AFRICA INFRASTRUCTURE
COUNTRY DIAGNOSTIC

BACKGROUND PAPER 17

Off Track:
Sub-Saharan African Railways

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Africa's Infrastructure | A Time for Transformation

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About AICD

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

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Figures and tables

Note

This report contains a number of tables and figures summarizing railway performance in Africa, with special attention to Sub-Saharan Africa. These reflect the data available as of December 2008. While in several cases detailed information was available following privatization and concessioning, in other cases authoritative information had become scarce. This is due to a combination of factors: the replacement of public operators' detailed annual reports by companies' summary reports; the limited reporting requirements in many concessions (which are often not met in any case); and the emphasis by some concessionaires on commercial confidentiality.

As a result, information in many cases has to be gleaned from a variety of sources, some of which are less reliable than others. Given these disparities, the following convention has been adopted:

- Where information is simply stated, it has been directly sourced from official reports or concessionaire data.
- Where information is qualified by "it is reported that," it has been sourced indirectly from third-party reports, the press, or the Internet.

Citations do not appear in the text unless a source has been drawn on directly; all consulted works are listed at the end of the report. The focus of this paper is on Sub-Saharan Africa. Although many of the figures include the North African railways for comparison, the discussion and analysis are centered on Sub-Saharan Africa.

The peer reviewers and World Bank staff, particularly Pierre Pozzo di Borgo and James Leigland, provided helpful contributions and comments concerning many of the transactions and Augustin Mbangala and Lou Thompson provided valuable background material and data. But all responsibility for the material remains with the author.

This paper uses the term "tonne." A tonne is 1,000 kilograms—a metric ton. Unless otherwise specified, the word dollar and the dollar sign ($) refer to U.S. dollars.

Summary

Thirty years ago, many Sub-Saharan African railway systems were carrying a high share of their country's traffic, either because competing road transport had poor infrastructure or faced restrictive regulations or because rail customers were established businesses that were locked in to using rail through physical connections or (if they were parastatals) policies that directed them toward the use of a fellow parastatal. Since then, Sub-Saharan economies in general, and transport in particular, have become liberalized. This, coupled with improvements in road infrastructure, has led to much stronger competition in the transport sector. Aside from dedicated mineral lines, there are now few railways outside South Africa that are essential to the efficient functioning of their countries' economies**,** and the smaller railways that remain face a challenging future.

The networks—lightly used and in poor condition

Railway development has followed a similar pattern across Africa. First, isolated lines reached inland from ports to link with trading centers or mines, with branch lines then built over time. Many lines were state-owned from the start, but some were constructed as concessions or, in the case of some mineral developments, by a mining company as an integral part of its operations. Although grand master plans for integrated rail systems have been proposed, none has been fully implemented and, for the most part, the African rail system remains fragmented, with lines connecting cities within a single country or linking a port and its immediate regional hinterland. The only significant international networks are those centered in South Africa and stretching north to Malawi, the Democratic Republic of Congo (DRC), and Tanzania; the North African network in the Maghreb; and the East African network linking Kenya, Uganda and Tanzania. A few railways cross borders to link landlocked countries to ports, and others provide inland railheads from which goods can be on-forwarded by road. But there has historically been little trade between most African countries outside southern Africa, and the financial and economic case for more general interregional links is unlikely to be strong.

At the end of 2008 there were 51 railways operating in 36 countries in Africa. Most of these used either the "Cape gauge" (1.067 meters) or the meter gauge. The main network in southern and Central Africa uses the Cape gauge, which is also used in some Anglophone countries farther north. The meter gauge is used in most of francophone Africa and much of East Africa. There are also a few, mostly disused, narrow-gauge lines (0.75 and 0.60 meters). The North African network is mostly standard gauge, as are a number of isolated mineral lines. Although the multiplicity of gauges suggests that interworking could be a major problem, there are currently only three locations where two gauges meet. This will, however, become more of an issue if some of the proposed connecting lines are constructed.

The total network size for Africa as a whole is around 82,000 kilometers (km), of which about 69,000 km are currently in use (table A), with the remainder closed due to war damage, natural disasters, or general neglect and lack of funds. Almost all the networks are single track, except for sections of the Spoornet network. Significant portions of the southern and North Africa networks are electrified, as well as the mining region of the DRC and a short section of the Zimbabwe network (currently not in use).

Table A Summary network and traffic statistics

	Route-km (000) (operated)	Passenger-km (billion)	Net tonne-km (billion)	Density (million traffic units per route-km)
North	13	45	13	4.7
West	9	1	12	1.4
Central	6	1	4	0.9
East	9	1	5	0.6
Southern	33	13	114	3.9
Total	69	61	148	3.0

Source: AICD database.

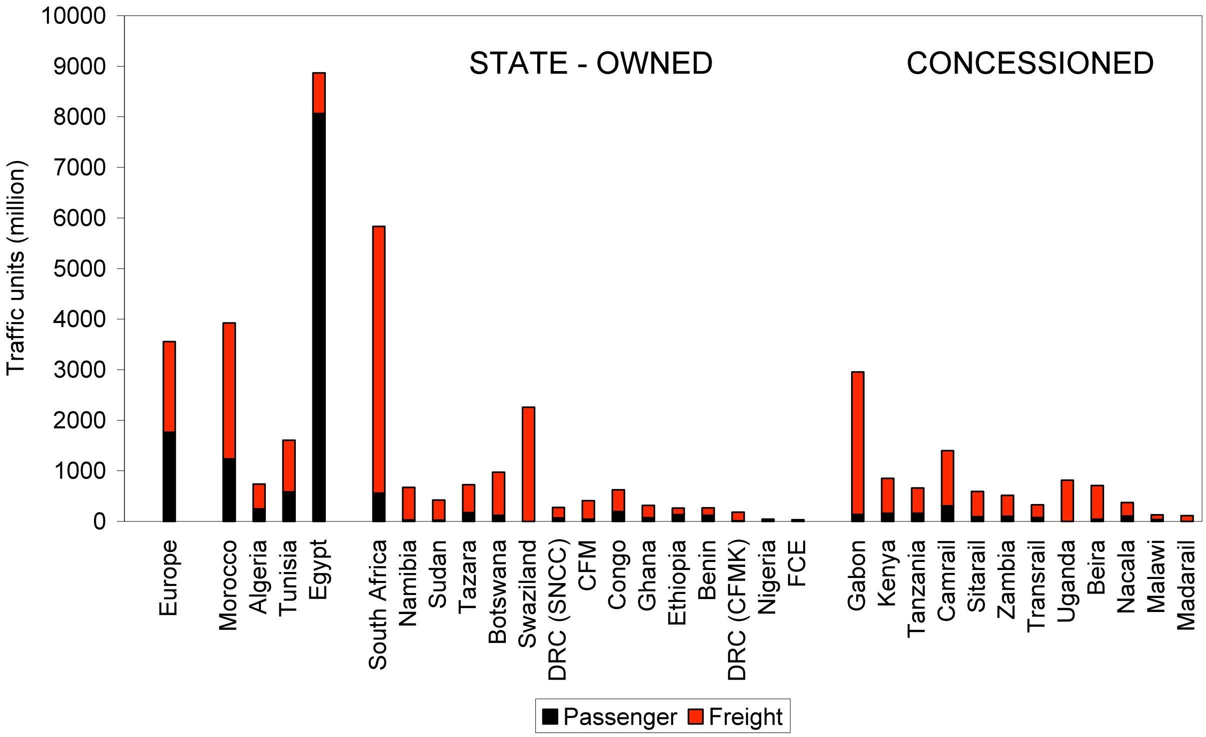
Note: Density is normally expressed as traffic units per route-km. The traffic units carried by a railway are the sum of the passenger-km and the net tonne-km. Although traffic units has some limitations as an indicator (for example, a first-class passenger-km in a high-speed train is treated the same as a passenger-km in a crowded suburban train), it is a simple measure that is widely used.

Traffic densities on Sub-Saharan railways are generally low. Specialized mineral lines in West Africa and Southern Africa —particularly the Spoornet coal and ore export lines—carry more than half the railways' total freight (as measured by net tonne-km). Southern Africa also dominates general rail freight, handling more than 80 percent of the freight traffic on the nonmineral lines. Southern Africa and Egypt dominate the passenger business, with more than 85 percent of passenger-km. The traffic density of the Maghreb systems (Morocco, Algeria, and Tunisia) ranges between 2 million and 4 million (similar to many European systems), but only three Sub-Saharan African railways have traffic densities of more than a million and many average less than 300,000 (figure A). Sub-Saharan African railways are therefore generally lightly loaded by world standards, and most networks struggle to generate enough funds to maintain and renew their infrastructure as required.

Most African railways outside South Africa and North Africa still operate at the standard to which they were originally constructed and now face major problems from competing modes of transport. Most lines can accommodate only relatively lightweight and slow-moving trains, and poor maintenance over a long period of time has caused many sections of the track to deteriorate, in some cases almost beyond repair, resulting in a loss of competitiveness and rolling-stock productivity. While this can be tolerated on low-volume feeder lines, and may be the only way some can be viably operated, it is a major handicap when competing against the modern roads being constructed in major corridors. Rehabilitating these networks will be expensive; finding a sustainable way to do this given the low traffic volumes and revenues that exist today is the central problem faced by most Sub-Saharan African railways.

Figure A Average network traffic density, 2001–05

Million traffic units per route-km



Source: AICD database.

Note: "Europe" excludes Commonwealth of Independent States (CIS) systems (Russia, Ukraine, Moldova, Belarus).

Investment—how much can be justified?

The term *investment* has historically been used for new construction and rolling-stock, for replacement rolling-stock, and also (but not universally) for the rehabilitation and replacement of tracks when they become life-expired. Thus the investment required at any one time is a function of the age and condition of the existing assets; lines that have been poorly maintained (as is the case with most Sub-Saharan African railways) generally require a substantial volume of "backlog" investment to return them to their original standard. Lines that have been superseded by road developments, and that now have low traffic levels, will rarely merit reconstruction; investment should instead be directed to those parts of the network with a long-term future. In broad terms, an average of $100 million is needed every year for track rehabilitation and renewal of the network north of South Africa, with a further $80 million a year needed for rolling-stock. Allowing $20 million for facilities, maintenance equipment, and so on brings the total to about $200 million a year. In addition, there is a backlog investment of possibly up to $3 billion, which could be spread over a 10-year period. The combined annual program would cost about $500 million for 10 years, after which investment would decline to the steady-state level of $200 million.

Investments could also be made in completely new projects. For instance, there have been many proposals, some dating back a century, to create new routes for landlocked countries and to integrate the isolated networks. But few of these projects will be financially or economically viable unless they can achieve traffic volumes of least 2 million to 4 million tonnes every year, which is more than almost any Sub-Saharan line (excluding a few in South Africa) currently carries.

These order-of-magnitude estimates demonstrate that the total funds required for rehabilitation are very large — of the same order as the annual revenues of some of the railways — and well beyond their capacity to self-finance. The only option in most cases is to seek large concessional loans and/or grants from third parties.

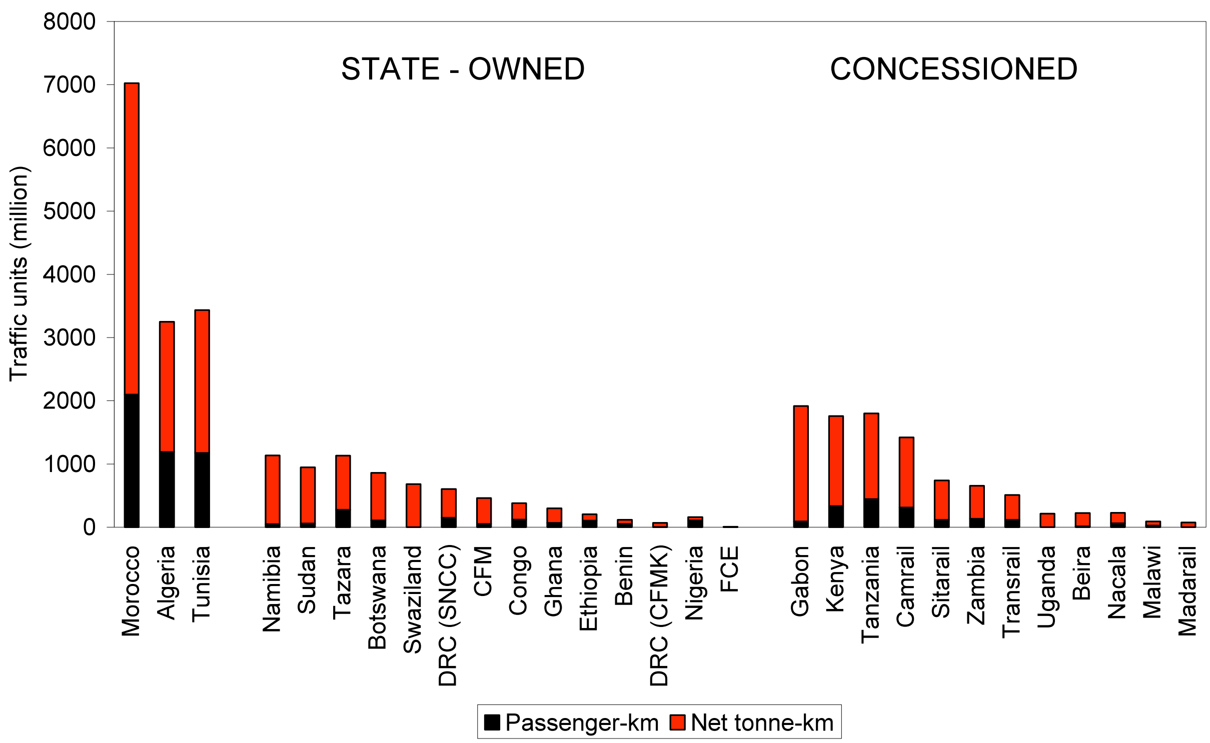
The market—small by world standards

Most Sub-Saharan African railways carry far more freight than passengers: freight averaged about 80 percent of total traffic units between 1995 and 2005. While almost all railways carry passenger traffic, a few—those in Swaziland, Uganda (since 1998), and Botswana (since 2009)—carry freight only. Most railways are small, with the busier railways carrying only 1 billion traffic units a year (figure B); Spoornet carries this volume of traffic every three days. In overall terms, most railways have similar volumes to moderately busy branch lines on railways outside Africa.

Because their volume is so low, few of the region's railways can generate sufficient investment funds for maintenance or new projects. In most places, freight rates are constrained by road competition and, as government entities, railways are hampered by bureaucratic constraints and lack of commercial incentives. Since 1993 several governments have responded by concessioning their systems and, at the same time, setting up rehabilitation programs funded by international financial institutions (IFIs).

Figure B Average traffic volume, 2001–05

Billion traffic units



Source: AICD database.

Note: Excludes Egypt and South Africa.

In spite of steady economic growth over the past decade, only four Sub-Saharan African railways saw an increase in both passenger and freight traffic over this period; two of these had been concessioned. One other railway saw an increase in average passenger traffic, but all others saw a reduction. Fifteen railways had an increase in freight traffic. Where railways have been concessioned, freight traffic has generally, but not universally, increased, but passenger traffic has generally stagnated or declined. The growth or decline of traffic on many systems over the past decade, however, has often had little to do with changes in demand. War and natural disasters have had a major impact in some cases. In others, the scarcity of rolling-stock, particularly locomotives, has affected the volume carried; many Sub-Saharan African railways have a shortage of locomotives and, when fleets are increased (either through the acquisition of new or secondhand locomotives or the rehabilitation of old ones), traffic often increases accordingly.

Passenger services—a declining market for all except commuters

Several cities in the region have announced plans to introduce modern heavy-rail suburban commuter networks. Such services are currently limited to South Africa and Dakar, Senegal. Based on experience elsewhere in the world, any new services will need substantial external financial support for capital and, in many cases, recurrent operating costs. Moreover, these lines should be operated by new and independent transport authorities separate from the existing railway authorities. Road services present strong competition to almost all alternative passenger services; rail passenger services are the only effective means of transport or the market leader in just a few corridors. Formal compensation schemes, such as public service obligations, have been introduced in a few cases to support passenger rail services, but these rarely provide timely compensation. As a result, most long-distance passenger services are trapped in a cycle of minimal investment, deteriorating services, declining patronage, and financial losses.

Some proposals have been made for new medium-speed (around 200 km per hour) interurban railways, but substantial demand and increased fares would be required simply to cover their costs of operation. There are few, if any, corridors in which such expenditure could be justified, at least for the medium term.

Freight—improving the level of service should be the priority

Freight traffic on Sub-Saharan African railways is dominated by bulk and semibulk commodities, mostly being carried to and from ports. Average freight tariffs typically range from three to five US cents per net tonne-km, similar to tariffs on other low-density, general-freight railways in comparable countries. Still, in spite of most rail rates being well below comparable road rates, rail typically carries only 20 to 50 percent of the traffic in a corridor, and some of the smaller state-owned railways have much smaller shares.

For rail to play a significant role in the general freight transport system, it must improve its service level, addressing overall transit time, reliability, security, and service frequency. Rail infrastructure and rolling-stock should be maintained "fit for purpose", operators should show more discipline in adhering to schedules and commercial arrangements should be introduced to ensure that customers fulfill their contractual responsibilities. Most concessionaires are much better than state-owned railways at meeting these basic service requirements.

Institutional arrangements—patchy progress

Until the 1980s almost all African railway companies were government departments or publicly owned corporations with varying degrees of financial and management autonomy. Attempts at commercialization while retaining public ownership were generally unsuccessful, so concessions began to be introduced in the 1990s. Under these concessions, the state remained the owner of some or all of the existing assets (typically infrastructure) and transferred the other assets (typically the rolling-stock), as well as responsibility for operating and maintaining the railway, to a concessionaire.

Most countries in Central, East, and West Africa have moved to concessioning some or all of their railways, often because of pressure from multilateral and bilateral organizations, which have made doing so a condition for providing loans for asset rehabilitation and renewal. Exceptions to the reform process include southern Africa (South Africa, Namibia, Botswana, and Swaziland), North Africa, and countries suffering or recovering from civil disruption (Angola, the DRC, and Zimbabwe). Of the 30 Sub-Saharan countries with publicly owned railways, 14 have opted for a concession arrangement and one operates under a management contract. A further four have begun the concessioning process.

