-fourth of the capacity allocated to each leg. Though the even distribution of the legs is an assumption, overall this methodology prevents double counting of capacity for multileg flights, and the overall impact of these calculations produced a roughly 10 percent adjustment in capacities.

To check the accuracy of this method, some of the airport aggregates were compared to actual data when they were available from the ICAO. The ratio of seats versus reported traffic hints at a load factor of about 65 to 69 percent for those routes tested—a solid and reliable figure, further supporting the credibility of the data. Other, rougher summaries hint at a load factor of 50 to 60 percent, but these are large aggregates measured against each other, most likely also having significant assumptions in the index measured against. For example, some of the actual passenger data were aggregates from other sources, where the overall knowledge of what countries were reported were lost in continental traffic figures, and therefore casting doubts on the completeness of the data.

The data are particularly helpful in capturing trends in city and country pairs, fleet renewal (in most cases the type of aircraft is provided down to the series number, such as Boeing 737-100 versus 737-800), and airline market share. But it must be kept in mind that the data reflect only *scheduled* and *advertised* services. An "informal" airline with no reservation system—one that issues paper tickets at the airport and prints its schedule on a flyer or chalkboard—will not be captured. Accordingly, the SRS Analyser data show virtually no older Eastern-bloc-built aircraft operating in Africa, yet we have anecdotal evidence of such operations, as well as accident statistics. While these types of services are suspected to be relatively rare, they account for a high incidence of accidents.

Other data sources

Because central data collection in Africa is still in a developmental stage, diverse sources were needed. A questionnaire was sent to all 54 African countries asking for extensive details on such things as civil aviation budgets, airport charges, and the number of employees within the CAA. Twenty countries returned the questionnaires at various levels of completion. When and if a true comparative sample set

[22] The plane is full from A to B, but half of the passengers get off at B, so the A–B leg is allocated 50 percent. The plane fills up again as passengers board at B to go to C. There are shortcomings to this method because of the distribution between the intermediary airports, but it is the best method we could come up with.

was derived from the questionnaires, it has been applied in this report. But since the questionnaire was large and many sections were not completed by the CAAs while others were not, the actual sample size per answer often remained very small.

For air navigation and air traffic control infrastructure, the ICAO reports provided by the Air Navigation Bureau of the ICAO provided the most comprehensive inventory, and spot checks with actual data returned from the questionnaires showed both in agreement.

The status of airport infrastructure was gleaned from a variety of sources. Overall airport and runway conditions were assessed based on satellite images available through a popular satellite photo agency. Roughly 80 percent of all the airports receiving scheduled services in November 2007 (according to SRS Analyser data) were photographed at a high enough quality to draw conclusions. Of those 226, expert on-the-ground observational inputs confirmed the general conclusions on a sample of 23. Additional information for each airport was researched using common data sources, including Jeppesen's.

Since the ICAO does not keep a central database, airport-terminal capacity was derived from www.azworldairports.com, a publisher in the United Kingdom that collects self-reported information from the largest of the African airports.

Appendix 2 Additional traffic figures

Table 2.1 Competition in the top 20 intercontinental routes in Africa

Country 1	Country 2	Estimated seat miles (millions)	Annual growth 2001–7 (%)	No. of airlines
South Africa	United Kingdom	11,693	1.02	5
Germany	South Africa	5,444	9.08	3
France	Morocco	5,378	17.40	8
South Africa	UAE	3,195	28.62	2
South Africa	United States	3,102	-3.34	2
Egypt	Germany	3,099	9.24	8
Hong Kong, PRC	South Africa	3,041	10.85	2
France	South Africa	3,025	9.29	2
Algeria	France	2,954	8.74	3
Kenya	United Kingdom	2,872	8.27	4
France	Mauritius	2,780	-0.12	3
Nigeria	United Kingdom	2,715	9.45	5
Egypt	UAE	2,592	16.94	6
Egypt	Saudi Arabia	2,415	6.04	2
Netherlands	South Africa	2,378	5.84	1
Australia	South Africa	2,139	0.37	2
Kenya	Netherlands	2,077	6.30	3
France	Tunisia	1,982	5.21	5
Mauritius	United Kingdom	1,803	3.85	3

Source: Analysis of data provided by Diio's SRS Analyser.

Table 2.2 Top 20 airlines for intercontinental travel with Africa

Airline	Seat miles 2001 (millions)	Seat miles 2004 (millions)	Seat miles 2007 (millions)	Annual growth 2001–7 (%)	Annual growth 2004–7 (%)	Market share 2007 (%)
South African Airways	14,879	14,088	14,795	-0.09	0.82	9.32
Air France	7,986	11,195	12,654	8.0	2.1	8.0
British Airways P.L.C.	11,387	10,907	10,656	-1.1	-0.4	6.7
EgyptAir	7,800	7,164	10,577	5.2	6.7	6.7
Emirates	1,528	4,398	8,924	34.2	12.5	5.6
KLM Royal Dutch Airlines	4,576	5,854	6,641	6.4	2.1	4.2
Royal Air Maroc	3,872	4,594	6,153	8.0	5.0	3.9
Ethiopian Airlines	1,840	2,398	4,962	18.0	12.9	3.1
Air Mauritius	4,226	4,589	4,838	2.3	0.9	3.1
Deutsche Lufthansa AG	3,228	4,391	4,770	6.7	1.4	3.0
Kenya Airways	1,892	2,686	4,237	14.4	7.9	2.7
Virgin Atlantic Airways	1,889	2,267	3,213	9.3	6.0	2.0
Qatar Airways (W.L.L.)	211	633	2,865	54.5	28.6	1.8
Air Algerie	2,071	2,263	2,636	4.1	2.6	1.7
TunisAir	2,307	2,401	2,569	1.8	1.1	1.6
Saudi Arabian Airlines	1,765	2,047	2,483	5.9	3.3	1.6
Swiss International Airlines.	59	1,919	2,148	82.1	1.9	1.4
Singapore Airlines Limited	1,876	2,121	2,145	2.3	0.2	1.4
Alitalia	1,535	1,674	1,986	4.4	2.9	1.3
TAP	921	1,190	1,948	13.3	8.6	1.2

Source: Analysis of data provided by Diio's SRS Analyser.

Table 2.3 Overview of the capacities offered for international travel within North Africa

Country 1	Country 2	City pairs 2001	City pairs 2007	Airlines Feb 2001	Airlines Nov 2007	Adjusted seats 2001 ('000)	Adjusted seats 2004 ('000)	Adjusted seats 2007 ('000)	Annual growth 2001–7 (%)	Annual growth 2004 –7 (%)	Herfindahl index Feb 2001	Herfindahl index Nov 2007	Leading airline 2007	Airline market share 2007 (%)	Leading airline 2001	Airline market share 2001 (%)
Egypt	Libya	6	5	2	3	178.3	203.8	527.7	19.8	37.3	6,814	3,965	EgyptAir	45	Jamahirya Libyan Arab Airlines	79
Libya	Tunisia	3	3	3	2	141.2	169.4	298.0	13.3	20.7	4,670	5,037	Jamahirya Libyan Arab Airlines	51	Jamahirya Libyan Arab Airlines	58
Morocco	Tunisia	2	2	4	2	228.4	232.6	270.8	2.9	5.2	3,787	5,006	Royal Air Maroc	52	TunisAir	46
Algeria	Tunisia	1	2	3	2	169.5	184.3	212.0	3.8	4.8	3,576	5,005	TunisAir	54	TunisAir	43
Algeria	Morocco	2	2	5	2	80.9	99.4	165.4	12.7	18.5	2,482	5,017	Royal Air Maroc	58	Air Algerie	32
Egypt	Morocco	1	1	2	2	92.4	66.2	142.0	7.4	29.0	5,005	5,169	Royal Air Maroc	59	Royal Air Maroc	50
Libya	Morocco	1	3	2	4	94.8	109.6	141.9	7.0	9.0	5,214	2,688	Jamahirya Libyan Arab Airlines	37	Jamahirya Libyan Arab Airlines	67
Algeria	Egypt	1	1	2	2	55.2	66.3	99.3	10.3	14.4	5,351	5,152	EgyptAir	58	EgyptAir	65
Egypt	Tunisia	1	1	2	2	69.4	86.7	98.3	6.0	4.3	5,134	5,005	TunisAir	52	TunisAir	59
Algeria	Libya	1	1	2	2	33.9	38.8	35.6	0.8	-2.9	5,001	5,341	Air Algerie	56	Jamahirya Libyan Arab Airlines	52
						1,144.0	1,257.1	1,990.8	9.7	16.6						

Source: Analysis of data provided by Diio's SRS Analyser.

Table 2.4 Airlines operating in monopoly markets in Sub-Saharan international traffic

Leading airline 2007	Seats 2007 ('000)	Seats 2001 ('000)	Percent 2007 (%)	Percent 2001 (%)
Ethiopian Airlines Enterprise	1,173	273	45	43
Kenya Airways	583	35	22	5
Bellview Airlines Ltd.	101	8	4	1
SA Airlink d/b/a South African Airlink	86	45	3	7
Zambian Airways	77	0	3	0
Air Namibia	76	17	3	3
TAAG Angola Airlines	67	12	3	2
Air Seychelles Ltd.	64	0	2	0
Hewa Bora Airways	49	2	2	0
Air Tanzania Co. Ltd.	36	20	1	3
Slok Air International	32	41	1	7
Air Mauritanie	28	11	1	2
Air Mauritius	26	0	1	0
Air Senegal International	25	5	1	1
Rwandair Express	23	8	1	1
Eritrean Airlines	22	0	1	0
South African Airways	18	85	1	13
Air Botswana Corporation	15	0	1	0
Afriqiyah Airways	15	0	1	0
Air Madagascar	14	31	1	5
Air Burkina	14	38	1	6
Sudan Airways Co. Ltd.	13	0	0	0
Inter-Aviation Services (South Africa)	12	0	0	0
Star Equatorial Airlines	12	0	0	0
Nas Air (Eritrea)	10	0	0	0
Steffen Air Charter Services (Swaziland)	9	1	0	0
SN Brussels Airlines	9	0	0	0
Air Zimbabwe (PVT) Ltd.	9	0	0	0
Air Service	9	0	0	0
Transportes Aereos de Cabo Verde (TACV)	2	0	0	0
Benin Golf Air SA	1	2	0	0
Total seats in monopoly markets	2,628	632	100	100
Annual growth rate monopolized routes		27%		
Annual growth rate monopolized routes Ethiopian only		28%		
Annual growth rate monopolized routes Kenyan only		60%		
Source: Analysis of data provided by Diio's SRS Analyser.				