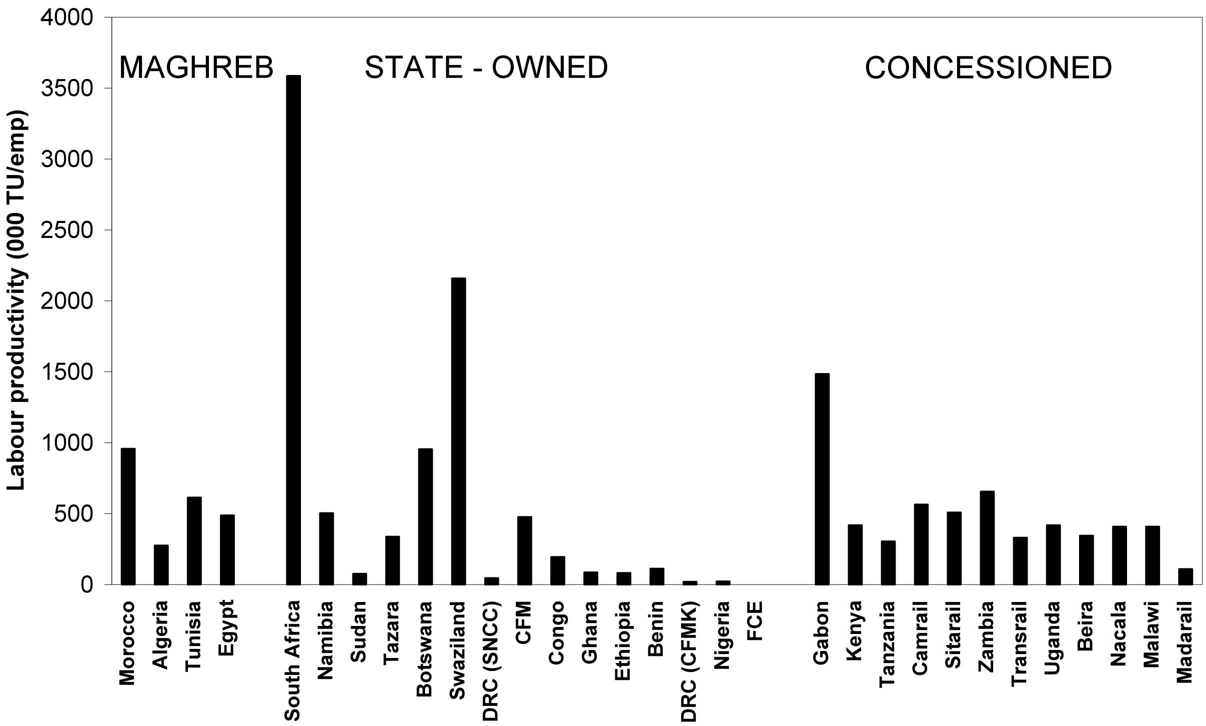
Railways that have not been concessioned remain subject to significant political and governmental influence. Although most railways nominally have financial and managerial autonomy, legal and regulatory frameworks often allow the state to intervene at both the institutional and jurisdictional levels, doing much to discourage managers' initiative and effectiveness.

Concessions—becoming the norm

The first railways to be concessioned in recent times were in West Africa. Reform gained momentum after 2000, but implementation typically takes three to five years and many concessions are still in the early stages. While there are a few third-party operators (normally industries carrying their own products), the market size for most African networks is too small for on-rail competition, and concessions are all vertically integrated in practice.[1] Concessions are granted for periods ranging from 15 to 30 years, and the concessionaire is generally free to operate as a business, with freight tariffs determined by supply and demand and passenger fares subject to some form of indexation. The Sub-Saharan African rail concessions have attracted a limited pool of mainly foreign private and semipublic operators who in most cases have significantly improved labor and asset productivity, partly through growth in traffic but mostly through a reduction in the workforces and the scrapping of redundant and obsolescent rolling-stock.

[1] On-rail competition is where more than one operator competes for freight from the general public. This is a favorite policy of many economists, who believe that such competition will improve standards and service levels. However, railways need to be a certain size for this to be viable, as otherwise the market fractures and no operator is large enough to be efficient. The third-party operators referred to are industries that operate their own trains carrying their own products but that do not compete as public carriers.

Figure C Labor productivity (2007 or latest available)



Source: AICD database.

Note: Common averages have been used for Kenya and Uganda, which are both included in a single concession, and for Nacala (Mozambique) and Malawi, which share common resources.

Almost all railway companies have streamlined their workforces to some extent over the past 10 to 15 years, but labor productivity on most African systems remains relatively low by world standards, with few railways achieving more than 500,000 traffic units per staff per year (figure C). Because wage levels are generally low, the direct financial impact on railways is not always catastrophic, but a large body of staff who are at best semiemployed (employed full-time but engaged in little productive activity) incurs resentment, discourages initiative, and undermines overall effectiveness. Asset productivity is similarly low, with a lack of spare parts often hampering the timely repair of broken equipment.

Safety is also an important aspect of operational performance. Rail travel is still safer than road travel, but the safety record of Sub-Saharan African railways is much worse than that of comparable railways elsewhere due to a combination of obsolete track infrastructure, poorly maintained rolling-stock, and a lack of operational discipline. But, as with productivity, safety has generally improved following concessioning.

Financial performance—generally not sustainable

Although most state-owned Sub-Saharan African railways just about break even on a cash basis after receipt of government support, this is only because a significant amount of maintenance has been deferred. When the maintenance backlog becomes too great, it is typically addressed using a loan, with the expenditure being treated as investment. Passenger services generally do not contribute significantly to the cost of maintaining infrastructure or covering corporate overheads. Freight services normally cover their avoidable operating costs (i.e., the cost of operating the train services, excluding any infrastructure-related and general management costs). Some earn enough to also cover infrastructure costs and even the capital costs of rolling-stock.

Investment in concessioned railways is largely financed by low-interest sovereign loans, with concessionaires rarely providing more than 20 percent of the equity. This again indicates that many concessions are unable to support major investment on a commercial basis; they are also prone to liquidity problems and are likely to have difficulty funding major asset maintenance and reinvestment.

Concessionaires normally agree to pay concession fees as well as a series of taxes, often of the same order of magnitude. But a concessioned railway's ability to pay will always be ultimately constrained by the business fundamentals of the proposed railway privatization deal. A concessionaire will be able to bear only so many charges (irrespective of whether they are concession fees, borrowing costs, or rolling-stock acquisition costs) and concessions with high levels of both debt and concession fees will be prime candidates for renegotiation.

The verdict on concessions—usually beneficial but not the full answer

Since 1992 there have been 14 rail concessions in Sub-Saharan Africa. Two have been canceled, one has been badly affected by war, and one has suffered from natural disasters and procedural delays. Six have operated for five years or more, but only two of these have done so without a significant dislocation of some sort. Two railways are also operating under management contracts, both for the second time. Except for the railways immediately adjacent to South Africa, the railways that have not been concessioned have continued to deteriorate over the past decade. In a number of cases these declines will prove to be terminal. Even if the responsible governments, some of whom regard concessions as only a last-ditch solution, do finally relent, it will be too late: the railways will have crumbled beyond repair[2].

When concessions have been offered, there have generally been very few bidders. Of these, even fewer have had the resources to finance the major investments required; as a result the state has had to guarantee investments. Even then, financing has been slow. Concessionaires have generally been unenthusiastic about running passenger services and have had difficulty getting government compensation for unprofitable services and other facilities. The level of concession fees, the length of the concession, and the redundancy arrangement have provided further problems, leading some concessions to be renegotiated.

Despite these problems, the results to date are encouraging. Even if all the prior expectations have not been met, most of the concessionaires have improved the railways' traffic levels and productivity and are providing a better service to users than the state did, albeit after a major investment by donors and IFIs. That said, some of these improvements might have occurred if the investment had been made without concessioning. However, most concessions have been in existence only for a short time in relation to typical railway asset lives and the real test will come when concessionaires themselves are faced with having to fund investment.

Probably the single largest disappointment for governments to date has been the lack of non-IFI-related funding of infrastructure. Responsibility for the ongoing rehabilitation and maintenance of track

[2] The only exceptions are where bilateral funding is being provided for major rehabilitation, as in Angola.

infrastructure is rapidly emerging as a key issue between concessionaires and governments. Many governments with railway concessions seek to obtain such financing from private sources or IFIs. But for most concessionaires, track rehabilitation and, especially, track renewal are major expenses that can often be deferred. Most concessions thus initially rely heavily on IFI loans but have often been slow to do the required work, and this has limited concession performance.

So are concessions a long-term answer to the problems of Sub-Saharan African railways, or are they merely short-term fixes that, by relying on investment by third parties, will ultimately prove unsustainable? And what more needs to be done to ensure a sustainable sector?

Key issues going forward

A striking feature of any review of Sub-Saharan African railways is the large gap that often exists between government expectations of what concessioning can achieve and what actually happens once the concession has been awarded. The low volumes on most railways can commercially justify infrastructure which allows train speeds of 40–60 kilometers/hour (km/hr) at best. This is not fast enough for competitive passenger services except where there is no practical alternative—an increasingly rare situation. Governments that are not prepared to invest substantial sums in upgrading and maintaining infrastructure should therefore expect only a “fit for purpose” freight railway, which operates at moderate speeds but does so reliably and safely. This type of railway can be successfully operated under concession at typical traffic densities, but if traffic volumes are very low (say, 250,000 tonnes every year or less) or if high-standard passenger services are expected, the government will need to provide continuing financial support.

It is becoming clear that classic concession schemes[3] are likely to attract only those bidders who can secure financial benefits not directly linked to railway operations.[4] Consequently, unless the financial structure of these rail concessions is changed or the market environment in which they operate is favorably altered, private operators will continue to show only limited interest. In most concessions, substantial public funding is needed to finance passenger services as well as major track renewals and rehabilitation. Governments that provide such funding need to strengthen their regulatory capacity to ensure that concessionaires comply with any conditions imposed on the concession. They must also consider how new policies in other sectors of the economy will impact the rail sector in general and concessionaires in particular.

Passenger services

Governments that require concessionaire to offer passenger services should set up clear compensation arrangements with timely and easily monitored payments. This should enable the concessionaire to focus on freight services, the improvement of which is of economic importance to most countries. Passenger rail services are in most cases a carryover from earlier times. Passengers are better served, and more economically, by road-based systems.

[3] That is, those that require the private operator to take on a significant debt burden in relation to revenues.

[4] For example, by controlling the entire distribution chain or through the supply of rail equipment and services.

Capacity and/or willingness of private operators to finance track renewal

Few, if any, of the concessions are generating significant profits for their operators, certainly not enough to fund long-term renewals. While most concessionaires pay concession fees into general government revenue, few could probably afford to do so if they were properly accruing funds for future renewals. It is therefore doubtful whether a privately financed rail concession model would be achievable—or sustainable—in much of Africa except where significant mineral traffic is expected. Even if there is sufficient cash, few concessionaires will earmark funds on an annual basis and just let them sit in a bank account for the five or ten years until a major expenditure is required. And using debt finance for such expenditure would generally mean getting a corporate loan—an almost impossible feat for a small, stand-alone railway financially ring-fenced by its shareholders.

If the government wants a railway service because of the external benefits of rail transport, it will need to contribute grant funds on a regular basis. One option is to partly finance infrastructure renewal, independently from the concessionaire, through a land transport renewal fund. This could be an extension of a road fund, covering both the road and rail sectors (for example, concession payments could be paid into the fund rather than into general revenue). A third of this, say, might come from public funds; one rationale for this could be the external costs avoided by using railways rather than roads.[5]

Effective and efficient regulation of private rail operators

Once a concession is awarded, governments should monitor concessionaire behavior and ensure that the government's interests, implicit in any concession agreement, are fulfilled. Many concessionaires have short- to medium-term financial objectives that often do not align with the longer-term economic objectives of governments. Monitoring and supervision of many concessions has been weak, and regulatory bodies need to be strengthened and their funding assured.

Consistent government approach to infrastructure cost recovery

At a more strategic level, governments should also develop a coherent and realistic policy of infrastructure cost recovery. Requiring that railways fund 100 percent of their long-term maintenance and upgrades, while tolerating high road maintenance costs and the overloading of arterial routes, is a handicap that most general freight railways will not be able to overcome in the medium and long term.

Governments should keep in mind that well-run railways could still offer the most economical way of transporting non-time-sensitive general freight in major corridors for distances over 500–800 km (and shorter distances for bulk commodities). As such, their revival through concessioning is usually warranted as long as the market is there. If governments are to benefit from the substantial economic benefits of such concessions, they must ensure that concessionaires' financial returns will be high enough to attract broad and competitive investor participation.

[5] External costs are nonfinancial costs imposed by road users, especially trucks. Those costs include road maintenance costs that are not fully recovered, congestion affecting other road users, accidents, and emissions.

1 Introduction

The role of railways in Africa has changed over the past 30 years. While many systems once carried a high share of their country's traffic, their market share has declined, their assets have steadily deteriorated, and their quality of service has fallen. In their current state, railways can be expected to make only a minor contribution toward solving the transport problems of the continent.

The first railways south of the Sahara were built in South Africa in the 1860s and 1870s, with lines heading inland from the ports of Cape Town and Durban.[6] The networks in what were then Cape Province, Natal, and Transvaal continued to develop, but it was not until the turn of the twentieth century that large-scale railway development began in other parts of the continent.

In almost every case, the pattern of their development was the same: isolated lines heading inland from a port to reach a trading center or a mine, with a few branch lines added over time. As almost all the lines were constructed under colonial administrations, many were state-owned. But several were constructed as concessions or, in the case of mineral developments, by a mining company as an integral part of its mining operation.

This process has continued until recent times, with several lines added since the second World War. Although grand plans for their integration have been proposed for over a century (figure 1.1), most Sub-Saharan African railways remain disconnected lines, either within a single country or linking a port and its immediate hinterland. The only true international networks are those centered in South Africa and stretching north to Zimbabwe, Zambia, and the Democratic Republic of Congo (DRC); in the Maghreb, linking Morocco, Algeria, and Tunisia; and, to a lesser extent, the old East African railways network in Kenya, Uganda, and Tanzania.

This reflects the limited amount of intercountry trade. Looking back in time, there was naturally little trade between, say, English and French colonies, but even today, trade volumes between adjacent countries are remarkably small. For example, between 1996 and 2000, less than 6 percent of Tanzania's trade by value was with Kenya, and about 2.5 percent with neighboring Zambia, Rwanda, Burundi, DRC, Uganda, and Malawi; even trade with South Africa represented only 7 percent. The same pattern can be seen in many other countries. While it can be argued that the lack of regional trade is a product of the transport infrastructure inherited from colonial times, the similarity in the products exported from many countries suggests that, even if interregional links existed, they would only be lightly used.

This pattern of economic development has meant that African railways, more than almost anywhere else in the world, are closely linked to ports (indeed, much of Africa had integrated port and railway systems for many years). Where railways traverse more than one country, freight traffic is largely in transit, with comparatively little originating or terminating in the intermediate country.[7]

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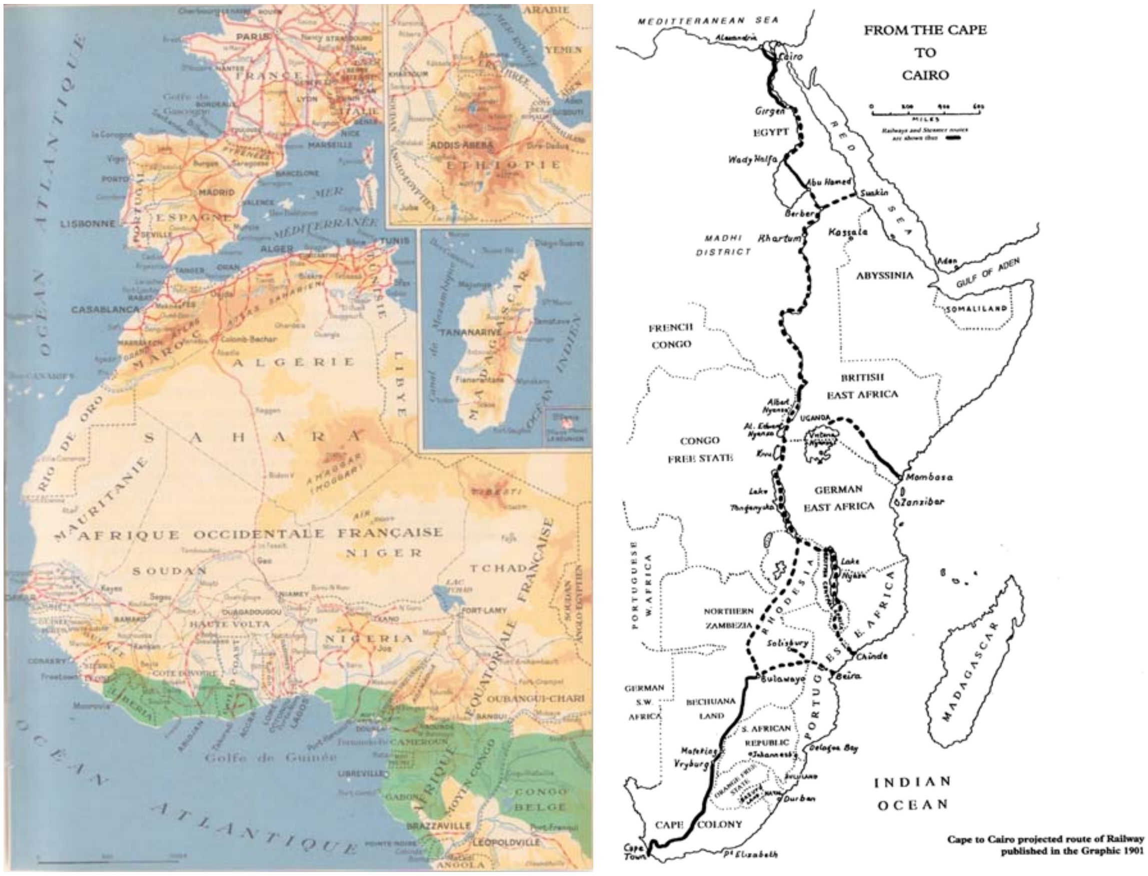
[6] In North Africa, the first railway was built in 1853 in Egypt, and construction began in Algeria in the 1860s and Tunisia a decade later. But construction in Morocco did not begin until 1911 as part of its annexation by France.

[7] Other than the special case of Spoornet, the most significant exception is Kenya, one of the few coastal countries where the main port is not also the commercial capital; the railway was originally built to access Uganda, but Kenya has since developed to such an extent that it is now by far the larger traffic generator.

Figure 1.1 What might have been—the Trans-Sahara and Cape-to-Cairo railways



Source: Lartilleux (1950); London *Graphic* (1901).

While some railways struggled financially from the start, they generally managed to operate reasonably well up to the 1960s. Then, as the road system developed and larger trucks were introduced, roads gradually captured higher-value general freight, leaving only bulk mineral and agricultural traffic (and semibulk commodities, such as fuel) to the railways. While this has in many cases provided enough revenue to cover working expenses, railways have rarely been able (or allowed by the government, even when they had the potential) to collect enough reserves to fund asset renewal. Such renewal has almost universally been provided on an intermittent basis through loans from multilateral or bilateral agencies, often leaving railways with a patchwork collection of disparate kinds of equipment and rolling-stock. The steady degradation of the asset base has meant that even when, as in recent years, railways have tried to capture higher-value traffic such as containers, the quality of service has been so low that they have achieved only a limited market share wherever roads are adequate.

Another problem for most Sub-Saharan African railways has been the continued government requirement to operate passenger services without budgetary compensation. Passenger tariffs generally cover only a part of the related working expenses; this not only consumes cash that should have been used to renew the freight and infrastructure assets but also, for many railways, ties up traction power that could be used for cash-generating freight services.

Meanwhile, operators have suffered the impact of the many wars and civil disturbances that have occurred over the past 50 years. Railways are often one of the first targets for destruction and this has affected many networks, either directly (for example, in Angola, Mozambique, Ethiopia, and Eritrea) or indirectly by cutting inland railways off from their ports (for example, in Malawi and Burkina Faso).

As a result, most of the railways presented for concessioning in Africa require substantial rehabilitation of both infrastructure and rolling-stock. Even where traffic volumes are significant by local standards, they are generally low by world standards (a railway carrying more than 1 billion net tonne-km is the exception rather than the rule in much of Africa) and the concessions often come with requirements to continue loss-making passenger services.

Nevertheless, the rhetoric accompanying some of the transactions suggests that many politicians believe, or want to believe, that the concession award will be the prelude to very substantial investments by the concessionaires, particularly in infrastructure. To date, this has barely materialized, with most infrastructure improvements being done with international financial institution (IFI) or donor funds. The main issue for most railways in the region is whether concessioning is a permanent solution or whether some alternative approach is needed to ensure a long-term future for railway systems providing acceptable levels of service.

2 The railways

The networks

At the end of 2008, there were 52 railways operating in 33 countries in Sub-Saharan Africa (annex A1 and figure 2.1) and another 4 in North Africa. Most of these use either the Cape gauge (1,067 meters) or the meter gauge, with Egypt and much of the Maghreb being the only substantial standard-gauge networks. The main interconnected network in southern and Central Africa uses the Cape gauge, as far north as the Democratic Republic of Congo (DRC) and southern Tanzania; this is also used in the ex-British possessions of Ghana, Nigeria, and Sudan and, a little surprisingly,[8] in the Republic of Congo. The meter gauge is used in all the other francophone nations and also in the East African network linking Kenya, Uganda, and northern Tanzania, as well as the disconnected Ethiopian line. Of the few narrow-gauge lines built at various times, most[9] are either derelict or not operating. There are also several isolated standard-gauge lines—those in Mauritania and Guinea are privately operated mineral lines, while that in Gabon, although primarily developed for mineral traffic, is a public railway that also carries general and passenger traffic.

Although the multiplicity of gauges suggests that linking the lines across Sub-Saharan Africa could be a major problem, there are currently only three locations (two in Tanzania and one in Guinea) where two gauges are being used at once. This will, however, become more of an issue if some of the proposed connecting lines are constructed.

The South Africa–based Cape-gauge network, in theory,[10] connects 11 countries, and the East African and Maghreb networks both directly connect three. There are two international meter-gauge networks in West Africa connecting landlocked francophone countries to the coast: Ouagadougou-Abidjan (Sitarail), linking Burkina Faso to Côte d'Ivoire and Bamako-Dakar (Transrail), linking Mali to Senegal; and one in East Africa, linking Ethiopia to Djibouti. Other networks do not cross international borders but provide railheads from which traffic can be transported by road: Cotonou-Niamey (OCBN), which is entirely within Benin, provides a link to Niamey through a railhead at Parakou; Camrail provides railheads for traffic between the port of Douala in Cameroon and the Central African Republic and Chad; and, in East Africa, TRC and KRC, carry traffic for Burundi (and the eastern DRC) and Rwanda, respectively.

In some countries, parts of the network are not currently operational, whether because of war damage, natural disasters, general neglect, or lack of funds. The total length of the Sub-Saharan African network is around 70,000 km, of which about 55,000 km is currently being operated, with a further 12,500 km in North Africa. Almost all the network is single track, except for sections of the Spoornet[11] network. Large parts of the North African network are electrified, as are those of South Africa (where 42 percent of the network, or nearly 9,000 km, is electrified). The only other electrified sections are 858 km in the DRC (24 percent of the SNCC network) and 313 km in Zimbabwe, of which only the former is currently operating.

[8] This was so that it could link, presumably by ferry, with the Cape-gauge networks in the DRC.

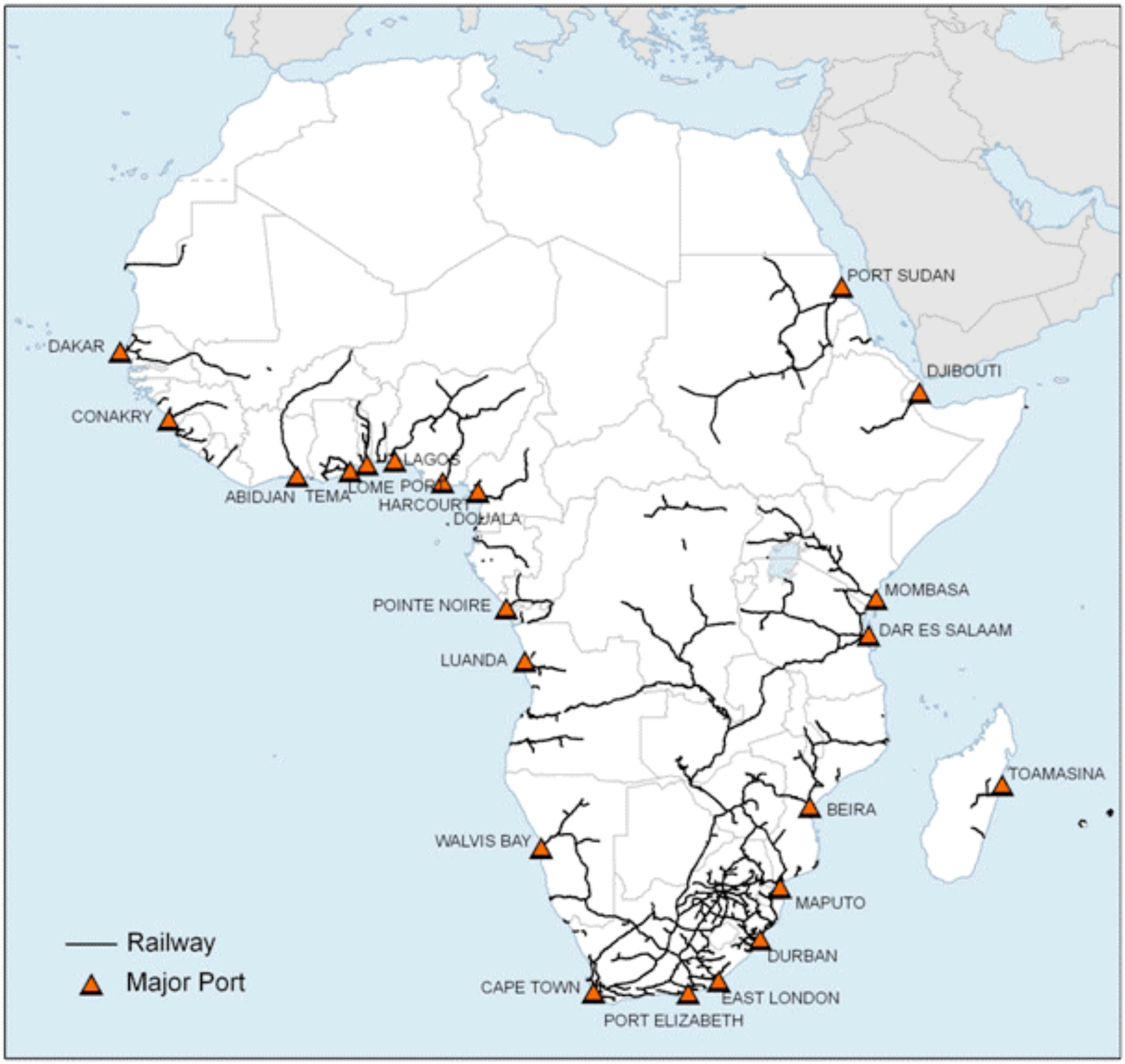
[9] The Eritrean network is the only one currently in operating condition.

[10] Damage from civil wars has cut connections to Malawi and Angola for many years.

[11] Although Spoornet recently changed its name to Transnet Freight Rail, its previous name has been retained for convenience.

The bulk of the network was built during the colonial period at the end of the nineteenth century and the first half of the twentieth century. Since then, very few lines have been constructed outside South Africa and its immediate neighbors. The most significant is the Tazara line linking Tanzania and Zambia, built by the Chinese during the 1970s. Other major projects include the Trans-Gabonais (opened in 1987 principally to transport minerals), the extension of the Cameroon network from Yaoundé to Ngaoundere, and the northeastern extension of the Nigerian network from Kuru to Maiduguri.

Figure 2.1 Rail map of Africa



Source: AICD database.

Not surprisingly, the railway network density is low. The highest density (measured as route-km/1,000 km^2) is in South Africa (16) but most other countries are in the range of 1 to 6; meanwhile, 13 Sub-Saharan countries currently have no operating railway at all. Too much, however, should not be read into this statistic, as network density is strongly affected by population patterns. For example, China, Canada, Russia, and Australia (all with large undeveloped and sparsely populated areas) also have densities between 5 and 7, while most European countries range from 20 to 100. More telling is the network density per million of population, which is highest in Botswana (494) and Gabon (520), followed by South Africa (460). Most other Sub-Saharan countries range from 30 to 150 km per million. In comparison, European countries range from 200 to 1,000, with Australia and Canada reaching over 1,500; China is much lower, at 50.

But these broad statistics, in isolation, do not by themselves make a case for network expansion. The construction of new lines requires a minimum level of traffic to be an economically sound investment. A country's geographical distribution of potential traffic generators and absolute level of expected usage are more important than national averages.

With over 50 companies operating on around 55,000 km of track in Sub-Saharan Africa, there are many small operators, especially when Spoornet represents about 40 percent of the operating network and 70 percent of the traffic. Figure 2.2 shows the distribution of network length and passenger and freight traffic among the main system groups:

Southern Africa. South Africa, Botswana, Namibia, Angola, Swaziland, Madagascar, Mozambique, Zimbabwe, Zambia, and Malawi.

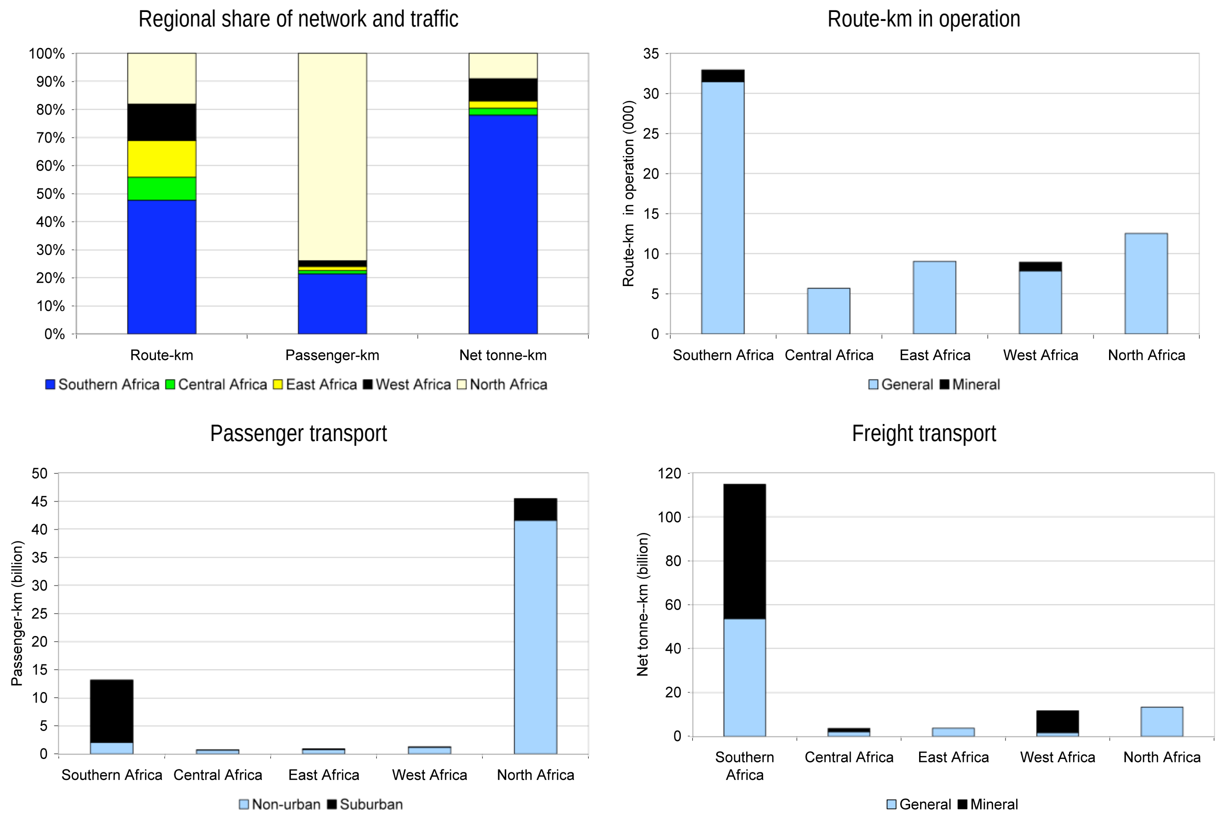
Central Africa. DRC, Republic of Congo, Cameroon and Gabon.

East Africa. Tanzania, Kenya, Uganda, Sudan, Ethiopia, Djibouti and Eritrea.

West Africa. Nigeria, Benin, Togo, Ghana, Côte d'Ivoire, Burkina Faso, Guinea, Senegal, Mali and Mauritania.

North Africa. Morocco, Algeria, Tunisia and Egypt.

Figure 2.2 Network size and traffic, by region



Source: AICD database.

There are some specialist mineral lines (see box 2.1) in both West and Southern Africa; these total only 4 percent of the network but carry over half the freight (as measured by net tonne-km), mostly carried on the Spoornet coal- and ore-export lines. Southern Africa also dominates rail freight, handling 74 percent of the freight traffic (some of which is also minerals and coal) on the nonmineral lines and more than 80 percent of the total net tonne-km.

Southern Africa also dominates the passenger business, with more than 70 percent of passenger-km, largely because of its heavy commuter passenger business. Several Sub-Saharan African cities outside South Africa operate (or have operated) commuter services, but with the exception of Dakar, these are generally one or two peak-hour services that cover short distances along the main line (box 2.2). Lagos, however, is currently tendering for private operators to build two "light"[12] rail lines, which are together expected to carry nearly 2 million passengers per day, more than the southern African services in total. But all these are dwarfed by the massive suburban flows in North Africa, especially in Cairo and Alexandria.

[12] Planned to hold eight cars or more and to operate on high-frequency lines with signaling, these will be conventional commuter railways or surface metros by most measures. The infrastructure will be constructed by the government, while the operator provides the trains and the signaling, and operates the service.

Box 2.1 Mineral railways in Sub-Saharan Africa

Sub-Saharan Africa has a number of railways that are used primarily for the carriage of coal and minerals, either for export or as an integral part of a production process. Most of these lines have been constructed to higher technical standards (axle load, alignment, and so on) than conventional networks:

The Mauritania line is a standard-gauge line dedicated to an iron-ore mine and was built as an integrated project.

There are two standard-gauge lines and one meter-gauge line in Guinea. These carry bauxite from mines to ports and were also built as integrated projects. There is also a standard-gauge line linking to the meter-gauge government railway.

A Nigerian standard-gauge line has been planned and has been under construction for 30 years—one leg is intended to run from an iron-ore mine to the steel plant and the other from the plant to the coast. It remains disconnected from the main network but is now intended to be part of a new network linking the main cities in southern Nigeria with the capital in Abuja.

The Gabon standard-gauge line was built as a substitute for a cableway and meter-gauge line over which exports were previously made through Pointe Noire in Republic of Congo. The dominant traffic is from the mine (which is also currently the concessionaire), but the line also carries some timber and provides a passenger service.

The Sishan-Saldanha Cape-gauge line (Orex) is dedicated to iron-ore exports but is part of Spoornet.

The Richards Bay line (Coalex) is also a Spoornet Cape-gauge line, dedicated to coal exports.

Some of these lines also carry a small quantity of general traffic for the mine. Passengers often travel informally on freight wagons and one or two services reportedly include an old passenger coach.

Box 2.2 Sub-Saharan African commuter railways

By far the largest commuter rail networks in Sub-Saharan Africa are in South Africa, where Metrorail operates extensive electric multiple-unit (EMU) services in Pretoria, Johannesburg, Cape Town, and Durban, some carrying around half a million or more commuters each day, as well as much smaller loco-hauled operations in Port Elisabeth and East London. In total, South Africa's lines carry over 500 million paying passengers each year. Metrorail was operated as a distinct business unit within Transnet until 2006, when it became part of the South Africa Rail Commuter Corporation (SARCC). It has a fleet of 4,200 carriages (about 70 percent of which are operational) and runs services over more than 2,000 route-km, some of which it owns and some of which are Spoornet's.

Also in South Africa, a concession has been awarded for a standard-gauge rapid (160 km/hr) regional line between Johannesburg and Pretoria. Construction began in 2006 and is due for completion in 2010/11 by an independent organization.

The only regular commuter service operating outside southern Africa for many years has been the Petit Train Bleu (PTB) in Dakar, which has operated since 1988 between Dakar and Rufisque, on the main line of what is currently the Transrail concession. Service frequency is relatively high, with 19 pairs of trains each weekday, which are reported to carry 25,000 passengers every day. It is operated by the Agence Nationale de Nouveaux Chemins de Fer, the agency responsible for the non-Transrail network and services in Senegal.