Table 2.5 Domestic air transport markets in North Africa and their number of airlines in 2007

Country	Estimated seats 2007 (million)	Estimated seat-kilometers 2007 (million)	Annual growth in seat-kilometers 2004–7 (%)	Airlines 2007	City pairs November 2007	Net city pair change 2004–7
Libya	1.23	1,359.67	4.49	4	11	3
Egypt	2.98	1,333.21	12.88	10	18	-2
Algeria	2.17	1,088.71	-2.17	1	44	-5
Morocco	1.74	602.96	5.09	8	18	5
Tunisia	0.33	105.20	-10.62	4	10	2
Totals	8.45	4,489.73		27	101	3

Source: Analysis of data provided by Diio's SRS Analyser.

Table 2.6 Domestic air transport markets in Sub-Saharan Africa and their number of airlines in 2007

Country	Estimated seats 2007 (million)	Estimated seat kilometers 2007 (million)	Annual growth seat kilometers	Airlines 2007	City pairs November 2007	Net city pair change 2004–7
South Africa	15.9	14,309.96	11.8	12	36	-8
Nigeria	4.7	2,235.54	66.8	7	19	13
Mozambique	0.6	492.62	19.7	3	28	9
Kenya	1	408.13	-3.7	4	15	-3
Tanzania	0.9	386.24	-1.8	5	16	-3
Madagascar	0.6	335.71	3.7	2	24	-61
Angola	0.6	309.64	10	2	21	4
Sudan	0.3	256.69	12.9	3	13	-5
Congo, Dem. Rep. of	0.2	170.91	-5.7	2	9	-7
Mauritius	0.3	150.47	16	2	1	0
Ethiopia	0.4	129.87	-6.5	1	8	-42
Congo	0.2	83.85	-18.1	4	1	-7
Zambia	0.2	65.82	57.7	2	6	0
Botswana	0.1	64.53	6.3	1	3	-3
Cape Verde	0.3	56.01	-7.9	1	10	-1
Zimbabwe	0.1	48.12	-16.4	1	5	3
Gabon	0.2	46.51	-9.4	1	9	-2
Somalia	0.1	45.22	54.5	4	5	2
Namibia	0	22.21	-12.1	1	7	-6
Malawi	0.1	20.28	-1.1	1	3	-3
Ghana	0.1	18.67		1	4	
Senegal	0.1	17.38	4	1	3	0
Cameroon	0.1	16.90	-49	3	3	-7
Seychelles	0.4	15.45	1.5	1	1	0
Uganda	0	12.71	33.6	1	4	3

Country	Estimated seats 2007 (million)	Estimated seat kilometers 2007 (million)	Annual growth seat kilometers	Airlines 2007	City pairs November 2007	Net city pair change 2004–7
Comoros	0.1	10.94	11.9	3	7	6
Eritrea	0	9.33		1		
Mauritania	0	3.38	-62	1		
Burkina Faso	0	3.38	-12.9	1	1	0
Equatorial Guinea	0	2.09		1	1	

Source: Analysis of data provided by Diio's SRS Analyser

Note: During the year, airlines may have stopped servicing a city pair, that is, though the Republic of Congo may show four airlines for 2007, in November 2007 there were in fact only two. Significant are the very high growth rates in Nigeria, Mozambique, and Zambia. Though Somalia is also growing at a very high rate, the domestic market is roughly only one-tenth of, for example, Kenya's. *Countries with missing growth rates represent new data where previous services in 2001 either did not exist or were not published.*

Table 2.7 Countries with declining international inter-African flights per week affecting their connectivity

Country	Flights per week	Change from 2004	%	Region
Cameroon	66	(18)	-21.4	Central
Central African Republic	1	(6)	-85.7	Central
Chad	8	(6)	-42.9	Central
Congo	41	(22)	-34.9	Central
Gabon	41	(33)	-44.6	Central
Comoros	19	(8)	-29.6	East
Eritrea	9	(3)	-25.0	East
Botswana	75	(22)	-22.7	South
Namibia	98	(3)	-3.0	South
Seychelles	7	(2)	-22.2	South
Benin	47	(7)	-13.0	West
Burkina Faso	37	(3)	-7.5	West
Cape Verde Islands	11	(5)	-31.3	West
Côte d'Ivoire	123	(46)	-27.2	West
Mali	41	(36)	-46.8	West
Mauritania	6	(13)	-68.4	West
Niger	12	(2)	-14.3	West
The Gambia	26	(4)	-13.3	West
Togo	37	(2)	-5.1	West

Source: Analysis of data provided by Diio's SRS Analyser

Note: The arrival and departure of an aircraft, or conversely the departure and arrival of an aircraft, in this case constitute one flight, not two, since the arriving or departing passenger is offered only one opportunity, not two.

Table 2.8 Countries with gains in flights

Country	Flights per week	Change from 2004	%	Region
Equatorial Guinea	25	7	38.9	Central
Burundi	42	12	40.0	East
Congo, Dem. Rep. of	57	23	67.7	East
Djibouti	52	24	85.7	East
Ethiopia	177	62	53.9	East
Kenya	359	110	44.2	East
Mozambique	115	33	40.2	East
Rwanda	54	19	54.3	East
Somalia	41	22	115.8	East
Sudan	58	36	163.6	East
Tanzania	205	73	55.3	East
Uganda	110	57	107.6	East
Lesotho	31	9	40.9	South
Madagascar	26	8	44.4	South
Malawi	65	27	71.1	South
Mauritius	33	1	3.1	South
Sao Tome & Principe	5	3	150.0	South
South Africa	681	126	22.7	South
Swaziland	56	16	40.0	South
Zambia	144	47	48.5	South
Zimbabwe	145	49	51.0	South
Angola	31	6	24.0	South/West
Ghana	118	52	78.8	West
Guinea	24	3	14.3	West
Guinea-Bissau	10	4	66.7	West
Liberia	34	17	100.0	West
Nigeria	120	38	46.3	West
Senegal	114	4	3.6	West
Sierra Leone	29	10	52.6	West

Source: Analysis of data provided by Diio's SRS Analyser.

Note: Most of the countries with increased connectivity as measured in international inter-African flights are in southern and East Africa. As with the previous table, the arrival and departure of an aircraft, or the departure and arrival of an aircraft, constitute one flight.

Appendix 3 Airport construction vs. rehabilitation

Table 3.1 Estimated basic construction cost of new airport with 3,000 meter runway

Area	Floors	Length	Width	Area	Total	Unit of measure	Costs	Running total
Terminal	2	1	100	20,000	20,000	Meters square	53,819,552	53,819,552
Dar overall land measurements		2.40	2.10	5.04				
		0.75	1.10	0.83				
		0.77	1.00	0.77	6.63	Km square		
Apron (1)		380	140	53,200				
		148	220	32,560	85,760	Meters square	18,462,259	72,281,811
Taxiway to Apron (only one for this example)		250	21	5,250	5,250	Meters square	1,412,763	73,694,574
Runway		3,000				Meters	17,716,535	91,411,110
Parallel Taxiway		3,000	21	63,000	63,000	Meters square	13,562,527	104,973,637

Note: Land acquisition costs are not included. Also missing are other significant costs, such as a control tower, ILS (instrument landing system), fuel facilities, vehicles, fire station, parking facilities, land side access, etc.

Data source for per unit costs: Florida Department of Transportation, as found at ***http://www.dot.state.fl.us/planning/policy/costs/Airports.pdf***. The per-unit costs have been cross checked with estimates on currently proposed airport projects in Africa.