Commuter services in other African cities have generally been small in scale, typically one or two loco-hauled return services per day (into the city in the morning and return in the evening). Examples include Nairobi (on three routes), Lagos (one route), Accra (two routes), Harare (two routes), Bulawayo, Luanda (one route with six return services daily), and Maputo and Kinshasa (one route each). Annual patronage is typically in the low millions.

There have been sporadic attempts and proposals in some other cities (such as the Njanji service in Lusaka) but few have survived in the long term. But there are signs of change: in addition to the Lagos plans mentioned in the main text, a new service was inaugurated in Kaduna in 2008, and Accra has also ordered new diesel multiple-units (DMUS) for its suburban service.

Source: Author.

Traffic density

Traffic densities on Sub-Saharan African railways (expressed as traffic units[13] per route-km) are generally low (figure 2.3).[14] Excluding Spoornet, the highest network average is in Gabon (2.7 million); Cameroon (1.1 million) is the only other railway to carry more than 1 million, and many railways average under 300,000. By comparison, the average traffic density of the Maghreb systems (Morocco, Algeria, and Tunisia) is nearly 2 million and Egypt is more than 10 million, while in Europe most systems are 2 to 5 million, with densities below 1 million found only in Albania and Montenegro.

Even in South Africa, there are many lines with low densities; Spoornet classifies the lines in its network into three groups:

- *High density*—those carrying more than 2 million net tonnes every year;
- *Light density*—those carrying under 2 million net tonnes every year but with prospects for growth; and
- *Low density*—those carrying under 2 million net tonnes every year and with no prospects for growth.

Around 50 percent of the network falls into the first category, 25 percent into the second, and 25 percent into the third. The significance of this classification lies not so much in the distribution of these lines within the network but rather the categorization of all lines carrying under 2 million tonnes every year as low density. This would include all public railways north of Bulawayo, excluding Gabon.

In sum, Sub-Saharan African railways are lightly used by world standards, and many networks struggle to generate enough funds to maintain and renew necessary infrastructure.

Infrastructure condition

Most networks outside southern Africa still operate at the standard to which they were constructed; some limited upgrading has occurred but the lines can be characterized as low-axle-load, low-speed, small-scale undercapitalized networks that are ill-suited to modern requirements. In addition, many structures, and even some track work, are now more than 100 years old. Poorly maintained for years, many sections of track have deteriorated to the point of no return. While this can be tolerated on low-volume feeder lines, and indeed may be the only way some can be viably operated, it is a major handicap when competing against the modern road networks being constructed in major corridors.

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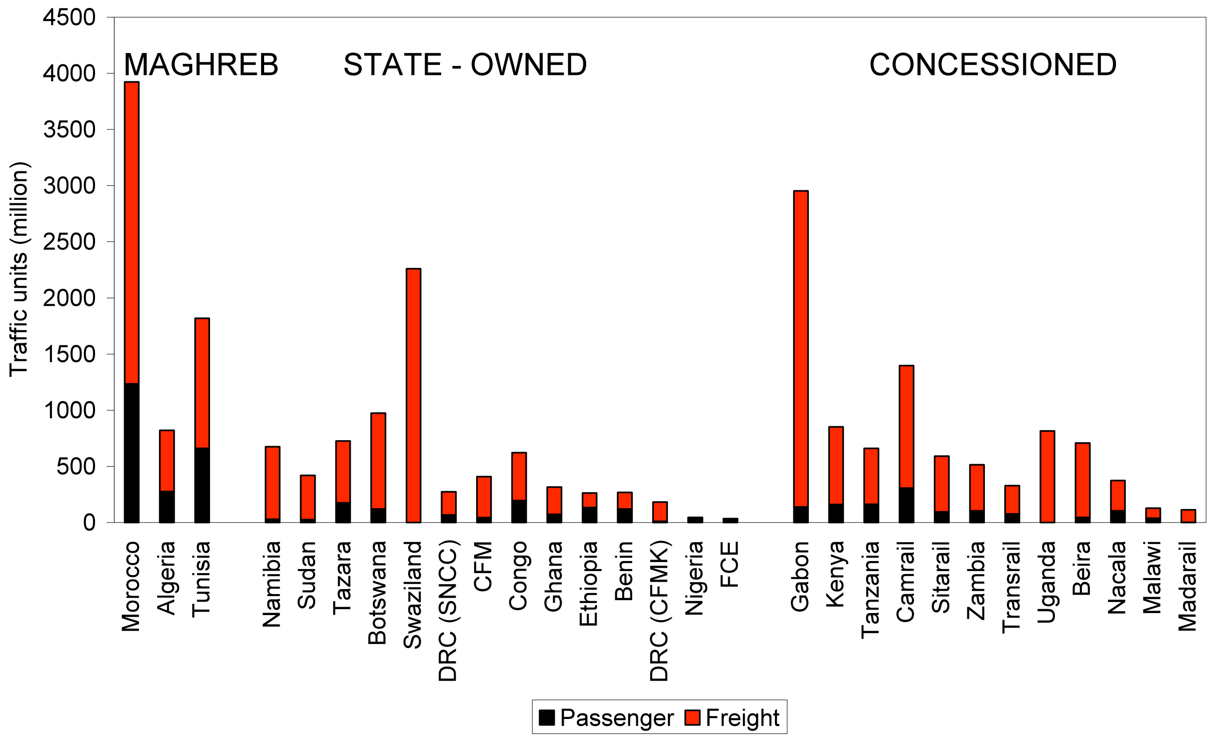
[13] The traffic units carried by a railway are the sum of the passenger-km and the net tonne-km. It is a simple measure that is widely used, although it has some limitations as an indicator (for example, a first-class passenger-km in a TGV is treated the same as a passenger-km in a crowded suburban train). The relative weighting of passenger and freight is conventionally taken as 1:1, although alternative weightings have been used on some railways from time to time, usually trying to reflect relative costs.

[14] For clarity, this figure excludes Spoornet, which averages around 5 million overall (although this reduces to only 2.4 million when the specialized coal and ore lines are excluded) and Egypt, which averages around 9 million overall because of its dense commuter flows.

Figure 2.3 Network traffic density (average 2001–5)



Source: AICD database.
Note: Some railways in the "concessioned" group were only concessioned close to or after 2005.

Most systems have considerable sections of track that require repair or replacement. Several countries have major sections that are not in operation and will require rehabilitation before any operations can recommence: typical examples include Angola (69 percent), Benin (23 percent), and Uganda (91 percent). In other countries, many sections of the network (up to 60 percent in Ghana) do not see regular operations. Even where services are operated, poor track conditions force speed restrictions over long sections, decreasing railway competitiveness and rolling-stock productivity. When the Dakar-Senegal railway was concessioned, the average age of track was reported as 37 years in Senegal and 51 years in Mali. Such averages hide many problems, with much of the track inevitably being much older and often too light for even the moderate axle loads[15] currently being operated (box 2.3). In addition, the strength of rail manufactured 60 or 70 years ago is often well below current standards for a similar weight of rail, leading to fatigue failures and rail fractures.

The cost of repairing such sections (conservatively estimated at $200,000 per km in the most straightforward cases and probably closer to $350,000 per km on average) is beyond the financial capacity of most railways at current traffic volumes. Funding such repairs would absorb all operating surpluses for many years, by which time another backlog will have appeared, and so on. But rehabilitating the sections in disrepair is not economically viable unless there are good prospects for bulk traffic or there are no alternative road connections. Few lines carrying less than 1 million net tonnes every year are likely

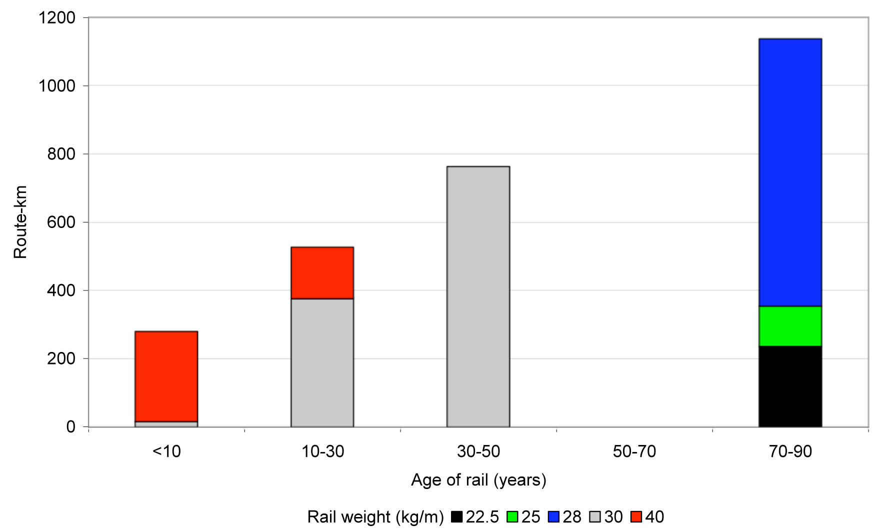
[15] An approximate rule-of-thumb is the permissible axle load is about 25 percent of the rail weight in lbs/yard (or 50 percent of the rail weight in kg/m); but in practice the limiting factor is often bridges, not tracks.

to warrant major rehabilitation, and lines carrying under 250,000 tonnes every year probably cannot support anything more than routine maintenance.

Box 2.3 Track structure on the TRC network

The figure shows the age and weight of rail on the TRC network in Tanzania in 2001, just prior to the beginning of the concessioning process and when the mainline was carrying about 2 million gross[1] tonnes, a respectable figure for such a railway. Over half the network still had the original rail, nearly 90 years old and at 28 kg/m only just capable of carrying a 15-tonne axle load (and that only if the track was properly ballasted with sleepers in good condition—the official axle load limit at the time was 14.2 tonnes). Much of this was track on branch lines but there was over 500 km on the two main lines, heavily restricting the wagonloads that could be carried from end to end (which was most of the traffic).

Age and weight of rail—TRC 2001



TRC had been renewing its main line over the previous 10 years, financed by loans from international financial institutions (IFIs) and donors, and this had allowed them to begin the process of improving their track standard by installing 40 kg/m rail, which can easily support an 18-tonne axle load. The track renewal includes new steel sleepers, adequate ballast, and welded track—but after 10 years, they have still replaced only about 25 percent of the main line.

Source: Author and TRC.

Conditions in Angola and Mozambique illustrate the additional difficulties of rehabilitating railways in countries emerging from conflict, when much of the infrastructure is destroyed and the first task is to remove mines from the right-of-way of rail lines.

Signaling on many networks still relies in many cases on manual systems, whether with mechanical signals or through train orders. Considering the low train volume on most lines, manual systems are quite adequate from a capacity viewpoint, but human error often creates significant safety problems. Where power signaling is installed, it is often not operating due to short circuits, lack of electrical power, and dilapidated cable networks. Telephone exchanges in many companies are similarly obsolete, with limited capacity and a requirement for spare parts that are virtually impossible to find.

In summary, most Sub-Saharan African railways are confronting major infrastructure problems associated with:

- *Aging track*—insufficient ballast, rail wear (especially on curves), deteriorating earthworks, and formation
- *Inadequate maintenance*—most structures are in poor condition
- *Rail signaling and telecommunications*—obsolete equipment and a lack of spare parts

The total amount of funds required to overcome these problems is very large. In the case of TRC (box 2.3), the cost to upgrade the remainder of the main line was about $300 million in 2001. Its gross revenue was about $60 million every year and it broke even on working expenses (excluding depreciation) only by deferring maintenance of infrastructure and rolling-stock. Perennially deferred maintenance generally leaves a legacy that is beyond the capacity of a railway to self-finance; the only option in most cases is to seek large concessional loans and/or grants from third parties.

Network expansion proposals

There have been many proposals, some dating back a century, to create new routes for landlocked countries and to integrate the isolated networks. The most ambitious was in 1976, when the Union of African Railways (UAR) prepared a master plan for a pan-African rail network that included 18 projects requiring 26,000 km of new construction (annex 5), many of which had been proposed for several decades. This plan, designed to create a grid to support intra-African trade development and regional economic integration, was approved by the Organization of African Unity (OAU) in 1979 but few, if any, of the proposed links have left the drawing board.

The UAR is now concentrating on a 2001 revised master plan containing a subset of 10 corridors (table 2.1) [16], in some of which the network is already partially constructed (for example, Corridor 8).

Table 2.1 Union of African Railways 10-corridor master plan

	Corridor	Countries linked
1	North–Center–South	Libya-Niger-Chad-Central African Republic (CAR) CAR-Republic of Congo-DRC-Angola-Namibia
2	West–Center	Senegal-Mali-Burkina Faso-Niger-Nigeria-Chad Senegal-Mali-Burkina Faso-Niger-Nigeria-Ghana Côte d'Ivoire-Ghana-Togo-Benin-Nigeria-Cameroon
3	North–East	Sudan-Ethiopia-Kenya-Tanzania-Uganda
4	North–East–West	Sudan-Chad-Nigeria
5	East–South	Tanzania-Rwanda-DRC-Uganda Dar es Salaam-Kigoma-Burundi
6	East–Center	Sudan-CAR-Cameroon Kenya-Uganda-DRC
7	North	Morocco-Algeria-Tunisia-Libya-Egypt-Mauritania
8	East–South	Tanzania-Zambia-Zimbabwe-Mozambique-South Africa
9	Center–South	Cameroon-Gabon-Republic of Congo-DRC-Angola-Namibia
10	North–West	Senegal-Mauritania-Morocco

Source: See, for example, Overview given at First African Union Conference of African Ministers responsible for rail transport, Brazzaville, 2006

[16] In 2005, the UAR further simplified this with its adoption of three major transcontinental routes: Libya-Niger-Chad-CAR-Republic of Congo-DRC-Angola-Namibia (6,500 km). Senegal-Mali-Chad-Djibouti (7,800 km). Kenya-Tanzania-Uganda-Rwanda-Burundi-DRC with possible extensions to Ethiopia and Sudan (5,600 km).

There have been a number of regional studies and action plans for subsets of these corridors in Sub-Saharan Africa:

- In West Africa a major feasibility study for network development was launched by the African Development Bank (ADB) in 2004. Other studies have looked at connecting Benin-Niger-Burkina Faso-Togo (the Africa Rail project of 1,070 km costing $6 billion), as well as the rehabilitation of existing lines such as Benin Railways (OCBN).
- Preliminary studies have been undertaken by the UN Economic Commission for Africa (ECA) in both Central Africa and East/southern Africa to improve linkages.
- In 2000 the Common Market for Eastern and Southern Africa (COMESA) launched the Great Lakes railway project to improve connections between the Great Lakes and the southern African rail network. This project involved both rail and water transport on Lakes Tanganyika, Kivu, and Edward connecting Burundi, the DRC, Rwanda, Uganda, and Zambia. It included a new rail link from the Zambian network to Mpulungu on Lake Tanganyika, a series of five lines linking to the Ugandan network, rehabilitation of the Kasese line in Uganda, as well as modernization of six lake ports.
- A project promoted by the Northern Corridor Transit Transport Coordination Authority, based in Mombasa, to link Kisangani with Mombasa with a new line from Kasese to Kisangani, with feeder lines linking Kasese to Goma and from there to Kigali and Bujumbura via Bukavu.
- In 2009 the East African Community (EAC) prepared an East Africa Railways Master Plan that included a number of the above projects as well as lines in southern and western Tanzania, links to Rwanda and Burundi, and extensions from Kenya/Uganda into the DRC, Sudan, and Ethiopia. It also discussed proposals for standardization and electrification of the regions railways.

In addition to the above, there have been a number of proposals for individual lines, most of which are either segments of the corridors in table 2.1 or (in the case of the Trans-Kalahari) of the original 18 links given in annex 5:

- Linking Isaka in Tanzania to Rwanda, together with complementary links from Rwanda and Burundi to the Uganda and Tanzanian network;
- Linking Kenya (or possibly Uganda) to southern Sudan;
- Extending the Lilongwe line in Malawi from Mchinji to a railhead at Chipata in Zambia (with the aim of then connecting with Tazara to provide an east-west trans-African link once the Benguela line has been rehabilitated); and
- Promoting (and partially constructing) routes from Walvis Bay in Namibia to Zambia and Angola to develop the port hinterland.

There have also been a number of proposals for dedicated mineral lines by mining companies. Prior to the end of the minerals boom, the coal deposits at Moatize in western Mozambique were being developed by the Brazilian mining company, CVRD.[17] Although the line from there to Beira is being

[17] This company operates major mineral railways in Brazil.

upgraded as part of the rail concession awarded in 2005, its planned capacity is relatively low, and CVRD has examined an alternative of constructing a new high-capacity line to Nacala, which is also a much better port. This line would be a dedicated mineral line, probably standard gauge, with no interaction with the networks it crosses. Similar dedicated minerals lines have also been planned in other parts of Africa, for example, the Pepel line in Sierra Leone (a rehabilitation of a line abandoned more than 20 years ago) and the Chinese line in Gabon.

A Trans-Kalahari railway from Botswana to Walvis Bay has been suggested at least three times over the past 25 years, primarily as a route to export the Mmamabula coal deposits in Botswana via Gobabis and as an upgraded Namibian network through the port at Walvis Bay. The total distance to the port is 1,480 km, of which 880 km would be new construction.

In 2008 the concept of spatial development initiatives (SDIs) and development corridors (DCs) was embraced by the African Union as a means to facilitate economic growth and development (especially in the minerals sector) through private sector investment and improved infrastructure[18]. The objective, based on the model of the Maputo Development Corridor, is to concentrate resources in areas where they are likely to have the greatest impact rather than having them spread thinly to little or no effect. Around a dozen such corridors have been identified, most of which either have, or have had, railways within them. Any program for systematic upgrading of the transport infrastructure within these corridors, especially if it involves mineral-related developments, will almost certainly involve either rehabilitation and extension of the existing network or, in a few cases, completely new construction.

While there is no shortage of schemes, the economics of many of the proposals are uncertain and even the proposed mineral railways are likely to be postponed for several years following the recent slump in commodity prices. The next section examines the likely investment required and the extent to which it can be economically justified.

[18] See, for example, Thomas R, Development Corridors and Spatial Development Initiatives in Africa [World Bank?] 2009

3 Infrastructure investment and maintenance

The dividing line between railway investment and maintenance is far from well defined.[19] The term *investment* has historically been used for new construction and rolling-stock, for replacement rolling-stock, and also (but not universally) for the rehabilitation and replacement of track when its life has expired. In some cases, railways that are chronically short of funds and rely on third parties for funding classify the periodic overhaul of locomotives and rolling-stock as investment. In addition, railways often have a choice of whether to maintain assets in their original condition (as far as that can be done) or to let them steadily deteriorate and then decide whether they should be replaced—particularly since much railway infrastructure has a long life and the demands on it may vary greatly from what was envisaged when it was originally constructed.

Railway assets have a finite life, which can be measured in terms of either time or usage. For the low-tonnage lines common over much of Africa, time is generally the determining factor. In certain areas usage can be a factor as well, such as wear on curved rails. But whether measured by time or usage, asset life will inevitably reduce if maintenance is not carried out on a regular basis, as has, unfortunately, often been the case on Sub-Saharan African railways. The obsolescence of aging assets has only exacerbated the problem; one of the causes of undermaintenance on many railways is the difficulty of getting spare parts for equipment that has long ceased being manufactured, with communications and nonmechanical signaling systems[20] being particularly affected. Diesel locomotives, which generally require a regular supply of imported spare parts, also often present difficulties which did not arise with steam locomotives, which had relatively few components and which could be repaired or manufactured locally. This is exacerbated in those railways which find themselves with a plethora of different makes and models acquired under a range of donor programs.[21]

Providing a detailed estimate of the investment currently needed by Sub-Saharan railways is a daunting task. In addition to detailed inventories and assessments of infrastructure conditions, one must consider how much investment is economically justified. Lines that have been, or will be, superseded by road developments and those with low traffic levels rarely merit reconstruction. Investment should be directed instead to those parts of the network with a long-term future. Although a government's desire to rehabilitate its entire railway network is understandable, this is often extremely expensive—and it is legitimate to question whether the transport solutions of 100 years ago are still the most economical.

[19] Self-funding railways generally adopt the conventional accounting view that replacement of track is maintenance, since it merely maintains an asset in a condition "fit for purpose." If, as is common, a track is upgraded when it is replaced (for example, by using a heavier weight of rail), then the expenditure is split between a maintenance component and a "betterment" component, which is capitalized. Railways that rely on external funding generally have significant track maintenance arrears. These can only be addressed by irregular injections of either government grants or loan funds, which are almost invariably capitalized. The common requirement in concessions for a certain amount of investment to be undertaken has also encouraged what would normally be classified as maintenance (for example, ballast cleaning) to be reclassified as investment.

[20] In one case, spare parts were no longer available as little as 10 years after the system had been installed.

[21] At the time of its concessioning, Tanzania had 96 operating locomotives of 10 different types from 8 different manufacturers.

The investment required at any one time to maintain a system in good order is a function of the age and condition of the existing assets. Where railways have been undermaintained, as in most of Sub-Saharan Africa, a substantial volume of backlog investment will be required to bring it back to "fit-for-purpose" condition. The necessary investment also depends on the extent to which assets whose life has expired need to be replaced and whether they are replaced on a like-for-like basis or progressively upgraded, as is often done, for example, for track standards such as axle load.[22]

Infrastructure

Infrastructure is the largest investment item for a railway. The construction cost of a new single-track nonelectrified railway is at least $1.5 million per km in relatively flat terrain and $5 million or so in more rugged country requiring more extensive earthworks. Reconstructing an existing line for which the right-of-way and earthworks already exist typically costs at least $350,000 per km if new materials are used and rather less, say $200,000 per km, if secondhand material such as cascaded rail can be obtained. Where lines are to be upgraded, bridges may need to be strengthened to handle higher axle loads and additional earthworks may be required to improve alignments (almost always the case in hillier country). Overall, as a reasonable rule of thumb, upgrading can easily cost twice as much as simple track renewal. (That excludes signaling, for which relatively cheap options are now available for the typical low-volume network.)

During its life, track is normally subject to both annual and periodic maintenance of various types. A well-run railway inspects its network at regular intervals. Large railways use a track-recording vehicle; these can also be used by small railways that are connected to a larger adjacent system (for example, the southern Africa networks could use one from South Africa). Such inspections are typically done once or twice a year for lines carrying around 2 million tonnes or less. On heavily used lines, the rail itself is tested using specialized equipment, but most networks would not require this.

Besides routine maintenance, including regular attention to earthworks and drainage, track used on a regular basis is tamped to ensure its geometry remains within safe limits. The frequency ranges from every year (or more often for very heavily used track) to every six or eight years, depending on the tonnage using the line as well as engineering factors such as the type of sleepers, whether the track is welded or not, and the condition of the subgrade on which the ballast has been laid. For low-volume lines, tamping might be done every four or five years, but where the track structure is weak (for example, where there are a large proportion of rotted sleepers) and volumes are very low (say under 250,000 net tonnes every year), it may be decided to not tamp at all. Instead, the track is allowed to gradually deteriorate and to impose speed restrictions as necessary. Many low-volume branch lines in Australia and "short" lines in the United States have adopted this approach (see box 3.1).

Eventually, the various elements of the track structure wear out as a result of usage and the passage of time. Generally, timber sleepers have the shortest life span, but most lines have used steel sleepers almost since initial construction and these generally last several decades. Track that has been relaid with concrete sleepers will have an equally long life—50 years is a commonly quoted figure as long as the concrete specifications were adhered to. Typically, rail life is directly related to usage. On most Sub-Saharan

[22] Many African railways were originally built with axle loads of around 15 tonnes; replacement programs should generally consider increasing them on main lines to at least 17 or 18 tonnes.

African railways, rail life should be measured in decades rather than years (even though there is an order of magnitude difference between the life of the rail on sharp curves and that on straight track). Finally, ballast also has a reasonably long life as long as it was of good quality to start with.

These figures all assume that the track was built properly, with good-quality materials. Unfortunately, many of these railways were built with an eye to economy: formations were not properly consolidated, insufficient ballast was used, and so on. In the early days, when rail had an overwhelming advantage over other modes of transport, these problems were manageable.[23] They became more serious as its monopoly was challenged and particularly as it has found itself needing to upgrade technologically to survive. Understrength formations inexorably lead to high maintenance costs and reduced operating speeds, until eventually there are no options other than to reconstruct the line or to cease operations.

Reconstructed infrastructure should have a life of at least 40 to 50 years, given the low volumes of traffic. Thus, the cost of periodic reconstruction should be about \$5,000–\$10,000 per km per year. (This excludes any return on investment, or ROI; if a 5 percent ROI is included, the annual cost increases to \$20,000–\$40,000 per km.[24]) To fund the reconstruction, a line carrying 1 million net tonnes a year would need to earn 0.5–0.8 cent/net tonne-km (c/ntkm) while a line carrying 250,000 tonnes a year would need to earn 2–3 c/ntkm. If ROI is included, these numbers quadruple, at a minimum. As yields on most freight railways in Africa are around 4–5 c/ntkm, only those with a density of 2 million to 3 million net tonnes or more can even begin to consider full rehabilitation from a purely commercial viewpoint, unless it is assumed that the investment would bring a significant increase in traffic.

This is a relatively high threshold. From an economic perspective, there are significant benefits—in addition to those accruing to operators—that need to be considered as well. These are discussed in the next section.

Box 3.1 "Short lines" in the United States and track quality

Although the seven Class 1 rail lines in the United States normally dominate descriptions of U.S. rail-operating practices, there are also a large number of secondary railways (or "short lines") that handle local traffic and also act as feeders to the Class 1 systems. In 2007 these secondary railways included 33 regional railroads (these each own a minimum of 500 km of track and have revenues greater than \$40 million) and 523 local railways. These latter are further classified into shunting and terminal railways and local line-haul railways which do not meet the regional railway criteria.

The regional railroads typically operate about 800 route-km and carry an average traffic of 3–4 million tonnes; the average local line-haul railroad operates about 150 route-km and carries an average of about 400,000 tonnes, similar to the smaller networks. Overall, the average traffic density of "short lines" is about 2 million tonnes.

Track quality standards in the United States are defined by the Federal Railroad Administration; this classifies track into categories ranging from Class 1 (sidings and yards where the maximum speed is set at 15 km/hr) to Class 9 (main line on which speeds of up to 350 km/hr are permitted). Most track on the short lines is in Classes 1–4: the regional railroads have about 55 percent of their track in or below Class 2 (maximum speed 40 km/hr) while the local line-haul railways have over 70 percent below Class 2 and only 4 percent in Class 4 (where the maximum speed is over 60 km/hr and under 80 km/hr).

Source: Author.

[23] When the Gold Coast (later Ghana) Railway was built, its rates were about half those of shipping by cart and between one-sixth and one-half of those for head-loading.

[24] For a commercial ROI of investment of 10–15 percent, these numbers would double or triple again.

Economic evaluation of infrastructure investment

The criteria, economic or otherwise, for track and infrastructure investment, should be related to the policy framework within which the railway operates. This typically has three main elements.

First, the railway can transport freight more efficiently than other modes, using fewer resources and creating smaller external impacts on the environment and general public. It can be more efficient than road over relatively short distances for bulk freights, such as ores and minerals, petroleum, and agricultural products; over medium distances for semibulk freight, such as steel and cement; and over longer distances for general freight. Greater efficiency flows through to manufacturers and consumers to create more general developmental benefits.

Second, the railway can often perform an important social role in carrying passenger traffic that would otherwise be carried via road, and thus can lower expenditures on road infrastructure, decrease overall accident numbers, and mitigate vehicles' environmental impact. But since rail service rarely, if ever, covers even its variable operating costs in Africa, expenditures and investment need to be concentrated where rail service is most competitive.

Finally, as rail is competing for both recurrent and capital expenditure with other transport modes, and with other sectors, investment should be targeted to ensure it is as efficient and effective as possible.

Against this policy background, the key economic criteria for selecting track and infrastructure investments are the same as for any other investment—the economic benefits (including external benefits) should be greater than the costs, and projects should be prioritized according to the relative size of these benefits, as measured by the economic internal rate of return (EIRR).

When track is rehabilitated or upgraded, benefits accrue not only to operators through reduced operating costs but also to two other groups:

- Users of the infrastructure, who benefit from improved services, and
- Nonusers of the infrastructure, who benefit from the reduced impact either directly (for example, through reduced congestion on roads) or indirectly (for example, from economic development made possible by a new line or more general effects such as a reduction in greenhouse gas (GHG) emissions).

User benefits

Improvements include not just reduced line-haul tariffs but also better service quality such as reduced transit time and damage and increased reliability and security. Though rail generally (but not always) has a lower line-haul cost than road, it often has additional pickup and delivery costs, which need to be considered. Road also offers a faster transit time, more flexibility in terms of scheduling, and more reliability.

The economic benefits of infrastructure investment are determined by the overall service level rather than just the line-haul tariff, as is shown by the many situations in which rail has line-haul tariffs well below those of competing modes but only a small share of the market.[25] It also explains why railways in

[25] As an extreme example, at one time, some of Fiji's sugarcane tramways were free, but they still could not compete with road because of their poor level of service.

many countries handle mostly low-value bulk commodities, for which there are often direct rail connections, marketing is relatively simple, and level-of-service issues are relatively straightforward. It is also why freight volumes have often increased following privatization: even though tariffs may not have reduced, the level of service has generally improved considerably.

Establishing the user benefits associated with any particular scheme requires comparing not just line-haul costs but these other attributes of travel as well, collectively known as generalized costs. The user benefits are calculated as the difference in generalized cost between the "with-investment" and "without-investment" cases.[26] There is an extensive literature discussing the relative importance of the various components (cost, time, reliability, and so on) for passenger traffic but rather less for freight traffic. Where an existing line is already in operation, the impact of relatively small changes in the level of service on demand can be measured using elasticities. There is a literature on these as well, although again more for passenger traffic than for freight.

Nonuser benefits

Nonuser benefits arise as a result of the change in transport flows by both road and rail. There are three main benefits, all related to the reduced use of the road network. Where an investment enables rail to attract traffic previously moved by road, it reduces the following:

- Road congestion
- Road damage (and, consequently, road maintenance costs)
- Road accidents

There may be other general benefits, such as a reduction in pollution, including GHG emissions, depending on the project.

The savings associated with a decrease in congestion is also project specific: if the parallel road network is uncongested (say, with a volume to capacity, V/C, ratio under 0.6–0.7), the savings will be small. But savings are often significant in urban areas, particularly in the approaches to ports.

Road damage costs are a direct function of tonnes carried, with more weight given to overloaded vehicles.[27] The precise cost depends on parameters such as the standard of initial construction, the level of overloading, and the mix of traffic. A typical cost for a paved arterial road would be 0.5–1 c/ntkm[28] (with lower values for better-constructed roads, which usually have higher traffic volumes).

Road accidents are disproportionately affected by the number and size of heavy vehicles on roads. Precise accident rates by type of vehicle are difficult to establish, but are likely to be at least 1 fatality per 5 million heavy-vehicle-km.[29] Converting this to an economic cost requires assumptions about the "value

[26] Where the overall volume of traffic is expected to change because of the investment, the benefits attributable to the incremental traffic are normally valued using what is known as the "rule of a half." A description of this rule can be readily found in the literature.

[27] More precisely, a measure known as a standard axle, which heavily weights overloaded vehicles. Vehicles that are 30 percent overloaded will do three times the damage of those that are not.

[28] See, for example, the charges derived in the Third Heavy Vehicle Road Pricing Determination of the National Transport Commission, Australia (2005), which cover a wide range of paved and unpaved roads.

[29] Based on rates for Nigeria and South Africa of about 1 fatality per 250 heavy vehicles a year and an assumed average distance traveled of 20,000 km. This accident rate is probably an underestimate for long-distance haulage.

of statistical life" (VSL), which varies widely from country to country depending on per capita GDP.[30] A value of $240,000 has been adopted in this paper, which yields an accident cost of about 0.5 c/ntkm.

Rail freight produces between 75–85 percent less GHG emissions than articulated trucks per unit of output. Typical values of CO_2-equivalent emissions are 20 g/ntkm for rail and 80 and 150 g/ntkm for articulated and rigid trucks, respectively.[31] GHG emissions are subject to a wide range of valuations, but a range of $20–$50 per tonne of CO_2 is common,[32] putting the benefit from rail at around 0.1–0.4 c/ntkm. Other road vehicle emissions (especially CO, NOx, CH4, and particulates) have been decreasing substantially as new standards are introduced; their most serious impact is increased mortality, particularly from NOx, hydrocarbons and particulates, but this is predominantly in urban rather than rural areas.

Operator benefits and track quality

Installing better-quality track and other infrastructure improvements increases operating speeds and lower infrastructure and rolling-stock maintenance costs and fuel consumption.

Figure 3.1 demonstrates the impact of different track structures and tamping strategies on overall track quality. A satisfactory track structure will normally experience a steady deterioration in track quality (along AB), until tamping occurs, restoring the original quality (BC)—at which point the cycle recommences. If the existing track structure is weak, say, because it lacks ballast of either the right quantity or quality, the track quality deteriorates more rapidly, along the path A–B3–C3, requiring a shorter tamping cycle. If a railway cannot afford the shorter tamping cycle, the track continues to deteriorate until it is retamped at the point B4. Rolling-stock and routine track-maintenance costs steadily increase during this time because of the steadily declining track quality and its reduced capacity to absorb loading. Eventually, speed restrictions of increasing severity must be imposed. Using obsolete tampers (or manual tamping) will make it difficult to ever achieve the same track quality as a modern mechanized tamper, and track quality in such circumstances follows the path A1–B1–B2 before retamping occurs. If sleepers are in poor condition, the deterioration in track quality is even more rapid, following the path A1–B5–B6.

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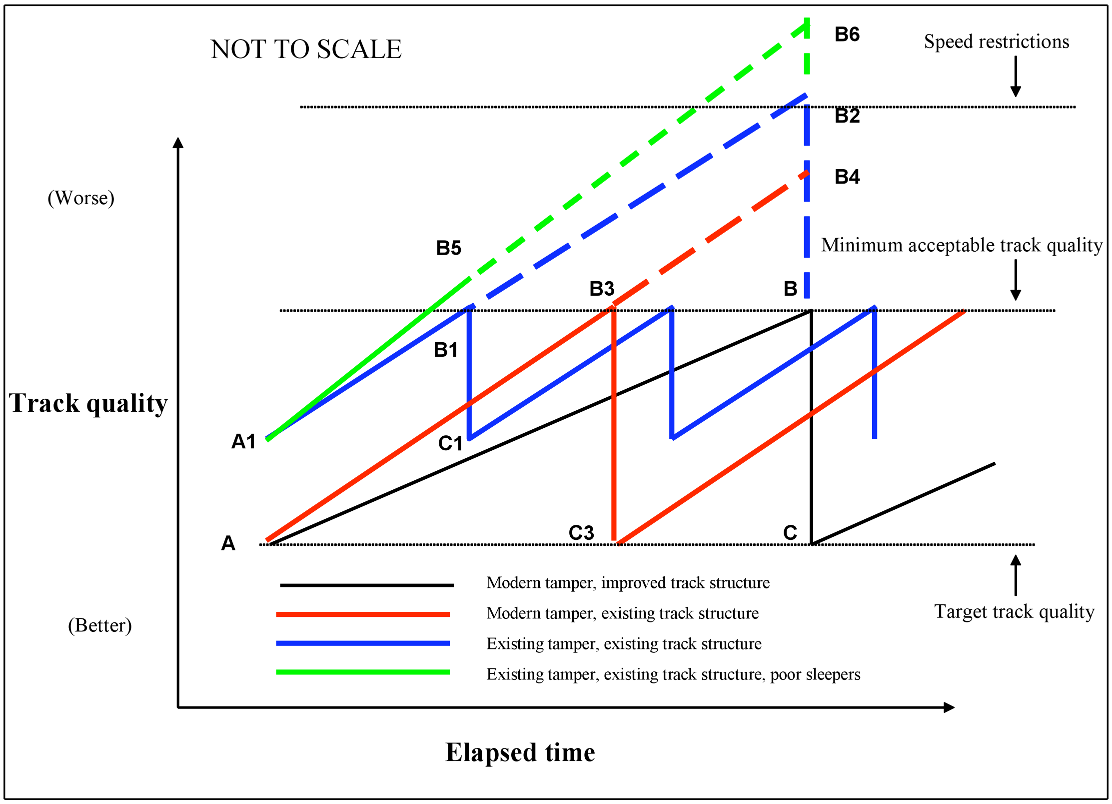
[30] There is an extensive literature on this concept (for example, see Anderssen and Treich in *Handbook of Transport Economics*). A survey by Miller in 2000 concluded that the VSL was typically valued at about 120 times per capita GDP, but this multiple was largely based on estimates from developed countries. There are few estimates from developing countries, but a detailed study in Cambodia (with a per capita GDP at the time of $450, similar to those of many African countries) estimated a VSL of $440,000, giving a multiple of nearly 1,000. This paper has adopted a more conservative multiple of 300, applied to a per capita GDP of $800.