Table 3.2 Estimated costs of rehabilitating airport with 2,000 x 30 meter runway, extending to 3,000 meters, and adding a parallel taxiway

Item	Unit cost per meter	Cost
Rehab 2,000 meter asphalt	5,506	11,011,788
Add 1,000 meters extension	8,000	8,000,000
Add full-length taxiway	4,593	13,779,528
Total		32,791,316

Appendix 4 Pricing samples

Table 4.1 Pricing sample for international travel within Africa

FROM		TO		Distance (nautical mile)	Indirect		Duration	Direct	
Country	City	Country	City		Fare $	$ per nautical mile		Fare $	$ per nautical mile
Kenya	Nairobi	Tanzania	Kilimanjaro	126	–	–	0:50	357	2.8320
Kenya	Mombasa	Tanzania	Zanzibar Kisauni	132	–	–	0:50	327	2.4809
Cameroon	Douala	Gabon	Libreville	213	–	–	0:45	369	1.7333
Ghana	Accra	Nigeria	Lagos	216	–	–	1:00	258	1.1943
Côte d'Ivoire	Abidjan	Ghana	Accra	226	–	–	1:00	332	1.4695
Togo	Lomé	Côte d'Ivoire	Abidjan	315	–	–	1:00	368	1.1671
Kenya	Nairobi	Tanzania	Dar es Salaam	359	358	$0.9982	1:15	378	1.0542
Côte d'Ivoire	Abidjan	Nigeria	Lagos	440	–	–	1:25	453	1.0286
Congo	Pointe Noire	Cameroon	Douala	543	558	1.0270		–	–
Congo	Brazzaville	Cameroon	Douala	595	–	–	3:10	624	1.0488
Namibia	Windhoek	South Africa	Johannesburg	630	–	–	1:45	400	0.6350
Zambia	Lusaka	South Africa	Johannesburg	646	–	–	2:00	360	0.5571
Namibia	Windhoek	South Africa	Cape Town	690	–	–	2:00	403	0.5843
Namibia	Walvis Bay	South Africa	Cape Town	690	–	–	2:00	391	0.5664
Egypt	Cairo	Sudan	Khartoum	871	–	–	2:30	473	0.5427
Sudan	Khartoum	Kenya	Nairobi	1,043	–	–	2:55	497	0.4769
Senegal	Dakar	Ghana	Accra	1,160	–	–	3:10	907	0.7817
Morocco	Casablanca	Senegal	Dakar	1,238	670	0.5415	3:25	732	0.5914
Morocco	Casablanca	Mali	Bamako	1,246	–	–	3:35	956	0.7674
Egypt	Cairo	Kenya	Nairobi	1,905	–	–	4:55	547	0.2870
Kenya	Nairobi	Nigeria	Lagos	2,071	843	0.4072	5:05	862	0.4162
Niger	Niamey	Kenya	Nairobi	2,251	2,088	0.9278		–	–
Senegal	Dakar	South Africa	Johannesburg	3,621	1,429	0.3946	8:35	1,616	0.4462

Table 4.2 Pricing sample for domestic travel within Africa

Country	FROM	TO	Distance nautical miles	Fare $	Carriers	$ per nautical mile	Duration
	City	City					
South Africa	Johannesburg	Cape Town	790	334	8	0.4229	2:10
South Africa	Hoedspruit	Johannesburg	213	230	1	1.0776	1:10
Nigeria	Lagos	Port Harcourt	264	294	3	1.1121	1:30
Nigeria	Lagos	Abudja	318	311	5	0.9775	1:00
Kenya	Nairobi	Mombasa	263	353	2	1.3413	1:00
Congo, Rep. of	Brazzaville	Pointe Noire	235	199	2	0.8464	0:45

Country	FROM	TO	Distance	Fare $	Carriers	$ per nautical	Duration
Malawi	Blantyre	Lilongwe	146	193	1	1.3198	0:50
Gabon	Libreville	Oyem	167	351	1	2.1030	0:45
Ethiopia	Bahir Dar	Lalibela	118	125	1	1.0568	0:30
Mauritania	Nouadhiba	Nouakchott	209	154	1	0.7361	0:40
Namibia	Ondangwa	Windhoek	334	340	1	1.0189	1:30
Sudan	Juba	Khartoum	745	1,403	1	1.8836	2:00
Tanzania	Dar es Salaam	Mwanza	530	253	2	0.4779	1:30

Table 4.3 Pricing sample for intercontinental travel within Africa

FROM		TO		Distance nautical miles	Indirect fare $	Nonstop flights			
Country	City	Country	City			$ per nautical mile	Duration	Fare $	$ per nautical mile
Kenya	Nairobi	Tanzania	Kilimanjaro	126	–	–	0:50	357	2.8320
Kenya	Mombasa	Tanzania	Zanzibar	132	–	–	0:50	327	2.4809
Cameroon	Douala	Gabon	Libreville	213	–	–	0:45	369	1.7333
Ghana	Accra	Nigeria	Lagos	216	–	–	1:00	258	1.1943
Côte d'Ivoire	Abidjan	Ghana	Accra	226	–	–	1:00	332	1.4695
Togo	Lome	Côte d'Ivoire	Abidjan	315	–	–	1:00	368	1.1671
Kenya	Nairobi	Tanzania	Dares Salaam	359	358	0.9982	1:15	378	1.0542
Côte d'Ivoire	Abidjan	Nigeria	Lagos	440	–	–	1:25	453	1.0286
Congo	Pointe Noire	Cameroon	Douala	543	558	1.0270		–	–
Congo	Brazzaville	Cameroon	Douala	595	–	–	3:10	624	1.0488
Namibia	Windhoek	South Africa	Johannesburg	630	–	–	1:45	400	0.6350
Zambia	Lusaka	South Africa	Johannesburg	646	–	–	2:00	360	0.5571
Namibia	Windhoek	South Africa	Cape Town	690	–	–	2:00	403	0.5843
Namibia	Walvis Bay	South Africa	Cape Town	690	–	–	2:00	391	0.5664
Egypt	Cairo	Sudan	Khartoum	871	–	–	2:30	473	0.5427
Sudan	Khartoum	Kenya	Nairobi	1043	–	–	2:55	497	0.4769
Senegal	Dakar	Ghana	Accra	1160	–	–	3:10	907	0.7817
Morocco	Casablanca	Senegal	Dakar	1238	670	0.5415	3:25	732	0.5914
Morocco	Casablanca	Mali	Bamako	1246	–	–	3:35	956	0.7674
Egypt	Cairo	Kenya	Nairobi	1905	–	–	4:55	547	0.2870
Kenya	Nairobi	Nigeria	Lagos	2071	843	0.4072	5:05	862	0.4162
Niger	Niamey	Kenya	Nairobi	2251	2,088	0.9278		–	–
Senegal	Dakar	South Africa	Johannesburg	3621	1,429	0.3946	8:35	1,616	0.4462

Appendix 5 Connectivity matrices for international travel within Sub-Saharan Africa

Tables appear on next three pages.

Table 5.1 Number of direct and indirect flights per week, November 2007, between different countries in Sub-Saharan Africa

Numbers below 4 have been highlighted, since they suggest that there are weekdays where the two countries cannot access each other directly. Heavily bordered rows and columns represent the three major inter-African hubs (South Africa, Kenya, and Ethiopia), and also Sierra Leone, which acts as a regional hub in West Africa.

Origin \ Destination	Angola	Benin	Botswana	Burkina Faso	Burundi	Cameroon	Cape Verde Islands	Central African Republic	Chad	Comoros	Congo	Congo DRC	**Cote D'Ivoire**	Djibouti	Equatorial Guinea	Eritrea	**Ethiopia**	Gabon	Gambia	Ghana	Guinea	Guinea-Bissau	**Kenya**	Lesotho	Liberia	Madagascar	Malawi	Mali	Mauritania	Mauritius	Mozambique	Namibia	Niger	Nigeria	Rwanda	Sao Tome and Principe	Senegal	Seychelles	Sierra Leone	Somalia	**South Africa**	Sudan	Swaziland	Tanzania	Togo	Uganda	Zambia	Zimbabwe
Angola											5	1			4		4			1											5				1					7						1	2
Benin				5		2					5		10		2			2		5			2					1				1	4			3				1				4			
Botswana																																3									69							3
Burkina Faso		4											10							3								9				1				6								4			
Burundi																	7						8											20											7		
Cameroon								1			6	1	7		3		2	19					10											15								2						
Cape Verde Islands																				1		1													1	8											
Central African Republic						1																																									
Chad																1	5																										2						
Comoros																							3				10																6				
Congo	5	5				7					11						6	3										1					1								2						
Congo DRC						1					5				3		7						12											2								14					7	6
Cote D'Ivoire		10		11		7												4		22	9		6		3			8					4	8			14		1		2			14			
Djibouti																2	13						5																		32							
Equatorial Guinea	4	2				3						3						4																6											2			1
Eritrea									1					2									2																				4						
Ethiopia	4				7	4			5		6	7		13				4		8			11				4	3					10	7		3			9	7	15		21	4	14	8	3
Gabon		2				18					3		4		4		2																3		2					3							
Gambia																					4				4								2			12		4									
Ghana	1	1		3			1						23				7						6		13								41		1			9		4			8			
Guinea													8						4						2			1					2			7										
Guinea-Bissau							1																													9											
Kenya		2			7	10				3		12	6	5		2	11			6					3	1	11	4		2	7			6	15		4	2	3	4	26	34		121		39	7	6
Lesotho																																									31							
Liberia													3						5	14	2		3										3					4									
Madagascar										8													1							8											9							
Malawi																	4						9																		16			5			22	9
Mali		1		7							1		4				3						4									3				18											
Mauritania																																				6											
Mauritius																							2			8											3				20						
Mozambique																							7																			95		5	6				2
Namibia	5		3																																							87							3
Niger		1		1									4															4								2											
Nigeria		3				11					2	2	8		6		10	3	2	46	2		6		2											5		4		7	1						
Rwanda					20												7						14																		1			1		11		
Sao Tome and Principe	1						1											2		1																											
Senegal		3		6			7						14				3		11		7	9	4		1			16	6				2	5				4		14				2			
Seychelles																							2							3											2						
Sierra Leone													1						5	7			3		6								3			4										
Somalia														28			9						4																								
South Africa	7	1	71			2					2	14	2				7	3		4			26	31		9	13			20	99	87		7	1		21	2				51	21		12	89	79
Sudan									2							4	15						28											1										8		
Swaziland																															5									51							
Tanzania										3							21						127				5				6			1						21				16	3	2
Togo		5		4									15		2		4			4													1			2										
Uganda					7												14						39											11							11	12		16				
Zambia												3					7						7				10														89			3			25
Zimbabwe	2		3									8			1		3						8				7				2	3									79						29	

Table 5.2 Number of direct flights per week in November 2007

Connectivity goes down when compared to the chart above.