[31] Based on typical fuel consumptions of 8l/000 ntkm and 30l/000 ntkm for rail and articulated trucks respectively, and a conversion factor for diesel of 2.6 kg CO_2 per liter.

[32] See, for example, the guidance provided by Department for Transport for transport evaluation in the United Kingdom. http://www.webtag.org.uk/webdocuments/3_Expert/3_Environment_Objective/pdf/3.3.5.pdf.

Figure 3.1 Alternative tamping strategies



Source: Author.

This cyclical pattern of steady deterioration and either partial or full restoration by tamping continues until the track structure's life expires. At that point, it is no longer possible to significantly improve its quality for any length of time and a progressive decline sets in. As the deterioration accelerates, severe speed restrictions have to be imposed and track-maintenance and rolling-stock-related costs rise rapidly.

Although the general process is well understood, track deterioration varies significantly among railways and lines (primarily because of variations in subgrade strength and the standard of initial construction). Nevertheless, it is certain that failure to undertake periodic maintenance on a well-used line will significantly shorten the life of its track.

The benefits of track rehabilitation vary from system to system. They depend on the line's existing and new track structure, as well as the volume of traffic on the line. Major maintenance benefits can be expected from replacing jointed track with welded track, and the improved track quality following rehabilitation typically reduces wear on rolling-stock bogies, wheels, and draw gear by 5–10 percent and fuel consumption by 2.5–5 percent.

The major operating benefit is the increased operating speed, reducing all time-related costs, particularly those associated with rolling-stock utilization.

Indicative evaluations

Though the economics of any specific track investment depends on the level of traffic and the likely pace of track deterioration without investment, some order-of-magnitude evaluations of track renewal have been summarized in table 3.1.

The evaluations are based on the following assumptions:

- A track rehabilitation cost of $250,000 per km (that is, using some cascaded or reused material)
- A "with-investment" traffic volume of from 0.25 to 5 million tonnes
- A "without-investment" traffic volume of 50 percent of the "with-investment" volume
- Average road tariffs of 9 c/ntkm and average rail tariffs (which are assumed to cover full costs) of 4 c/ntkm
- Average pickup and delivery charges of $100/tonne for an average haul of 500 km (equivalent to a 2 c/ntkm penalty against rail)
- A service-quality penalty of 10 percent against rail (that is, if the road door-to-door rate is within 10 percent of the rail door-to-door rate, users will choose roads because of their better service quality)
- Rolling-stock maintenance and fuel savings for existing traffic of 7.5 percent and 4 percent, respectively
- External benefits as derived above (0.75 c/ntkm for road maintenance, 0.5 c/ntkm for road accidents, and 0.1 c/ntkm for GHG)

Table 3.1 Economic internal rate of return on track rehabilitation

Volume per year	Benefits ($ 000/yr)				EIRR
(million net tonnes)	User	Operator	External	Total	(%/yr)
0.25	1	3	2	6	0
0.50	3	5	3	11	2
0.75	4	7	5	16	5
1.00	6	9	7	21	8
1.50	9	12	10	31	12
2.00	12	16	14	41	16
5.00	29	39	34	101	37

Source: Author.

Given the assumptions adopted, the expected volume must be around 1–2 million net tonnes before major track rehabilitation is economically worthwhile. Traffic volumes under 1 million tonnes will provide poor returns. Such lines should look for cheaper approaches than full rehabilitation—for example, using cascaded rail with partial sleeper replacement is probably all that could be justified. For very low-volume lines, with an expected volume of no more than 0.5 million tonnes, the case for anything other than "patch-and-mend" is likely to be weak.

These conclusions should be treated as indicative rather than as absolute guidelines. If the line is carrying bulk traffic, user benefits can be expected to be rather greater, as the pickup and delivery penalty of 2 c/ntkm will probably no longer apply and user benefits will then increase significantly (in this example by 100 percent). Similarly, if the local road network is very poor, road maintenance savings are likely to be greater than those assumed, increasing external benefits from rail rehabilitation.

As table 3.1 shows, the benefits of these examples accrue to both users and operators since it is assumed that 50 percent of the traffic in the "with-investment" case will travel by road if the investment is not undertaken. If some of it will instead be suppressed, and not travel at all unless the investment is made, the external benefits will decrease accordingly. More generally, "with-investment" traffic forecasts need to be carefully reviewed. The service penalty of 10 percent is a conservative estimate—it assumes an efficiently run, service-oriented railway, which in practice is probably only achieved through concessioning. A penalty of 30 percent, probably closer to the mark for the typical government railway, would reduce the user benefits by 60 percent, as well as eliminate most of the general traffic that might be carried. Thus, anything that can be done to improve service levels will improve both forecast traffic as well as economic returns.

This example excludes any congestion benefits, which are location-specific. These would need to be included in any evaluation of, for example, rail access to and from ports through heavily congested urban networks.

Though individual projects should all be evaluated according to their particular circumstances, the general conclusions of table 3.1 are likely to hold. In particular, low-volume lines (say, below 0.5–1 million net tonnes per year) are unlikely to merit full rehabilitation, and lines carrying bulk traffic will normally generate greater (and more certain) benefits than those carrying general traffic.

Economics of mechanized track maintenance

The complete renewal of the track itself may only take place every 30 to 40 years on most African railways. During that time, most mainline track—in addition to routine maintenance carried out by track gangs—will also require periodic maintenance at regular intervals to realign the track geometry. The track must be kept in a tolerably straight line without undulations, whether going up or downhill or on the flat. Historically, this work was done by track gangs, but most railways, especially those that have installed concrete sleepers, now use specialized equipment called tampers.

The main objective of tamping is to eliminate, as much as possible, irregularities in the "line" and "level" of track, so trains can operate at the designated speed for each section of track. Doing so:

- Reduces transit times, increases track capacity, and improves rolling-stock productivity
- Reduces track and rolling-stock maintenance costs and fuel consumption as a result of the improved track condition

Under normal circumstances, tamping would take place on Sub-Saharan African main lines every three to four years (equivalent to AC in figure 3.1). But if machinery is not available or the track structure is substandard, it may need to be undertaken every two to three years. If the work is delayed due to lack of resources, track quality will be below the "minimum acceptable" standard for 12 to 24 months every cycle, and temporary speed restrictions will often need to be imposed, especially if the sleepers are in poor condition as well.

Not tamping probably increases the wear on rolling-stock bogies, wheels, and draw gear by 10 percent and fuel consumption by 5 percent. It also increases recurrent track-maintenance costs, possibly by up to 20 percent.

Tamping typically costs $3,000 per km, including materials. It generates financial benefits of around 0.1–0.2 c/ntkm as well as some savings in unscheduled maintenance. Whether it is worth doing or not therefore depends on the volume of traffic. Typically, the return to the operator for lines carrying 500,000—1 million net tonnes is good (with rates of return between 50 percent and 100 percent) but, for volumes below 500,000 net tonnes, the returns are much more meager and below 250,000 net tonnes they are nonexistent.

The external benefits of tamping are not likely to be as great as those of track renewal. A rational railway manager would therefore be unlikely to tamp anything other than his main lines, with the objective of extending their lives as long as possible. In practice, any such decision will be complicated by two factors: passenger services normally require a higher track quality (and thus more frequent tamping) than freight to provide an acceptable ride quality, and tamping machines are not always available (as is often the case on isolated networks) and, even if they are, the track structure has to be strong enough to withstand the process.

Indicative investment needs of Sub-Saharan railways

A full analysis of the investment needs of Sub-Saharan African railways would require detailed data on infrastructure and rolling-stock condition and traffic volumes for each railway. In the absence of such data, an indicative estimate has been made using aggregate statistics and broad assumptions supported by the previous discussion. The network north of South Africa consists of about 44,000 km of track, of which about 34,000 km is operational. Nearly all the lines are low volume by most definitions, justifying only partial rehabilitation, possibly using cascaded materials. Even assuming a relatively low unit cost, say $200,000 per km, probably no more than 15,000–20,000 km of the network can justify this level of expenditure. Spreading the investment over a 40-year interval, the cost of infrastructure rehabilitation would average around $100 million a year.

The cost of replacement rolling-stock can be estimated in a similar manner, using assumed average asset lives. The network north of South Africa (excluding the mineral lines) carries around 15 billion ntkm a year and about 4 billion passenger-km (pkm). This volume will require, on average, replacing 500 wagons, 20 passenger carriages, and about 20 locomotives each year. Although, as with infrastructure, many of these will be obtained secondhand, typically from India or South Africa, the estimated cost will still average about $80 million a year, equivalent to about 0.4 c/ntkm or pkm. In all, the steady-state investment in the Sub-Saharan network north of South Africa (allowing $20 million for facilities, maintenance equipment, and so on) is likely to be around $200 million every year.

The required one-off backlog investment is possibly around $3 billion, assuming a 15-year backlog. In practice, this expenditure could be spread over, say, a 10-year period, with an annual expenditure of $300 million. The combined annual program would be about $500 million for the first 10 years, and would drop to the steady-state investment level of $200 million after that.

Though these calculations provide only broad, order-of-magnitude estimates, it is clear that the total amount required is very large, of the same order as the annual revenues of some railways and well beyond their capacity to self-finance. The only option for most railways is to seek large concessional loans and/or grants from third parties.

Railways may also consider investing in completely new projects. There have been many proposals, summarized in the previous section. Few are financially or economically viable. Though there is no shortage of schemes, in many cases the new routes would be competing with existing road and rail routes, which would constrain the rates that could be charged, typically to 5 c/ntkm at most. In the case of export mineral traffic, the potential rate is generally constrained to around 2–3 c/ntkm by the long-term delivered market price. As a serviceable two-lane road can generally be constructed for around $1-2 million per km, additional rail investment would be economically justified only if the forecast traffic volumes are at least 2–4 million tonnes per year. If, however, the capital costs of the infrastructure do not have to be recovered, the lines can probably be operated successfully at rather lower volumes, say 1 million tonnes.[33]

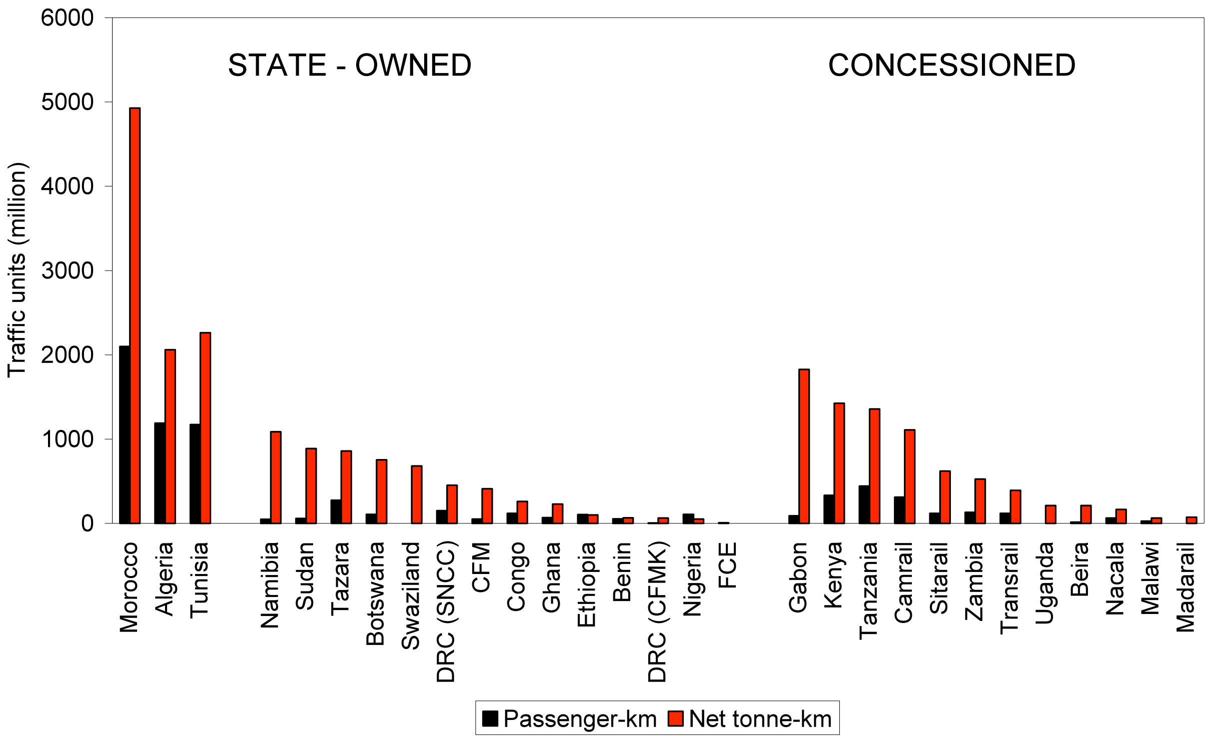
These "top-down" estimates can be cross-checked against "bottom-up" estimates available for some railways. Investment plans have been developed recently in Côte d'Ivoire, covering the next 20 years, and in Madagascar, covering the next decade. Annual infrastructure investment is equivalent to $8,000–$10,000 per route-km and rolling-stock investment is 1–1.4 c/ntkm; in both countries, around 50 percent of the investment is to be provided by the government. In the United States, where most investment is privately funded, the short lines typically invest about $6,000 per route-km annually on infrastructure; the Class 1 railways, with a far greater average density of about 20 million net tonnes, invested $45,000 per route-km in 2007.

[33] The experience of the Alice Springs–Darwin railway supports this conclusion. Although it was constructed at an average cost of under $1 million per km, with 40 percent funded by government grants, it has never carried more than around 2 million tonnes per year, and in 2008 it went into administration as it could no longer service its debts. It was able to cover its working expenses but could not service the 40 percent of the capital cost that was funded by debt, with the equity shareholders writing off their investment.

4 The market

Most railways in Africa, with the exception of Egypt's, carry far more freight than passengers (figure 4.1).[34] Between 1995 and 2005, freight traffic represented about 80 percent of total traffic units. But almost all railways carried some passenger traffic; only Swaziland, Uganda and (since 2009) Botswana have freight-only railways. There is also little difference in aggregate between the concessioned railways and the nonconcessioned railways. But as freight volumes have either grown, or at least remained steady, the proportion of passenger traffic has been decreasing. By 2005, it was down to 18 percent. In only a few cases—mostly railways that have very low traffic levels overall and have almost completely lost their freight business—does the percentage of passenger traffic reach 50 percent. Several of the other railways with a reasonable passenger business (for example, TRC, Tazara, and Transrail prior to 2005) only do so because competing road networks either do not exist or are in very poor condition.

Figure 4.1 Passenger and freight traffic on African railways (annual average), 1995–2005



Source: AICD database.

Note: Some railways in the "concessioned" group were only concessioned close to or after 2005; this figure should therefore not be used to compare the impact of concessioning on traffic volumes.

[34] This figure covers all railways in Africa other than South Africa and Egypt (because of their relative size), Zimbabwe (because of the lack of data on passengers in recent years), and internal Senegal traffic not carried by Transrail. Some data are missing for some countries for some years, so the averages are indicative rather than precise, and all data are subject to the caveats discussed in box 4.1. The data used for the chart is given in annex 1.

Box 4.1 Traffic and operating statistics

Almost every railway in the world maintains traffic and operating statistics. Several sources are generally available, for example, the Union Internationale des Chemins de Fer (UIC) website provides a time-series for many countries, and the World Bank also has a database. Most government railways also publish (or used to publish) annual reports that include a summary of the key indicators. But these sources often disagree and there are many traps for the unwary. Reported traffic statistics may differ because of what is included; freight may or may not include traffic carried for the railway itself, such as ballast and fuel (this can sometimes be very large, one year in Nigeria it represented more than 90 per cent of the total traffic) or traffic hauled by third parties (such as SEFICS in Senegal), while passengers may or may not include staff and other persons using passes (such as politicians and war veterans), commuter passengers carried in trains operated under contract to other authorities, and so on.

Other problems include differences in reporting years. When a reporting year ends in June, say, data may end up in different years in different sources. Less easily spotted problems arise from the method of compilation: tonnage statistics can be derived from revenue accounts or from operating statistics (the two rarely agree to within 5–10 percent, even on the best-run railways); passenger statistics often include season tickets converted to trips based on "multipliers" (used to convert a weekly ticket, for example, to 10 trips); and sharp jumps are sometimes seen when assumptions are changed. Finally, some problems arise from simple issues of arithmetic, data entry (in the case of websites), and presentation. For example, in at least one case (and possibly two) when a concession started toward the end of the year, the data from the remaining months of the calendar year were included in the following year's results; thus the reported traffic for the last "year" before the concession consisted of only 11 months, while the first "year" of the new concession consisted of 13 months.

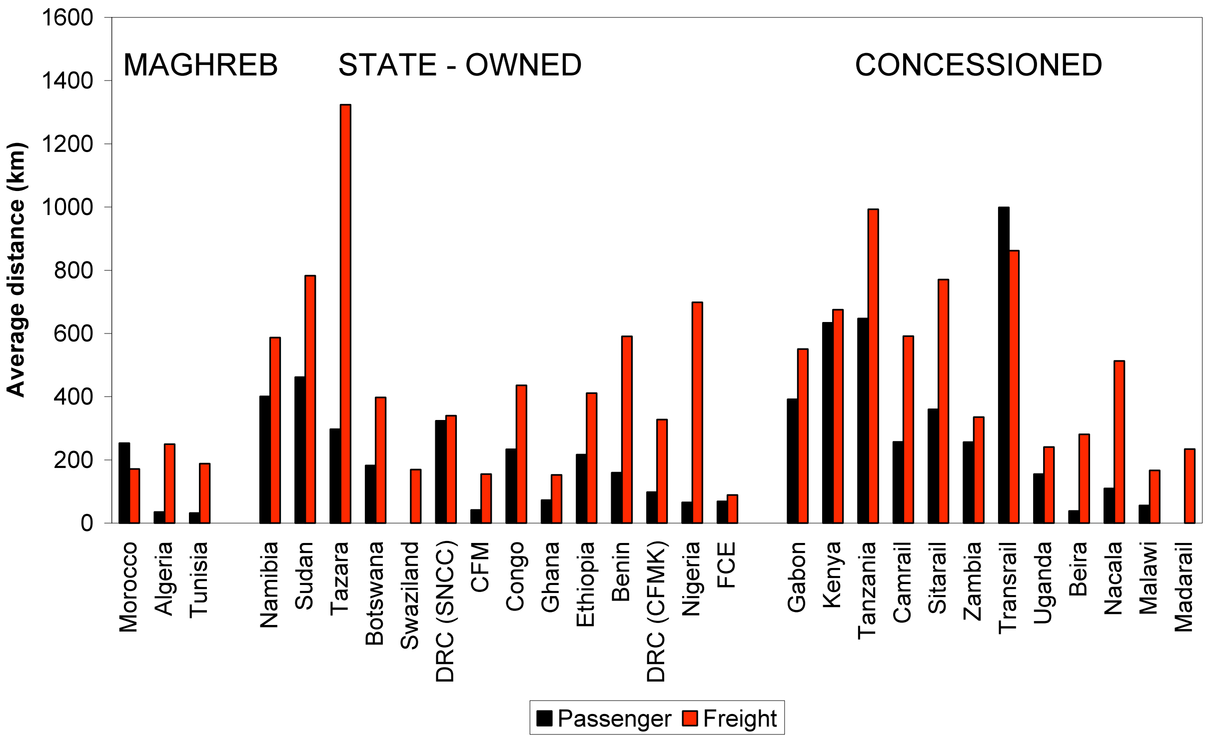
While the order of magnitude of these statistics is generally correct, precise values often vary between sources. The conclusions drawn in this paper are based on general trends rather than detailed results for individual railways, except for selected cases where data have been extracted especially for the purposes of analysis.

Figure 4.1 highlights the lack of scale of most Sub-Saharan African railways. The busier railways typically carry 1 billion traffic units, around one-third of the Maghreb railways; Spoornet carries this volume of traffic every three days. Of course, the Spoornet network is much larger, but in overall terms most railways have volumes similar to a moderately busy branch line on railways outside Africa. In some cases this is due to lack of demand, but in other cases it is caused by shortages of rolling-stock, particularly locomotives.

The average haul on networks (figure 4.2) is relatively large in proportion to their network size but not especially large in terms of competing with road. Some railways carry predominantly end-to-end traffic; TRC, Tazara, and Transrail all have an average distance for freight of around 1,000 km and some smaller railways, such as Uganda or the Mozambique lines, act as feeders to other systems, which subsequently carry the traffic a few hundred kilometers farther. These systems have a good chance of competing for general freight traffic, even as the road network is improved, as long as they can maintain satisfactory service levels. But the shorter systems, which require transshipment to roads at railheads will generally find they can only compete effectively for bulk traffic where these exist.

Few of the systems are operating significant commuter services. The average distance of passenger trips in figure 4.2 generally represents trips made between the capital city country and the major provincial centers. The only significant cross-border flows are in the Sitarail, Transrail, and Tazara networks.

Figure 4.2 Average distance traveled on African railways (annual average), 1995–2005



Source: AICD database.
Note: Some railways in the "concessioned" group were only concessioned close to or after 2005.

Traffic trends

The change in traffic on many systems over the last decade has often had little to do with changes in the underlying demand. In some cases, war or natural disaster has had a major impact: thus Sitarail and Republic of Congo both experienced sharp reductions in traffic during civil wars. CEAR (Malawi) suffered badly after a major bridge was destroyed and it took more than two years to raise funds[35] for its repair; TRC suffered severely from a cyclone in 1997. Conversely, when infrastructure has been rehabilitated, as is happening with both Madarail and on the Sena line (part of the CCFB Beira concession), traffic increases sharply from a low base.

In several other cases, the volume carried reflects the availability of rolling-stock, particularly locomotives.[36] Many of the fleets are old, and spare parts are not always available. When railways increase their fleets (either through obtaining new or secondhand locomotives or rehabilitation projects), traffic increases accordingly. Figure 4.3 indicates the general trend in traffic over the last decade, comparing average traffic levels for passenger and freight for 2001–5 with the averages for 1995–2000.[37]

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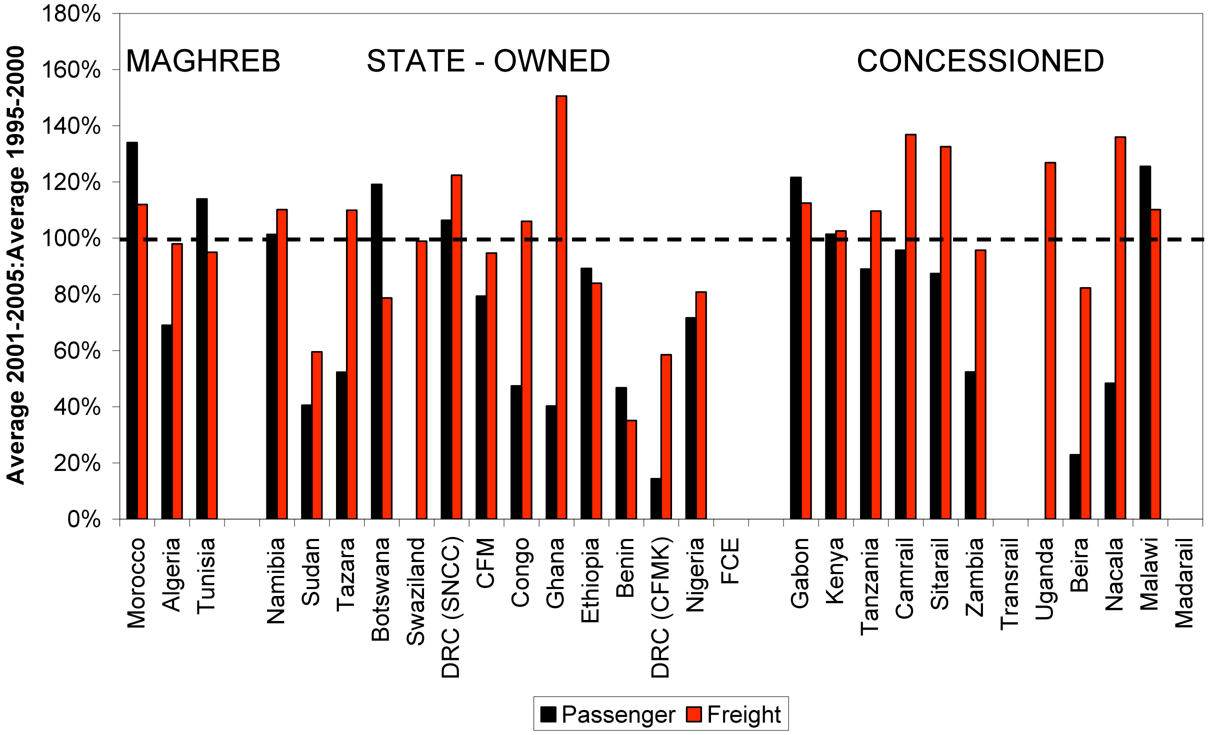
[35] Under the concession agreement, the repair of a structure destroyed by an act of God was the responsibility of the government, which had no funds.

[36] This situation also occurs at peak periods on much larger railways. For example, Spoornet came under heavy criticism in 2007 and 2008 for not having sufficient capacity to carry export coal and minerals to ports, but the situation on many Sub-Saharan African railways is more fundamental and long term.

[37] Abnormal years (wars, cyclones and so on) have been excluded from the averages.

Figure 4.3 Traffic growth on African railways (annual average), 2001-05 compared to 1995–2000



Source: AICD database.

Note: No comparable data available for FCE, Transrail, and Madarail. Some railways in the "concessioned" group were only concessioned close to or after 2005; this figure should therefore not be used to compare the impact of concessioning on traffic growth.

During this period, most African countries experienced steady economic growth. Gross domestic product (GDP) grew at an average of 4 percent a year, with corresponding increases in trade, and per capita GDP of about 1.5 percent a year; countries that avoided political upheavals, such as Tanzania, Mozambique, and Mali, grew up to 50 percent faster.

In spite of the generally favorable economic background, only five Sub-Saharan railways have seen an increase in both passenger and freight traffic over the period, of which three (Gabon, Kenya, and Malawi—which grew in spite of the cyclone damage) have been concessioned. The two nonconcessioned railways in this group are Namibia and SNCC, which is recovering from civil war.

Only one other Sub-Saharan African railway has seen an increase in average passenger traffic: Botswana.[38] But it also saw a drop in its freight traffic, a result of the rerouting of through traffic between South Africa and the north via the new Beit Bridge Railway. All other railways saw a reduction in passenger traffic, and a good many in freight traffic as well, including Sudan, Nigeria, Benin, and two of Mozambique's three railways. The Zambia concession (RSZ) also falls into this group, due in part to its deliberate withdrawal from local intermine traffic for a period.

[38] Ironically, passenger services were completely withdrawn in Botswana in 2009, partly on safety grounds but also because the subsidy from freight could no longer be sustained.

Figures 4.4 and 4.5 show detailed trends in passenger and freight traffic for four railway companies (Sitarail, Camrail, CEAR, and RSZ), before and after concessioning. Freight traffic has generally, but not universally, increased. Civil war badly affected Sitarail, and CEAR was affected by the bridge collapse. Passenger traffic has generally stagnated or declined, especially in the case of RSZ. Sitarail has subcontracted its passenger service, and now only provides haulage for the passenger train.

Figure 4.4 Concession passenger traffic

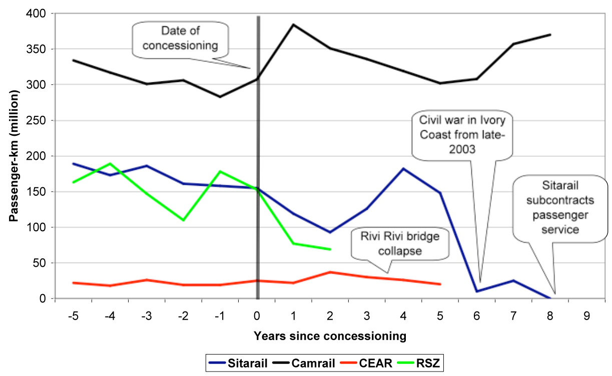
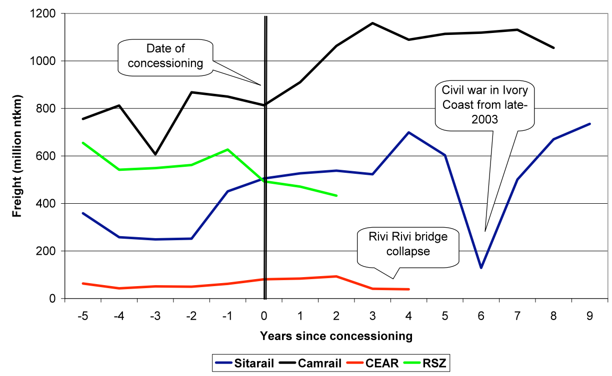


Figure 4.5 Concession freight traffic



Source: AICD database.

As a consequence of the downturn in the world economy, since late 2008 there has been a sharp drop of up to 20–30 percent in the shipment of some commodities on a number of the region's railways. Examples include transit cement and rice carried to Burkina Faso by Sitarail and wood exported through Camrail. This sudden reduction in traffic has had an immediate impact on revenue and profitability. If it continues, railways will inevitably require significant restructuring to maintain their financial viability.

Passenger traffic

Passenger rail services worldwide often serve two distinct markets:

- *Transport of suburban passengers*. Given the high population densities of Africa's large metropolitan areas, rail offers a way to counter urban traffic congestion and improve mobility between city centers and suburban areas.
- *Intercity transport.* Regional and long-distance transport linking major centers to rural areas.

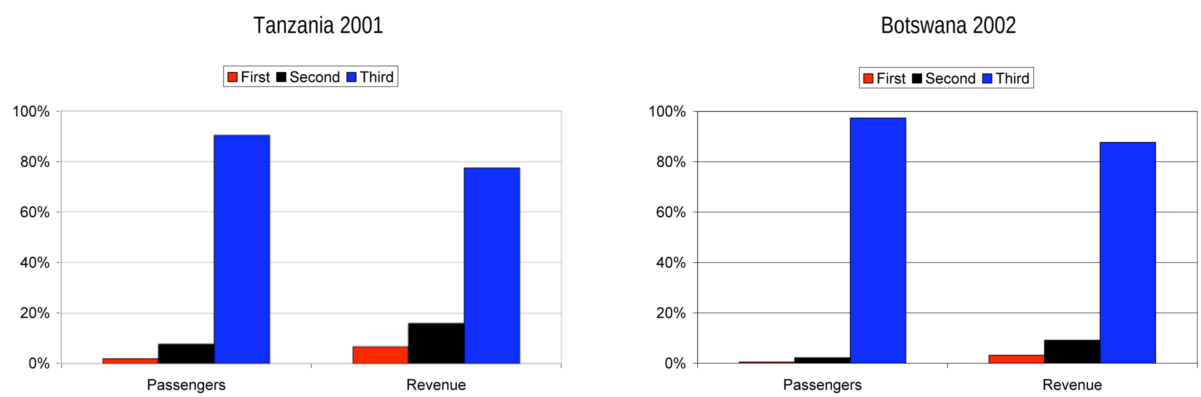
The suburban services currently operating in Sub-Saharan Africa are summarized in box 2.2. The only regular all-day service outside South Africa is the Petit Train Bleu in Dakar, and it operates on only one route. Elsewhere, suburban services generally consist of morning inbound and evening outbound loco-hauled trains, with little, if any, service at other times. Several cities have plans for modern commuter networks; based on experiences elsewhere in the world, these services will need substantial external funding, both for capital and recurrent operating costs, and should be operated by new and independent transport authorities separate from the existing railway, as in South Africa.

Historically, railways were the only practical mode of transport in many countries for longer-distance land travel. Governments controlled fares, limiting them to what were considered affordable prices, almost invariably below cost. In the best cases passenger revenue just covered the cost of train operation but contributed little to either infrastructure costs or the capital cost of replacement rolling-stock. Overall railway finances could only be balanced by contributions from the freight business. As the road networks have improved, buses and shared taxis have provided competition in many corridors[39] in terms of both price and service frequency, and few corridors remain in which rail passenger services are the only effective means of transport.

In a few cases, formal support schemes, such as Public Service Obligation arrangements, have been introduced to support rail services, but these rarely provide timely compensation. Payments from the government may take several years, or otherwise take the form of a subsidy calculated so that the railway merely breaks even as a whole, limiting its ability to increase maintenance and making impossible any attempts to improve the financial performance of its freight services. As a result, most long-distance passenger services in Africa are trapped in a cycle of minimal investment, deteriorating services, declining patronage, and financial losses.

Railways generally offer two, and sometimes (when there are sleeper accommodations) three classes of travel, but passengers overwhelmingly (80–90 percent) travel third-class (figure 4.6); few as they are, most first-class passengers are either railway or government employees. Most trains have one or two upper-class carriages (often with low occupancy levels) and as many third-class carriages as are required to accommodate demand (often well into double figures), assuming they are available. Load factors on many trains are therefore often quite good: in Tanzania the average third-class load factor was around 70 percent[40] in 2001.

Figure 4.6 Passengers, by class, in Tanzania and Botswana



Source: TRC, BR revenue statistics.

Average passenger tariffs typically range from 1-3 cents/passenger-kilometer (c/pkm) (figure 4.6), but on most routes, medium- and upper-income passengers have moved to car and air, while buses — where they operate — generally, but not always, provide strong competition for economy passengers. Passenger services also carry parcels and small freight; these typically add about 25 percent to their revenue, but even so revenues are generally insufficient to cover the cost of running the train (see chapter 7).

[39] When the Tanga–Moshi road was rebuilt in the mid-1990s, virtually all the train passengers switched to buses. The passenger rail service was withdrawn within months.

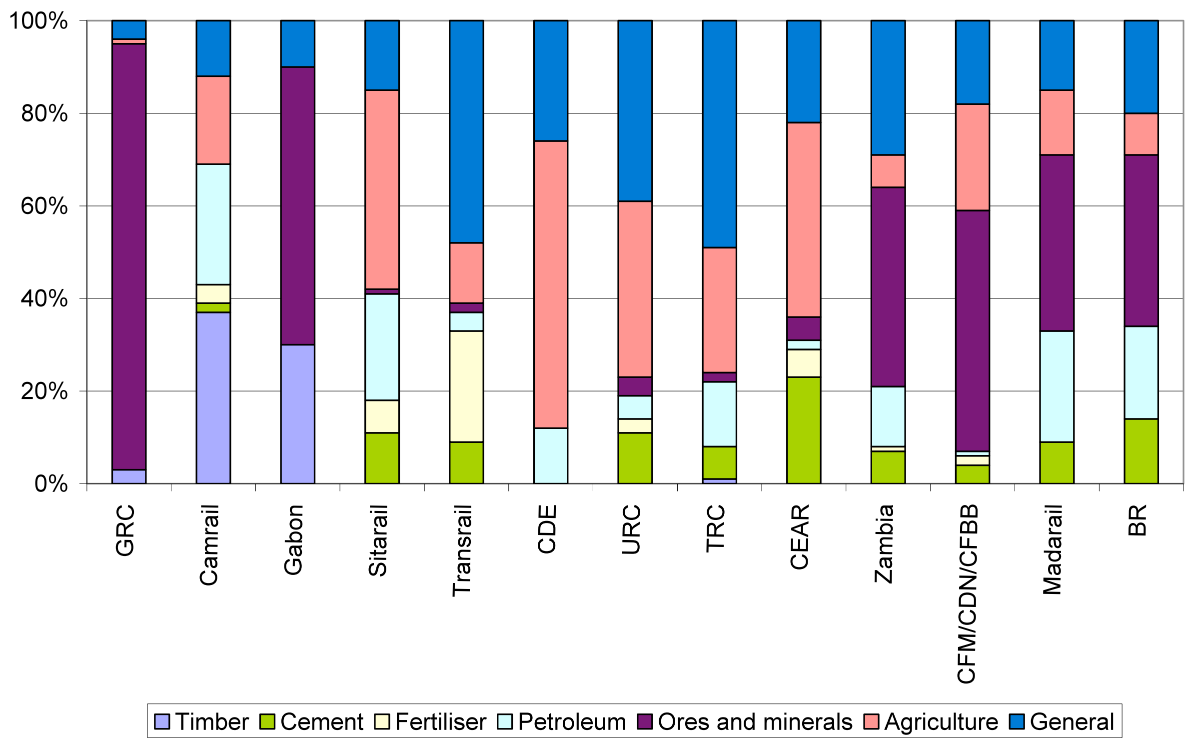
[40] This is the dynamic load factor, that is, passenger-km:seat-km. As not all passengers travel to the end of the route, occupancy is generally much higher at the maximum load point.