Origin \ Destination	Angola	Benin	Botswana	Burkina Faso	Burundi	Cameroon	Cape Verde Islands	Central African Republic	Chad	Comoros	Congo	Congo DRC	Cote D'Ivoire	Djibouti	Equatorial Guinea	Eritrea	Ethiopia	Gabon	Gambia	Ghana	Guinea	Guinea-Bissau	Kenya	Lesotho	Liberia	Madagascar	Malawi	Mali	Mauritania	Mauritius	Mozambique	Namibia	Niger	Nigeria	Rwanda	Sao Tome and Principe	Senegal	Seychelles	Sierra Leone	Somalia	South Africa	Sudan	Swaziland	Tanzania	Togo	Uganda	Zambia	Zimbabwe
Angola											4	1			2		4														5				1					7						1	
Benin				3		2					3		9		2			1		5			2					1				1	4										4			
Botswana																															3									69							3
Burkina Faso		2											8							3								9																2			
Burundi																							4											20										7			
Cameroon								1			3		4		3		2	19					7										15									2						
Cape Verde Islands																				1																8											
Central African Republic						1																																									
Chad																	5																								1						
Comoros																							2			8																	3			
Congo	4	3				3						11						3																							2						
Congo DRC						1					5				2		7						12										1									11					7	2
Cote D'Ivoire		9		8		4										2	13	2		22	6		1		3			7					4	4			8		1					3			
Djibouti																							1																	22								
Equatorial Guinea	2	2				3						2						2																3													
Eritrea													2																													4						
Ethiopia	4					2			5		6	1		13				2					11				4	3					10	7					5	7	15		7	4	14		3
Gabon		1				18					3		2		2		2																	2						2						
Gambia																					2														12		4									
Ghana		1		2			1						22										6		9									40		1		5		4				8			
Guinea													6						2						2			1								7										
Guinea-Bissau																																				9											
Kenya		2			6	7				2		10		1			11			6					1	3	4		2	4			6	11			2		2	25	25		101		39	4	5
Lesotho													3							11	2		1																	31							
Liberia										8													1							8								4								
Madagascar																							4																	13			3			15	5
Malawi		1		7									4				3						4									3				18										
Mali																																				6											
Mauritania																							2			8											3			20							
Mauritius																							4																	79		5	1				2
Mozambique																																									81							
Namibia	5		3										4															4													13			3			15	5
Niger		1																																													
Nigeria		3				11						2	3		3		10			46			6													3		3		7	1						
Rwanda					18												7						13																	1			1		10		
Sao Tome and Principe	1																	2		1																											
Senegal							7						9						11		7	9						16	6				3				2		14							
Seychelles																							2							3									2							
Sierra Leone													1						5	4					6								3			1										
Somalia														19			5						2																								
South Africa	7		71			2					2	11					7	2		4			25	31		9	12			20	81	81		7	1		21	2				51	14		12	89	79
Sudan								2								4	15						21																					6			
Swaziland																														5										51							
Tanzania										3							7						101				4				1				1					14					10	3	
Togo		5		2									3				4			4														1												
Uganda																	14						39												10					11	5		10				
Zambia												3					7						3				10													89			3				18
Zimbabwe	2		3									3											2				5				2									79							

Table 5.3 Average speed, in terms of kilometers per hour, for indirect flights between country pairs

The time for the speed calculation includes layover time, indicating that connections with a particular low speed rating (bolded) have in fact extensive and long layovers. But in many cases there are direct flights from one of the hubs, as shown in the previous table.

Origin \ Destination	Angola	Benin	Botswana	Burkina Faso	Burundi	Cameroon	Cape Verde	Central African Republic	Chad	Comoros	Congo	Congo DRC	Cote D'Ivoire	Djibouti	Equatorial Guinea	Eritrea	Ethiopia	Gabon	Gambia	Ghana	Guinea	Guinea-Bissau	Kenya	Lesotho	Liberia	Madagascar	Malawi	Mali	Mauritania	Mauritius	Mozambique	Namibia	Niger	Nigeria	Rwanda	Sao Tome	Senegal	Seychelles	Sierra Leone	Somalia	South Africa	Sudan	Swaziland	Tanzania	Togo	Uganda	Zambia	Zimbabwe
Angola											253	443			559		716			515											826				685				729					722	455
Benin				373		445					466		300		606			500		381			761					669				529	162			498				577			277			
Botswana																																								270						460
Burkina Faso		373											408							438								561				**97**				461					354			
Burundi																	460						410											296									512		
Cameroon								559			473	230	513		348		699	402					712										556			750							
Cape Verde																				724															613	469									
Central African Republic						559																																								
Chad															473	723																									504				
Comoros																							620			411																			
Congo	203	560				350						**77**					529	334										580					191			708									
Congo DRC						646					**77**				514		690						658										293			585								700
Cote D'Ivoire		519		385		513												527		434	412		596		481			340				612	397			562		595		591			362			
Djibouti																466	439						448															196							
Equatorial Guinea	436	606				348						533						204															**150**									372			599
Eritrea									473					466									355																		551					
Ethiopia	716				460	602			707		720	618		453				616		632			582				713	779					729	620		659		305	729	497		557	744	610	532	732
Gabon		401				392					355		525		**143**		726																296		399				642							
Gambia																					321				381								496			298		647							
Ghana	515	592		317			724						174				600						740		444								199		640			526		780			234			
Guinea													418						321						344			524					517			570									
Guinea-Bissau							233																													360									
Kenya		761			350	610				467		491	596	448		372	582			740					625	714	477	761		730	591		764	363		641	600	630	365	577	298		275		436	504	409
Lesotho																																								290							
Liberia													509						402	471	344												413					492								
Madagascar																							714							637										626							
Malawi																	430						420																	608			265		**73**	293
Mali		669		538							562		671				769						734									666				618										
Mauritania																																				407										
Mauritius																							716			602											707			681						
Mozambique																							549																	312		286				516
Namibia	528		388																																					622						325
Niger		560		**102**									612															689								531										
Nigeria		**129**				579					448	839	377		300		747	303	496	404	455		728		413											560		525		766						
Rwanda					**16**												620						305																	675			590		**73**		
Sao Tome	685						613											399		640																										
Senegal		493		461			374						593				653		286		594	360	625		490			612	407			531	588					509		791			502			
Seychelles																							630							684										734						
Sierra Leone													655						647	551			630		465								612			522									
Somalia														315			246																													
South Africa	712	596	322			756					708	468	591				752	642		758			587	311		671	517			758	335	584		745	675		771	758				311	597		701	612	520
Sudan									533						642	572							330										362										513		
Swaziland																														393										307						
Tanzania										547							662						193				361			315										665				661	668	504
Togo		263		354									379		372		738			227													350			502										
Uganda					256												610						440											176						694	332		307				
Zambia												367					734						525				434													591			668			**123**
Zimbabwe	726		460									463			601		519						492				303			516										558					**119**	

Appendix 6 List of all known carriers with scheduled traffic between 2001 and 2007

The following two tables list all carriers found in the Diio's SRS Analyser dataset with known scheduled traffic in Africa. The list is split between African and non-African carriers, ranked by estimated seat miles flown in 2007. By the nature of the sorting failed carriers appear in the bottom of each list, in descending order according to the last known seat mile figures.

Table 6.1 List of carriers with traffic in Africa, based in Africa

The total count for 2007 is 79 carriers.

Airline	IATA code	ICAO code	Country	Region	Seat km 2001 (mil.)	Seat km 2004 (mil.)	Seat km 2007 (mil.)
South African Airways	SA	SAA	South Africa	SSA	34,427	33,538	33,914
EgyptAir	MS	MSR	Egypt	NA	15,296	14,117	21,510
Ethiopian Airlines Enterprise	ET	ETH	Ethiopia	SSA	7,538	9,013	13,693
Royal Air Maroc	AT	RAM	Morocco	NA	4,504	6,176	12,421
Kenya Airways	KQ	KQA	Kenya	SSA	5,192	7,043	11,534
Air Mauritius	MK	MAU	Mauritius	SSA	7,330	7,979	8,549
Comair Ltd.	MN	CAW	South Africa	SSA	4,707	5,210	5,818
Air Algerie	AH	DAH	Algeria	NA	4,202	4,533	5,006
TunisAir	TU	TAR	Tunisia	NA	–	2,360	3,944
Air Namibia	SW	NMB	Namibia	SSA	1,328	1,632	2,411
Virgin Nigeria	VK	VGN	Nigeria	SSA	1,389	1,997	2,384
Nationwide Airlines (Pty) Ltd.	CE	NTW	South Africa	SSA	686	1,610	2,339
Atlas Blue	8A	BMM	Morocco	NA	–	8	2,264
African Star Airways (Pty) Ltd.	4M	ASG	South Africa	SSA	–	–	2,064
Air Seychelles Ltd.	HM	SEY	Seychelles	SSA	1,712	1,669	1,987
1Time Airline	1T	RNX	South Africa	SSA	1,642	2,557	1,925
TAAG Angola Airlines	DT	DTA	Angola	SSA	2,742	1,350	1,882
Afriqiyah Airways	8U	AAW	Libyan Arab Jamahiriya	NA	67	824	1,805
South African Express Airways	YB	EXY	South Africa	SSA	1,400	931	1,738
Air Madagascar	MD	MDG	Madagascar	SSA	–	–	1,566
SA Airlink d/b/a South African Airlink	4Z	LNK	South Africa	SSA	846	–	1,518
Air Senegal International	V7	SNG	Senegal	SSA	1,770	1,573	1,416
Air Zimbabwe (Pvt) Ltd.	UM	AZW	Zimbabwe	SSA	186	1,368	1,251
Jamahirya Libyan Arab Airlines	LN	LAA	Libyan Arab Jamahiriya	NA	584	875	1,211
Zambian Airways	Q3	MBN	Zambia	SSA	–	883	1,050
Transportes Aereos de Cabo Verde	VR	TCV	Cape Verde Islands	SSA	–	822	920
Ghana International Airlines	G0	GHB	Ghana	SSA	389	570	854
Guinée Airlines, S.A.	J9	GIF	Guinea	SSA	200	563	640
Bellview Airlines Ltd.	B3	BLV	Nigeria	SSA	–	–	614

Airline	IATA code	ICAO code	Country	Region	Seat km 2001 (mil.)	Seat km 2004 (mil.)	Seat km 2007 (mil.)
Mango	JE	MNO	South Africa	SSA	80	30	611
Air Tanzania Company Ltd.	TC	ATC	Tanzania	SSA	–	–	547
Sudan Airways Co. Ltd.	SD	SUD	Sudan	SSA	134	–	499
Aero Contractors Company of Nigeria	AJ	NIG	Nigeria	SSA	1,779	1,616	483
Precision Air Services Ltd.	PW	PRF	Tanzania	SSA	–	400	483
Air Botswana Corporation	BP	BOT	Botswana	SSA	168	288	451
LAM	TM	LAM	Mozambique	SSA	632	622	442
Daallo Airlines	D3	DAO	Djibouti	SSA	–	213	392
Cameroon Airlines	UY	UYC	Cameroon	SSA	464	763	390
Hewa Bora Airways	EO	ALX	Congo, Dem. Rep. of	SSA	131	510	291
Regional Air Lines	FN	RGL	Morocco	NA	–	126	262
Société Nouvelle Air Ivoire	VU	VUN	Côte d'Ivoire	SSA	43	130	261
Tuninter, S.A.	UG	TUI	Tunisia	NA	162	173	203
Air Mali International	XG	KLB	Mali	SSA	218	235	197
Pelican Air Services CC (Pelican Air)	7V	PDF	South Africa	SSA	61	302	194
Eritrean Airlines	B8	ERT	Eritrea	SSA	115	77	192
Trans Air Congo (TAC)	Q8	TSG	Congo	SSA	171	219	162
Rwandair Express	WB	RWD	Rwanda	SSA	–	104	162
Air Burkina	2J	VBW	Burkina Faso	SSA	–	–	162
Catovair	0C	IBL	Mauritius	SSA	–	–	150
Air Malawi Ltd.	QM	AML	Malawi	SSA	–	122	149
Alajnihah For Air Transport	2T		Libyan Arab Jamahiriya	NA	–	–	125
Air Mauritanie	MR	MRT	Mauritania	SSA	190	438	123
Marsland Aviation	M7	MSL	Sudan	SSA	–	–	120
JetLink Express	J0	JLX	Kenya	SSA	38	168	106
Air Service	X7		Gabon	SSA	50	61	99
Slok Air International	S0	OKS	The Gambia	SSA	–	–	96
Djibouti Airlines	D8	DJB	Djibouti	SSA	90	–	93
Inter-Aviation Services	D6	ILN	South Africa	SSA	171	–	86
Air Corridor	QC	CRD	Mozambique	SSA	–	–	80
Interlink Airlines (Pty) Ltd.	ID	ITK	South Africa	SSA	–	21	77
Nas Air (Eritrea)	UE		Eritrea	SSA	–	–	67
Airkenya Aviation Ltd. d/b/a Regional Air	QP		Kenya	SSA	–	67	62
ZanAir Ltd.	B4		Tanzania	SSA	–	–	56
African Express Airways (K) Ltd.	XU	AXK	Kenya	SSA	6	–	51
Air Senegal	DS		Senegal	SSA	–	–	48
Steffen Air Charter Services	Q4	SWX	Swaziland	SSA	–	–	43
Nouvelair Tunisia	BJ	LBT	Tunisia	NA	–	–	40
Eagle Air Ltd.	H7	EGU	Uganda	SSA	–	–	40
Wimbi Dira Airways	9C	WDA	Congo, Dem. Rep. of	SSA	–	–	37
Antrak	O4		Ghana	SSA	–	–	21

Airline	IATA code	ICAO code	Country	Region	Seat km 2001 (mil.)	Seat km 2004 (mil.)	Seat km 2007 (mil.)
Star Equatorial Airlines	2S		Equatorial Guinea	SSA	0	11	21
Benin Golf Air SA	A8	BGL	Benin	SSA	–	–	19
Proflight Commuter Services	P0	PFZ	Zambia	SSA	38	16	18
Overland Airways Ltd.	OJ	OLA	Nigeria	SSA	11	5	13
Karthago Airlines	5R	KAJ	Tunisia	NA	–	–	11
Air Sinai	4D	ASD	Egypt	NA	–	–	8
Gambia International Airlines Ltd.	GC	GNR	The Gambia	SSA	–	–	5
Comores Aviation	KR	KMZ	Comoros	SSA	35	18	5
Air Burundi	8Y	PBU	Burundi	SSA	6	3	3
Ghana Airways Corp.	GH	GHA	Ghana	SSA	2,467	2,198	–
East African Safari Air	S9	HSA	Kenya	SSA	1,211	1,136	–
Air Gabon	GN	AGN	Gabon	SSA	–	958	–
Air Luxor STP	C2	ALU	Sao Tome and Principe	SSA	–	293	–
STA	T8		Mali	SSA	–	160	–
Flamingo	F7		Kenya	SSA	–	158	–
Panafrican Airways	PQ	PNF	Côte d'Ivoire	SSA	–	142	–
Air Togo S.A.	YT	TGA	Togo	SSA	126	66	–
Air Luxor GB, Lda	L8	LXG	Guinea-Bissau	SSA	–	59	–
Nationwide Airlines (Zambia) Ltd.	4J	NWZ	Zambia	SSA	3	35	–
East African Airlines Ltd.	QU	UGX	Uganda	SSA	–	34	–
Chari Aviation Services	S8	CAH	South Africa	SSA	181	27	–
Avirex	G2	VXG	Gabon	SSA	–	26	–
Sierra National Airlines	LJ	SLA	Sierra Leone	SSA	–	13	–
Ocean Airlines	4O	KMO	Comoros	SSA	–	11	–
Satgur Air Transport	2S		Liberia	SSA	–	3	–
National Airways	YJ	NTN	South Africa	SSA	8	2	–
Business Aviation	4P		Congo DRC	SSA	3	0	–
Air Afrique	RK	RKA	Côte d'Ivoire	SSA	5,160	–	–
Bravo Air Congo	K6	BRC	Congo DRC	SSA	1,574	–	–
Majestic Air P/L	6M	MJC	Zimbabwe	SSA	594	–	–
Nigeria Airways Ltd.	WT	NGA	Nigeria	SSA	494	–	–
Ecoair International	9H	DEI	Algeria	NA	221	–	–
Chanchangi Airlines Nigeria Ltd.	3U	NCH	Nigeria	SSA	107	–	–
Salaam Express Air Services	N8	SEK	Kenya	SSA	99	–	–
Scorpio Aviation	8S	SCP	Egypt	NA	72	–	–
Eagle Aviation Ltd.	Y4	EQA	Kenya	SSA	62	–	–
Antinea Airlines	HO	DJA	Algeria	NA	34	–	–
Zircon Airways Benin, S.A.	Z4	BZW	Benin	SSA	30	–	–
Air Zambezi	ZT	TZT	Zimbabwe	SSA	29	–	–
Unknown (probably an Eritrean carrier)	7R		Eritrea	SSA	26	–	–
Eagle Air Ltd.	EY	EFL	Tanzania	SSA	24	–	–

Airline	IATA code	ICAO code	Country	Region	Seat km 2001 (mil.)	Seat km 2004 (mil.)	Seat km 2007 (mil.)
Guinea Bissau Airlines	G6	BSR	Guinea-Bissau	SSA	13	–	–
Inter Islands Airlines	H4	IIN	Cape Verde Islands	SSA	11	–	–
Linhas Aereas de Air Sao Tome And Principe	KY	EQL	Sao Tome and Principe	SSA	2	–	–
					115,482	121,259	156,474

Table 6.2 List of carriers with traffic in Africa not based in Africa

The total count for 2007 is 117 carriers.

Airline	IATA code	ICAO code	Country	Seat km 2001 (mil.)	Seat km 2004 (mil.)	Seat km 2007 (mil.)
Air France	AF	AFR	France	16,902	21,728	22,574
British Airways P.L.C.	BA	BAW	United Kingdom	21,288	17,480	17,050
Emirates	EK	UAE	United Arab Emirates	2,499	7,075	14,419
KLM Royal Dutch Airlines	KL	KLM	Netherlands	7,547	9,366	10,626
Deutsche Lufthansa AG	LH	DLH	Germany	5,581	7,048	7,632
Virgin Atlantic Airways Ltd.	VS	VIR	United Kingdom	3,022	3,627	5,141
Alitalia	AZ	AZA	Italy	338	1,093	4,597
Air Austral	UU	REU	Reunion Island	438	3,822	4,216
Delta Air Lines, Inc.	DL	DAL	United States of America	2,920	3,310	3,973
Swiss International Airlines	LX	SWR	Switzerland	179	–	3,482
Singapore Airlines Ltd.	SQ	SIA	Singapore	94	3,070	3,437
Cathay Pacific Airways Ltd.	CX	CPA	Hong Kong, PRC	3,114	3,394	3,432
Qatar Airways (W.L.L.)	QR	QTR	Qatar	2,464	2,683	3,190
TAP	TP	TAP	Portugal	1,530	1,931	3,149
Saudi Arabian Airlines	SV	SVA	Saudi Arabia	1,907	2,750	3,144
Qantas Airways Ltd.	QF	QFA	Australia	1,443	2,302	2,870
Iberia	IB	IBE	Spain	4,114	755	2,608
Aigle Azur	ZI	AAF	France	1,741	1,946	2,466
Etihad Airways	EY	ETD	United Arab Emirates	1,413	2,107	2,427
SN Brussels Airlines	SN	SAB	Belgium	1,749	1,845	2,326
Aviation Enterprise TESIS Ltd.	UZ	TIS	Russian Federation	–	923	2,302
Turkish Airlines, Inc.	TK	THY	Turkey	2,037	1,798	2,248
China Southern Airlines	CZ	CSN	China	–	–	2,050
Corse Air International	SS	CRL	France	970	531	1,426
Air Arabia	G9	ABY	United Arab Emirates	1,824	1,957	1,320
Gulf Air Company G.S.C.	GF	GFA	Bahrain	–	–	1,184
GB Airways Ltd.	GT	GBL	United Kingdom	–	–	1,154
LTU International Airways	LT	LTU	Germany	–	946	1,109
Flyhy Cargo Airlines Ltd	W3		Thailand	226	664	1,086
Olympic Airlines	OA	OAL	Greece	–	426	965

Airline	IATA code	ICAO code	Country	Seat km 2001 (mil.)	Seat km 2004 (mil.)	Seat km 2007 (mil.)
Euro-Asia International, JSC	5B	EAK	Kazakhstan	–	–	904
Transaero Airlines	UN	TSO	Russian Federation	651	800	819
Malaysia Airline System Berhad	MH	MAS	Malaysia	–	–	802
Condor Flugdienst GmbH	DE	CFG	Germany	675	654	784
Korean Air Lines Co. Ltd.	KE	KAL	Korea, Republic of	379	526	752
North American Airlines, Inc.	NA	NAO	United States of America	88	314	752
Komiinteravia Joint-Stock Company	8J	KMV	Russian Federation	–	–	746
Ryanair Ltd.	FR	RYR	Ireland	1,960	2,045	742
Thai Airways	TG	THA	Thailand	560	637	738
Easyjet Airline Company Ltd.	U2	EZY	United Kingdom	–	474	709
Eastair	XZ		Sweden	–	–	698
Rossiya-Russian Airlines	FV	PLK	Russian Federation	–	–	666
Kuwait Airways	KU	KAC	Kuwait	–	–	613
Air Berlin GmbH & Co. Luftverkehrs KG	AB	BER	Germany	–	–	602
China Eastern Airlines	MU	CES	China	–	–	592
Oman Aviation Services Co. (SAOG)	WY	OAS	Oman	–	–	517
British Mediterranean Airways Ltd.	KJ	LAJ	United Kingdom	429	426	478
Austrian Airlines	OS	AUA	Austria	–	–	474
British Midland Airways Ltd. d/b/a bmi	BD	BMA	United Kingdom	–	–	456
Superior Aviation, Inc.	SO	HKA	United States of America	418	390	446
Air India Ltd.	AI	AIC	India	363	290	440
Middle East Airlines	ME	MEA	Lebanon	0	102	438
Yemenia	IY	IYE	Yemen	291	352	418
VIM Airlines	NN	MOV	Russian Federation	–	–	402
Royal Jordanian (Alia	RJ	RJA	Jordan	–	–	397
Aerotrans Airlines Ltd.	6F	PFO	Cyprus	–	198	394
President Airlines	TO	PSD	Cambodia	816	347	381
Eurofly S.P.A.	GJ	EEZ	Italy	–	–	374
Hapag-Lloyd Express GmbH	X3	HLX	Germany	–	–	362
Thomsonfly	BY	TOM	United Kingdom	–	–	357
Siberia Airlines	S7	SBI	Russian Federation	234	238	346
El Al Israel Airlines Ltd.	LY	ELY	Israel	–	–	339
MyAir	8I	MYW	Italy	–	–	307
Air Europa Lineas Aereas, S.A.	UX	AEA	Spain	446	544	306
Dutch Caribbean Airline N.V.	K8	DCE	Netherlands Antilles	–	–	296
Hahn Air Line	HR	HHN	Germany	–	–	293
Hapag Lloyd Fluggessellschaft mbH	HF	HLF	Germany	–	21	267
Aeroflot Russian Airlines	SU	AFL	Russian Federation	422	461	266
Transavia	HV	TRA	Netherlands	–	–	242
Aerosvit Airlines	VV	AEW	Ukraine	77	–	234
First Choice Airways Ltd..	DP	FCA	United Kingdom	–	–	232

Airline	IATA code	ICAO code	Country	Seat km 2001 (mil.)	Seat km 2004 (mil.)	Seat km 2007 (mil.)
Syrian Arab Airlines	RB	SYR	Syrian Arab Republic	155	133	222
Czech Airlines A.S. , CSA	OK	CSA	Czech Republic	–	–	206
Volare	VE		Italy	–	373	203
Tyrolean Airways Tiroler Luftfahrt GmbH	VO	TYR	Austria	–	–	202
Spanair, S.A.	JK	JKK	Spain	–	–	197
TUI Airlines Belgium	TB	TUB	Belgium	–	–	190
FlyGlobeSpan	Y2	GSM	United Kingdom	–	2	189
Luxair	LG	LGL	Luxembourg	–	–	166
Excel Airways	JN	XLA	United Kingdom	437	157	147
Air Malta p.l.c.	KM	AMC	Malta	–	–	146
Britannia Airways AB	6B	BLX	Sweden	163	122	133
MALEV Hungarian Airlines Ltd.	MA	MAH	Hungary	158	–	128
Astraeus Ltd.	5W	AEU	United Kingdom	–	–	123
Air Slovakia BWJ, Ltd.	GM	SVK	Slovakia	–	–	122
Air Bashkortostan		BBT	Russian Federation	–	386	114
Martinair Holland N.V.	MP	MPH	Netherlands	88	115	112
Livingston S.p.A.	LM	LVG	Italy	–	–	106
Iraqi Airways	IA	IAW	Iraq	–	–	96
Aegean Airlines, S.A.	A3	AEE	Greece	115	117	88
Air Italy	I9	AEY	Italy	–	–	75
flyniki / NL Luftfahrt GmbH	HG	NLY	Austria	–	24	70
Hainan Airlines Company Ltd.	HU	CHH	China	94	93	67
TAROM	RO	ROT	Romania	–	–	66
Air Baltic Corporation S/A	BT	BTI	Latvia	–	–	64
Jat Airways	JU	JAT	Serbia and Montenegro	77	43	58
Virgin Express	TV	VEX	Belgium	–	–	54
Skynet Asia Airways	6J	SNJ	Japan	–	–	53
Blue Panorama Airlines S.p.A.	BV	BPA	Italy	–	–	50
Jordan Aviation	R5	JAV	Jordan	–	–	50
Air Finland Ltd.	OF	FIF	Finland	–	–	48
Joint Stock Aviation Company Donavia	D9	DNV	Russian Federation	–	–	46
MyTravel Airways	VZ	MYT	United Kingdom	–	–	45
Hamburg International	4R	HHI	Germany	–	–	42
Utility Enterprise Donbass Aero Airline	7D	UDC	Ukraine	–	30	38
Futura International Airways	FH	FUA	Spain	–	–	32
Air Nostrum L.A.M.S.A.	YW	ANS	Spain	–	–	26
Uzbekistan Havo Yullary	HY	UZB	Uzbekistan	–	–	21
Helvetic Airways AG	2L	OAW	Switzerland	21	18	18
Binter Canarias	NT	IBB	Spain	–	–	16
Cyprus Airways Ltd.	CY	CYP	Cyprus	–	–	16
Norwegian Air Shuttle A.S.	DY	NAX	Norway	–	–	16

Airline	IATA code	ICAO code	Country	Seat km 2001 (mil.)	Seat km 2004 (mil.)	Seat km 2007 (mil.)
Lauda Air Luftfahrt AG	NG	LDA	Austria	42	85	13
Aer Lingus Ltd.	EI	EIN	Ireland	–	–	11
Kaliningradavia Open Joint Stock Co.	KD	KNI	Russian Federation	–	–	11
Hemus Air	DU	HMS	Bulgaria	14	10	10
Air Bourbon	ZN	BUB	Reunion Island	–	979	3
Birdy Airlines S.A.	4V	BDY	Belgium	–	1,670	–
TAM Linhas Aeras	JJ	BLC	Brazil	–	469	–
Varig S.A. (Viacao Aerea Rio-Grandense)	RG	VRG	Brazil	–	445	–
Aero-Service	BF	RSR	Colombia	53	126	–
State United Venture Kavminvodyavia	KV	MVD	Russian Federation	106	86	–
Pakistan International Airlines	PK	PIA	Pakistan	–	70	–
Air Littoral	FU	LIT	France	40	48	–
Maersk Air A/S	DM	DAN	Denmark	–	48	–
Scandinavian Airlines System (SAS)	SK	SAS	Sweden	104	42	–
Air Ukraine	6U	UKR	Ukraine	32	34	–
Aero Flight GmbH & Co	GV	ARF	Germany	–	29	–
Belavia	B2	BRU	Belarus	–	29	–
Phoenix Aviation	P3	PHG	Kyrgyzstan	–	27	–
Ukraine International Airlines	PS	AUI	Ukraine	–	22	–
Fischer Air s.r.o.	8F	FFR	Czech Republic	–	18	–
Georgian Airways	A9	TGZ	Georgia	–	13	–
Palestinian Airlines	PF	PNW	Occupied Palestinian Terr.	2	3	–
Swiss Air UA	SR		Switzerland	3,829	–	–
AOM French Airlines	IW	AOM	France	1,659	–	–
TWA (Trans World Airways)	TW	TWA	United States of America	1,290	–	–
TAT (Touraine Air Transport)	IJ		France	898	–	–
Royal Air Force	RR	RFR	United Kingdom	456	–	–
Axis Airways	6V	AXY	France	429	–	–
Air Europe S.p.A.	PE	AEL	Italy	320	–	–
Anderson Airlink (AC-Coach Ops, Inc.)	4Q		United States of America	125	–	–
Aero Lloyd Flugreisen	YP		Germany	58	–	–
Teamline Air Luftfahrt GmbH	L9	TLW	Austria	53	–	–
PGA—Portugalia	NI	PGA	Portugal	50	–	–
Balkan	LZ	LAZ	Bulgaria	37	–	–
Aviaenergo	7U	ERG	Russian Federation	32	–	–
Heli France	8H	HFR	France	26	–	–
Menajet	IM	MNJ	United Arab Emirates	18	–	–
Romanian Aviation Company	WQ	RMV	Romania	8	–	–
Armenian Airlines	R3	RME	Armenia	6	–	–
Mahfooz Aviation (Gambia) Ltd.	M2	MZS	Saudi Arabia	5	–	–
Phuket Airlines Co. Ltd.	9R	VAP	Thailand	3	–	–

Airline	IATA code	ICAO code	Country	Seat km 2001 (mil.)	Seat km 2004 (mil.)	Seat km 2007 (mil.)
Trans State Airlines, Inc.	AX	LOF	United States of America	2	–	–
				104,149	119,262	161,886

Note: Reunion Island is grouped with these countries, since it is part of the French Overseas Department.

Appendix 7 Additional data on airport charges

The following charges are a regional sample as of January, 2007, as collected for a financial analysis for a new airport in Kigali, Burundi (Jacobs Consultancy 2007: 49–50).

Table 7.1 Passenger fees

Airport	Passenger fee ($)
Kenya–JKIA	40
Congo–Kinshasa	20
Burundi–Bujumbura	25
Nigeria–Lagos	35
Tanzania–Dar es Salaam	30
Uganda–Entebbe	40

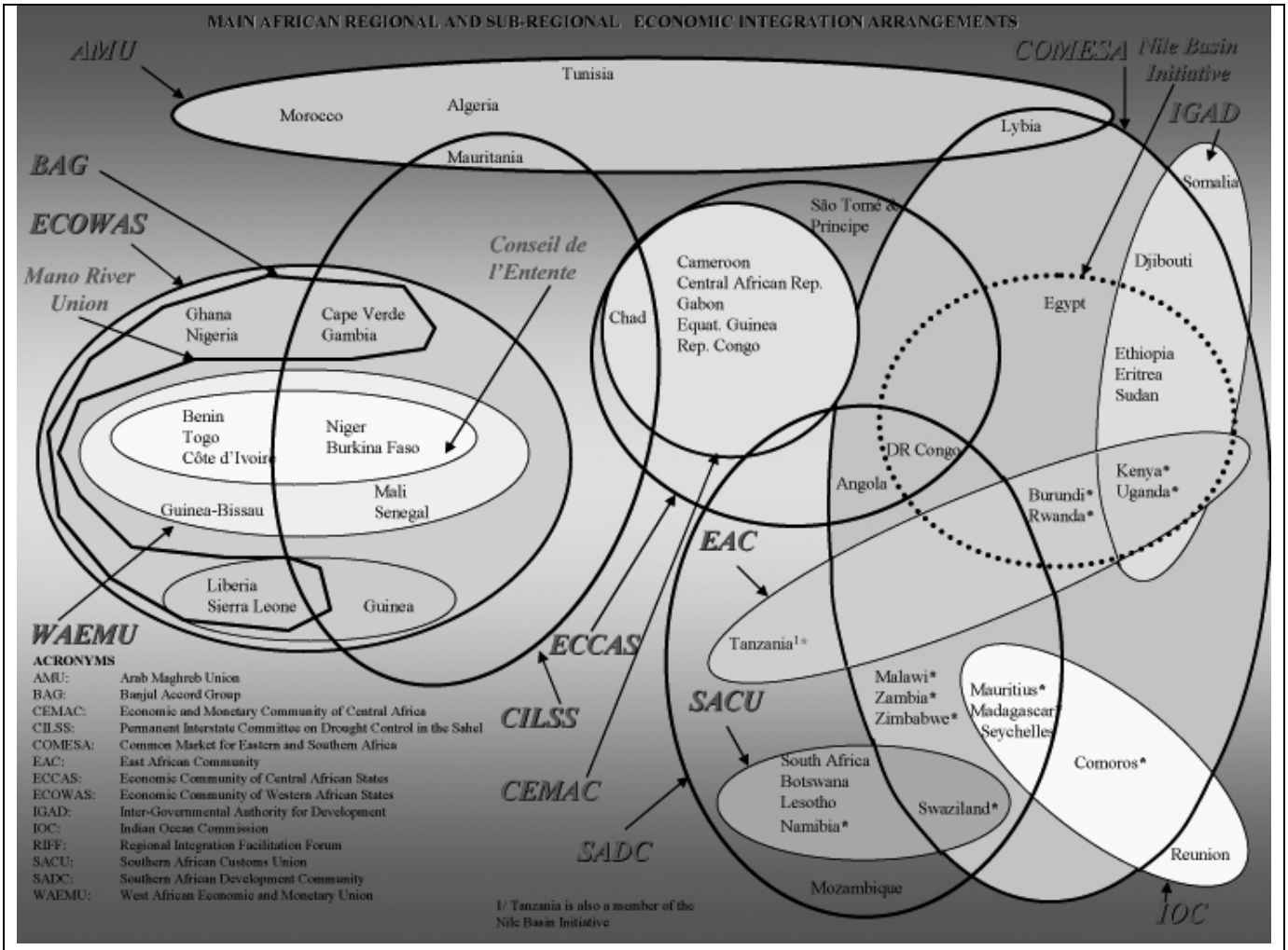
Table 7.2 Landing fees

Airport	A 330–300 ($)	B 737–400 ($)
Rwanda	1,240	390
Kenya–JKIA	1,345	223
Congo–Kinshasa	2,530	544
Burundi–Bujumbura	1,288	380
Nigeria–Lagos	2,090	618
Tanzania–Dar es Salaam	1,150	340
Uganda–Entebbe	1,150	408
Average	1,541	415

Table 7.3 Aircraft parking charges

Airport	Free period (hours)	A 330–300 ($ per day)	B 737–400 ($ per day)
Rwanda	6	40	20
Kenya–JKIA	6	50	25
Congo–Kinshasa	0	1,104	326
Burundi–Bujumbura	2	552	163
Nigeria–Lagos	3	6,293	1.860
Tanzania–Dar es Salaam	2	120	120
Uganda–Entebbe	6	40	12

Appendix 8 African regional and subregional economic integration arrangements



Appendix 9 Evaluation of schedule balance of main airport in each country

Group	Country	City	Airport	Ratio of maximum flights per hour to weekly average	Maximum flights per hour
Generally balanced	South Africa	Johannesburg	JNB	2.03	47
	Morocco	Casablanca	CMN	2.76	19
	Egypt	Cairo	CAI	1.84	19
	Kenya	Nairobi	NBO	2.86	15
	Nigeria	Lagos	LOS	2.41	14
	Algeria	Algiers	ALG	2.83	13
	Ethiopia	Addis Ababa	ADD	4.79	12
	Libya	Tripoli	TIP	3.63	11
	Tunisia	Tunis	TUN	2.83	11
	Mauritius	Mauritius	MRU	3.62	7
	Senegal	Dakar	DKR	3.16	7
	Seychelles	Mahe Island	SEZ	3.15	7
	Mozambique	Maputo	MPM	4.62	6
	Gabon	Libreville	LBV	4.57	5
	Madagascar	Antananarivo	TNR	3.82	4
Schedule may be able to be rebalanced if needed	Tanzania	Dar Es Salaam	DAR	3.29	8
	Zambia	Lusaka	LUN	4.06	7
	Sudan	Khartoum	KRT	3.45	7
	Namibia	Windhoek	WDH	6.42	6
	Angola	Luanda	LAD	6.22	6
	Zimbabwe	Harare	HRE	5.07	6
	Uganda	Entebbe	EBB	3.82	6
	Comoros	Dzaoudzi	DZA	13.77	5
	Swaziland	Manzini	MTS	7.71	5
	Cameroon	Douala	DLA	5.19	5
	Cote D'Ivoire	Abidjan	ABJ	4.18	5
	Ghana	Accra	ACC	2.84	5
	The Gambia	Banjul	BJL	13.71	4
	Guinea	Conakry	CKY	11.39	4
	Congo, Rep.	Brazzaville	BZV	8.20	4
	Congo, Dem. Rep.	Kinshasa	FIH	8.10	4
	Benin	Cotonou	COO	8.00	4
	Malawi	Lilongwe	LLW	7.55	4
	Rwanda	Kigali	KGL	6.65	4
	Djibouti	Djibouti	JIB	5.60	4

Group	Country	City	Airport	Ratio of maximum flights per hour to weekly average	Maximum flights per hour
	Cape Verde Islands	Sal Island	SID	5.29	4
	Mali	Bamako	BKO	5.17	4
	Botswana	Gaborone	GBE	4.05	4
	Sierra Leone	Freetown, Lungi Intl	FNA	13.62	3
	Somalia	Hargeisa	HGA	9.33	3
	Equatorial Guinea	Malabo	SSG	7.64	3
	Burkina Faso	Ouagadougou	OUA	6.90	3
Not graded, maximum two flights per hour	Liberia	Monrovia	ROB	15.27	2
	Guinea-Bissau	Bissau	OXB	14.00	2
	Chad	Ndjamena	NDJ	12.92	2
	Niger	Niamey	NIM	8.84	2
	Eritrea	Asmara	ASM	8.40	2
	Mauritania	Nouakchott	NKC	7.30	2
	Burundi	Bujumbura	BJM	5.89	2
	Togo	Lome	LFW	5.89	2
	Lesotho	Maseru	MSU	5.42	2
	Central African Republic	Bangui	BGF	42.00	1
	Sao Tome and Principe	Sao Tome Is.	TMS	28.00	1

Appendix 10 Airline ownership type, by country

Strong, state-owned (SSO): 6 Private: 25
Weak, state-owned (WSO): 20 None: 3

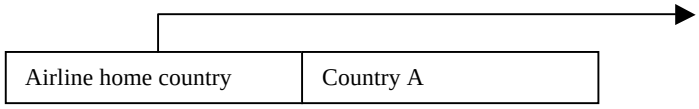
Country	Ownership type	Country	Ownership type
Algeria	WSO	Libyan Arab Jamahiriya	WSO
Angola	WSO	Madagascar	WSO
Benin	Private	Malawi	WSO
Botswana	WSO	Mali	WSO
Burkina Faso	Private	Mauritania	WSO
Burundi	Private	Mauritius	WSO
Cameroon	WSO	Morocco	SSO
Cape Verde Islands	WSO	Mozambique	WSO
Central African Republic	None	Namibia	WSO
Chad	Private	Niger	None
Comoros	WSO	Nigeria	Private
Congo, Republic of	Private	Rwanda	Private
Congo, Democratic Republic of	Private	São Tomé and Príncipe	Private
Cote d'Ivoire	Private	Senegal	Private
Djibouti	WSO	Seychelles	WSO
Egypt, Arab Rep. of	SSO	Sierra Leone	Private
Equatorial Guinea	Private	Somalia	Private
Eritrea	Private	South Africa	SSO
Ethiopia	SSO	Sudan	WSO
Gabon	Private	Swaziland	Private
Gambia, The	Private	Tanzania, United Republic of	WSO
Ghana	Private	Togo	Private
Guinea	Private	Tunisia	SSO
Guinea-Bissau	Private	Uganda	Private
Kenya	SSO	Zambia	Private
Lesotho	None	Zimbabwe	WSO
Liberia	Private		

Source: Analysis based on Schlumberger (2008: 287–88). Author altered the rating of Tunisia's flag carrier from weak state-owned to strong state-owned, since it is, though small, a successful niche operator.

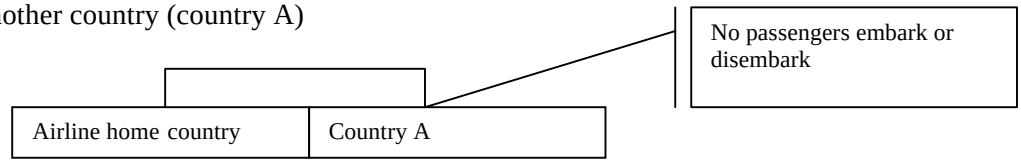
Appendix 11 Freedoms of the air

ICAO defines nine "freedoms of the air," which are one of the components found in (usually bilateral) air services agreements forged between countries. The first five are internationally recognized by treaty, whereas ICAO calls the last four concept "so-called freedoms of the air."

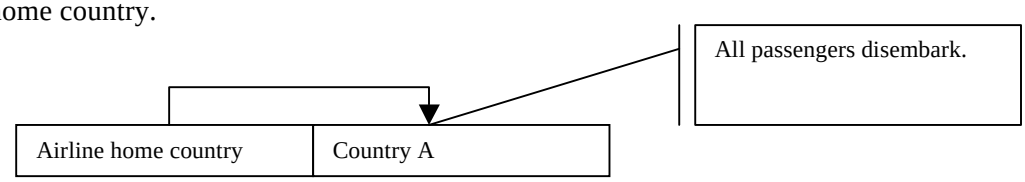
(1) First freedom of the air: Airline of home country can overfly another country (country A)



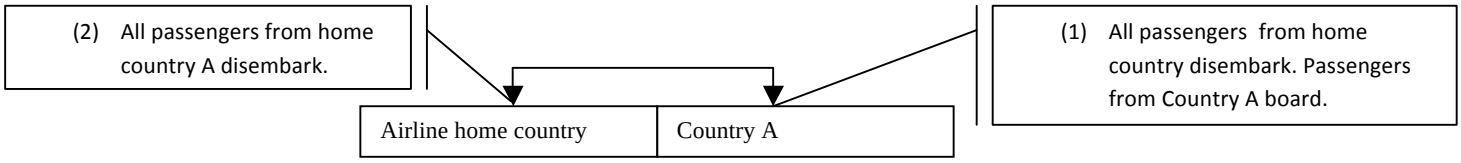
(2) Second freedom of the air: Airline of home country can do a technical stop for fuel, maintenance, supplies, etc. in another country (country A)



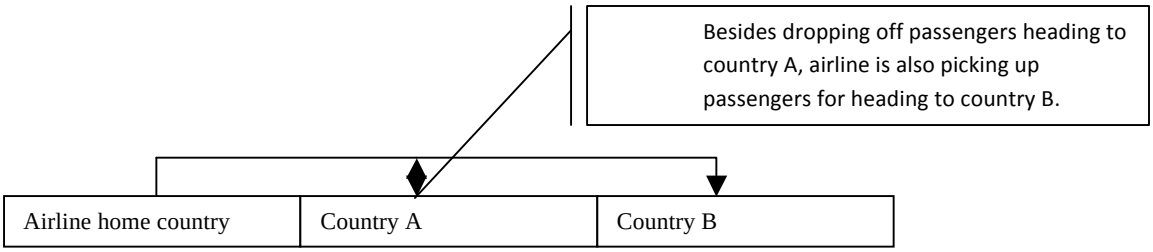
(3) Third freedom of the air: Airline of home country can land in another country (country A) to drop off passengers from home country.



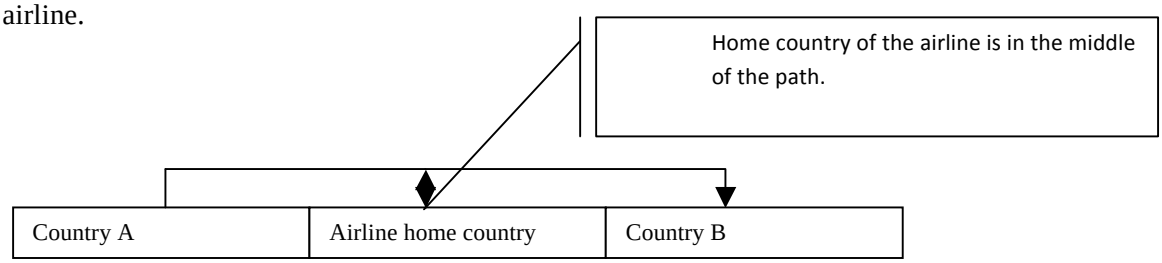
(4) Fourth freedom of the air: Airline of home country can land in another country (country A) to drop off passengers from home country and pick up passengers from country A going to home country.



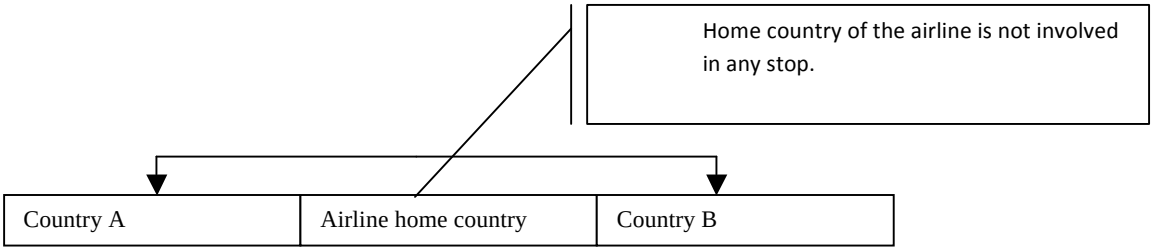
(5) Fifth freedom of the air: Airline of home country can pick up and drop off passengers in Country A, with some passengers boarding in country A going to a third country C. The caveat is that this is an ongoing operation originating (or terminating) in the home country.



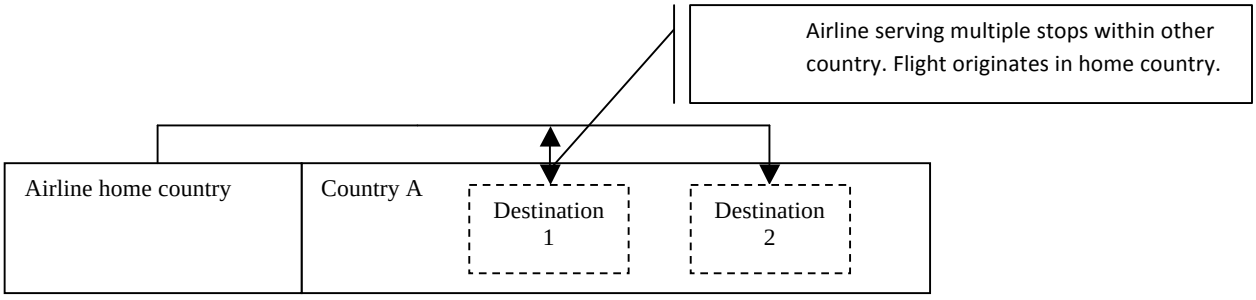
(6) So-called sixth freedom of the air: Traffic originates (or terminates) outside home country (say country A), and goes to (or comes from) a second country (say Country B) via a stop at the home country of the airline.



(7) So-called seventh freedom of the air: Airline from home country can travel between country A and country B without the home country being in the path (that is, no leg stops in the home country.



(8) So-called eighth freedom of the air: Airline from home country can serve several destinations in other country A in one flight, both pickup up and dropping off passengers, as long as the flight originates or terminates in home country.



(9) So-called ninth freedom of the air, also referred to as "cabotage": Airline from home country serves domestic stops within other country, without the home country being part of the flight.