Freight traffic

Bulk and semibulk commodities, principally to and from ports, dominate freight traffic on Sub-Saharan African railways (see figure 4.7). Of the railways included in the figure, only Botswana has a large proportion of non-port traffic, most of it either raw materials being supplied to or products (cement, petroleum, and so on) being received from South African manufacturers. The commodities transported by rail reflect the economic structure of countries served by the railway. Mining products (copper, tin, manganese, stone, and coal) constitute the bulk of the freight in several countries, as does timber together with export crops (cocoa, coffee, cotton, cereals) in West Africa.

Import freight traffic consists mostly of manufactured products such as cement, petroleum products, and general freight. On some systems much of the general freight is containerized; higher-value cash crops (such as coffee from Uganda) are increasingly traveling in this way, particularly when the trip involves crossing an intermediate border before the port.

Figure 4.7 Commodities carried on select Sub-Saharan African railways (various years around 2001)



Source: AICD database, railway revenue statistics, and author's data collection.

Unlike passenger services, freight services commonly have significant imbalances between traffic in the two directions. Even where traffic is balanced, the different commodities often require specialized wagons, resulting in trains that are rarely fully loaded in both directions. In some cases (for example, export traffic from Zambia to the ports), the imbalance is exacerbated by road transport backloading export freight at marginal cost after having delivered import freight, leaving rail to transport the remaining export freight without a compensating return load.

A significant proportion of the traffic on many railways is to or from a third country, either directly or by road from a railhead (figure 4.8). Import traffic is generally rather larger than export traffic; the only exceptions are a few railways such as Gabon, which have substantial mineral exports. Railways that cross international borders tend to be dominated by international traffic. The main exception is KRC, whose traffic to and from Nairobi is much greater than its traffic to and from Uganda.

Figure 4.8 Traffic mix on select Sub-Saharan African railways (various years around 2001)

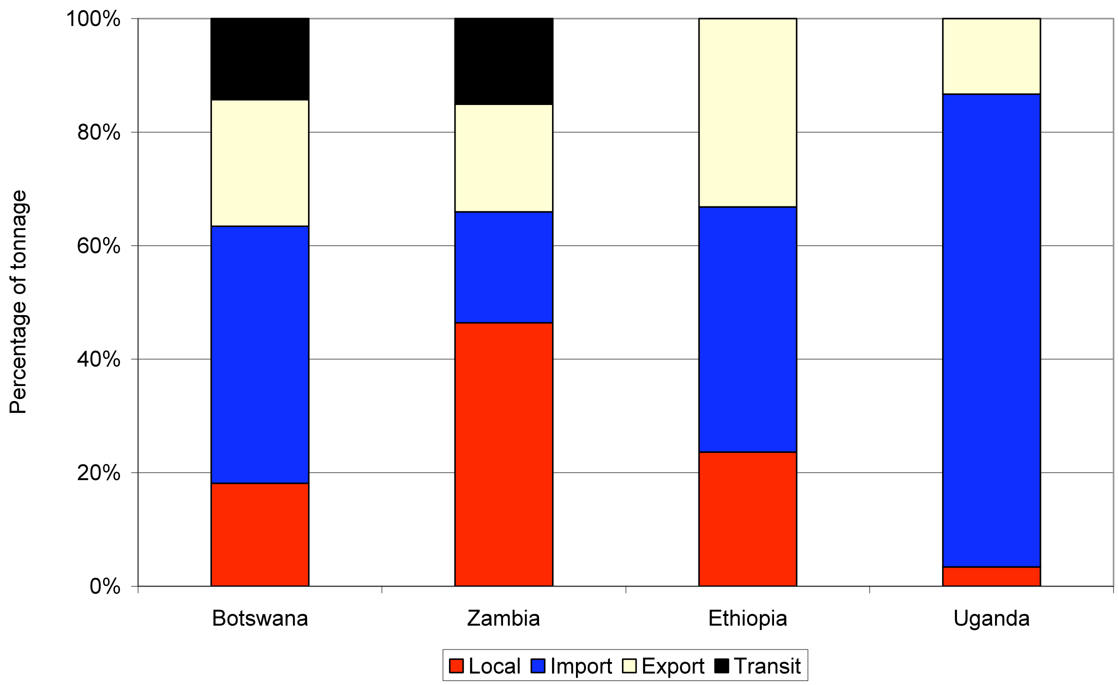
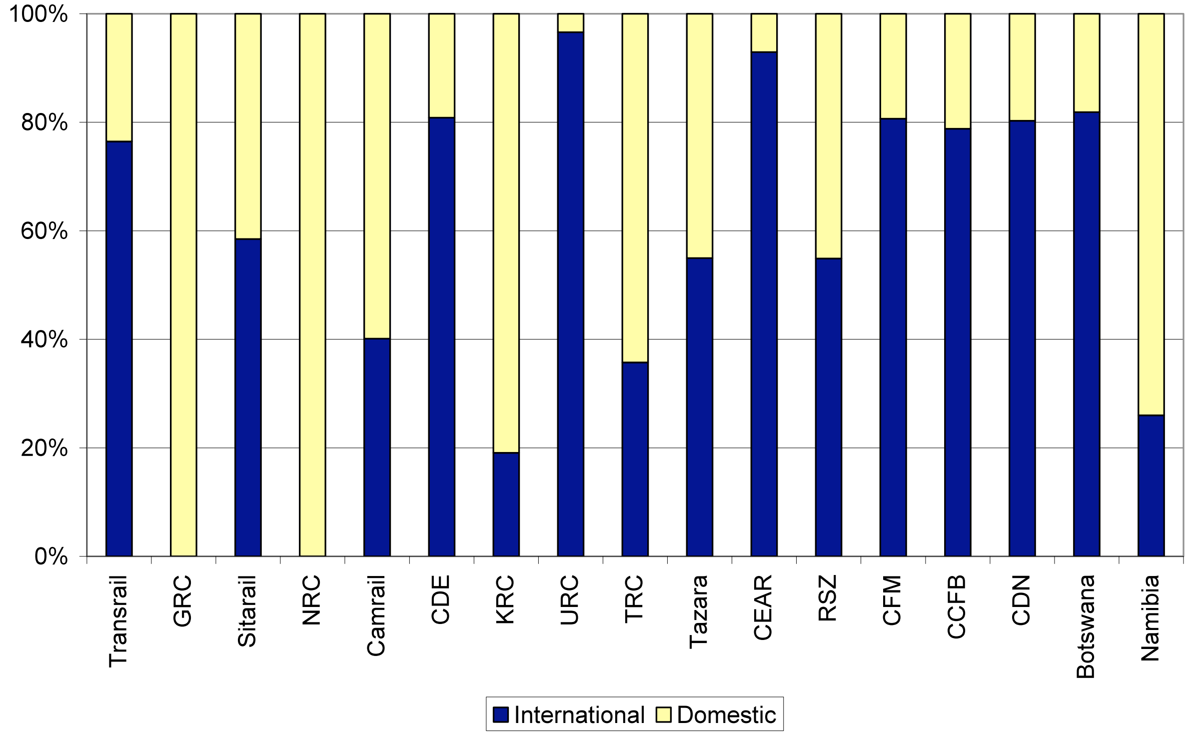


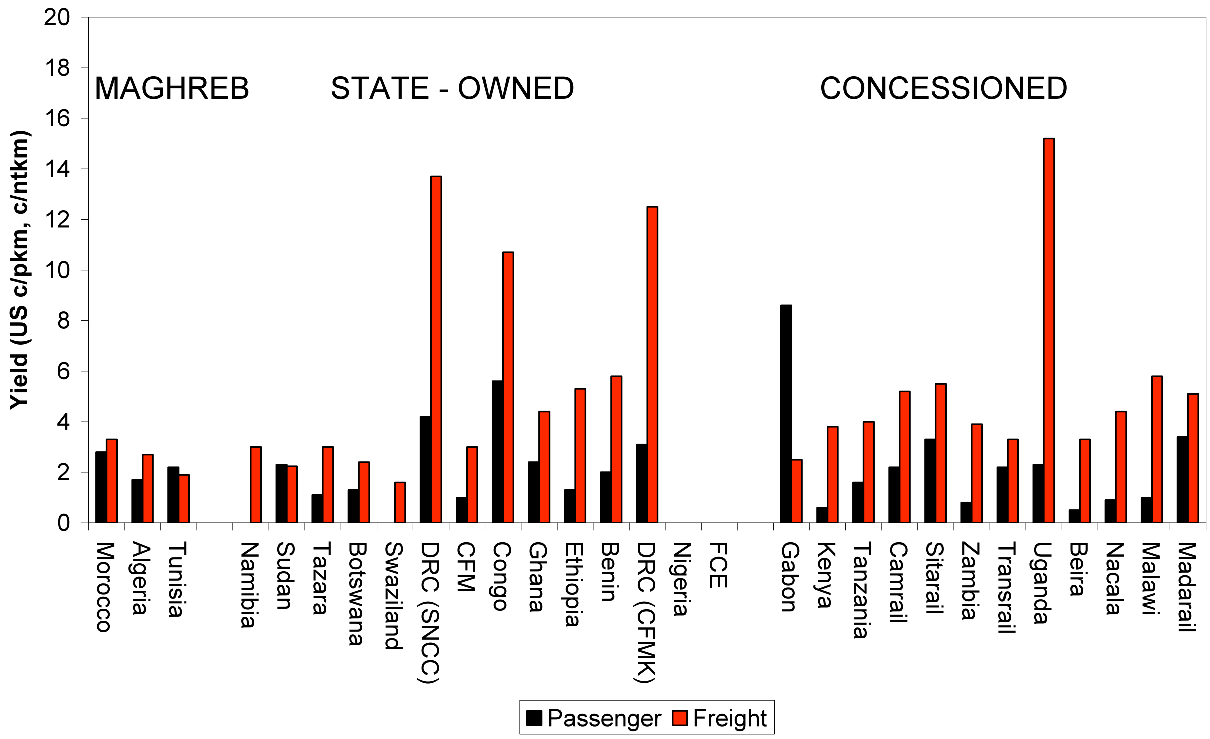
Figure 4.9 Domestic and international freight traffic on Sub-Saharan African railways (by tonnage for various years around 2001)



Source: Railway revenue statistics and annual reports.

Note: Because of the large differences in average haul for domestic and international traffic, the share by tonne-km is much different in many cases (for example, Transrail, for which international traffic is 97 percent of the total tonne-km).

Figure 4.10 Average yields for passenger and freight traffic (average 1995–2005 or similar)



Source: AICD database.

Note: No comparable data are available for Nigeria, FCE in Madagascar and Swaziland. Some railways in the "concessioned" group were only concessioned close to or after 2005; this figure should therefore not be used to compare the impact of concessioning on yields. Data for some countries extend only to 2004 or start at 1996. For some countries, the data series may not be complete (that is, a year of data is missing for some countries).

Average freight tariffs from 1995 to 2005 have typically ranged from 3-5 cents/net tonne-km (c/ntkm) (figure 4.10).[41] Except for occasional semimonopolies such as SETRAG, tariffs are generally constrained by competition, from either road or alternative routes. The highest rates in the figure are those of the two DRC railways and CFCO (Republic of Congo), countries where road competition is both expensive (or impossible) and not secure, and Uganda. Rates for the latter country are distorted by its rail-ferry operations, the very short distances much of its traffic moves on the port access lines, and a deliberate policy during this period of equalizing tariffs on all three routes (direct rail, ferry via Kenya, and ferry via Tanzania) to promote competition.

Typically, railways charge a range of tariffs for different commodities. Originally all railways followed the classical model of basing tariffs on the value of the commodity, charging low rates for low-value commodities such as fertilizers, and higher rates for manufactured goods.[42] Over the years this structure underwent some changes. Some commodities received discounts either because of a more

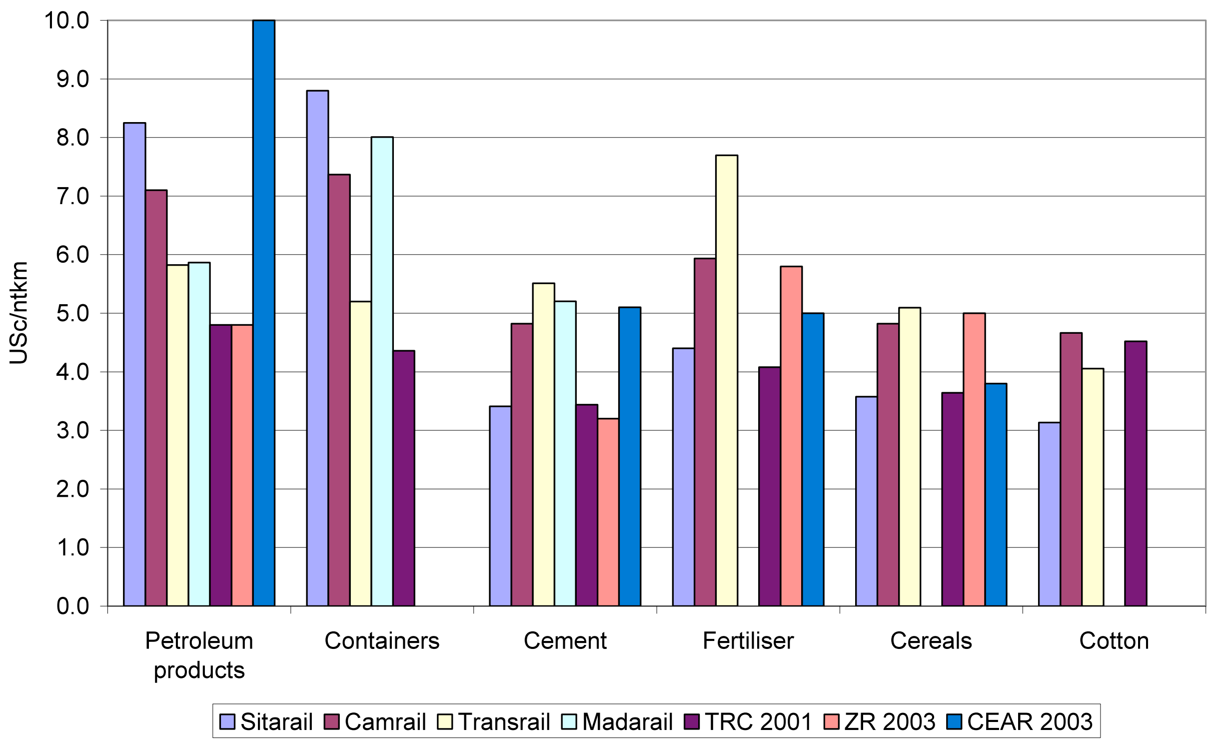
[41] Current tariffs in $US terms in 2008 were much larger than these averages in many cases; the 2008 freight yield for Camrail was 9.7 c/ntkm, Sitarail's was 6.4 c/ntkm, and Transrail's was 8.0 c/ntkm. These may not be sustainable as fuel prices fall, but it seems they will remain above the 10-year average.

[42] This structure also reflects to some extent the relative densities of these traffics: a wagonload of coal generally weighs much more and costs more (but less per net tonne) to haul than a wagonload of textiles. Low-density freight is thus normally charged a comparatively high rate per tonne to compensate.

general policy, such as supporting particular industries or agriculture, or because of astute lobbying by individual interests. As road transport developed, it picked off the commodities that were being charged the highest rates; rail was often slow to respond by increasing the rates for low-value commodities, partly from managerial and bureaucratic inertia and partly from a fear of losing such traffic as remained.[43] There have been gradual moves to ensuring tariffs at least cover marginal operating costs, but many Sub-Saharan African railways had only a moderate understanding of their cost structure (many government railways, for example, believed all their costs were fixed except for fuel and some other directly variable out-of-pocket expenses — which they probably were given many budgeting practices).

Tariff comparisons must be done with some care, as they are also a function of distance (for example, Uganda in figure 4.10). That said, figure 4.11 compares tariffs for a range of typical commodities for selected railways.

Figure 4.11 Average yields by commodity for select Sub-Saharan African railways



Source: AICD database and annual reports.

The tariffs for petroleum products and container traffic are generally significantly higher than average, while those for agricultural products and semibulk commodities such as cement and fertilizer are below average. These variations are due to a number of reasons:

- There is some holdover from the traditional value-based tariff structures (for example, containers often hold relatively high-value consumer goods).

[43] Another factor in some cases is that shippers by rail have faced unofficial charges for wagon supply and expediting transit, in addition to the published tariffs in the rate book.

- A reflection of the relative cost of carrying different commodities (for example, bulk commodities that have higher net loads per wagon are cheaper to carry, while petroleum is normally carried in tank wagons which have a comparatively high ratio of gross to net tonnes and, moreover, are almost always returned empty).
- When traffic is moving in the more lightly loaded[44] direction (often exports in Sub-Saharan African countries), tariffs are often much lower both for road and for rail due to the excess of transport capacity.
- Volume also influences tariffs. Many railways negotiate contract rates with large users. Casual users with small volumes, in contrast, will often pay the published (or "book") rates, which are generally significantly higher.

Competition

Passenger services

For years the rail networks provided the only practical way of traveling between many centers. Now roads provide competition. In some cases, rail, even at the low speeds typical of most routes, still provides faster service than the competing bus lines (for example, between Yaoundé and Ngaoundere in Cameroon or Cuamba and Nampula in northern Mozambique), and travel by unpaved road becomes difficult in the rainy season. But where roads are maintained in reasonable condition, buses have taken a large part of the passenger traffic away from rail and are likely to take more as the highway networks continue to improve.

Passenger travel by road ranges from luxury bus on a few routes to ordinary bus to minibus or bush taxi, with fares reflecting the quality of service provided. Bus fares typically run about 30 – 50 percent higher than economy rail fares, but service is faster — sometimes twice as fast (figure 4.12) — and generally much more frequent. Many bus services suffer from the same problems as rail: unreliable departures, with buses waiting for a full load of passengers; delays and breakdowns; and overcrowding, particularly on the cheaper services that most directly compete with the rail services. Among the main attractions of rail is the perception that it is safer and, on some routes, the ability to carry large quantities of produce and baggage more cheaply than by bus. Nevertheless, bus has the lion's share of the market (box 4.2).

The long-term prospects for nonurban rail services are generally poor, particularly as the road network improves. It costs significantly more to maintain rail track and signaling to allow speeds that are even marginally competitive with a sealed road maintained in average condition (say with a 70 km/hr commercial speed) than to maintain them for the 30–40 km/hr commercial speed needed for shipping freight. Also, it requires large capital expenditures to construct new medium-speed (say 200 km/hr) interurban railways. Such expenditure needs substantial demand (several million passengers per year), who need to have relatively high-incomes to afford the fares to cover even its above-rail operating costs. Few, if any, corridors in Africa have the demand necessary to justify such investment, at least in the medium term.

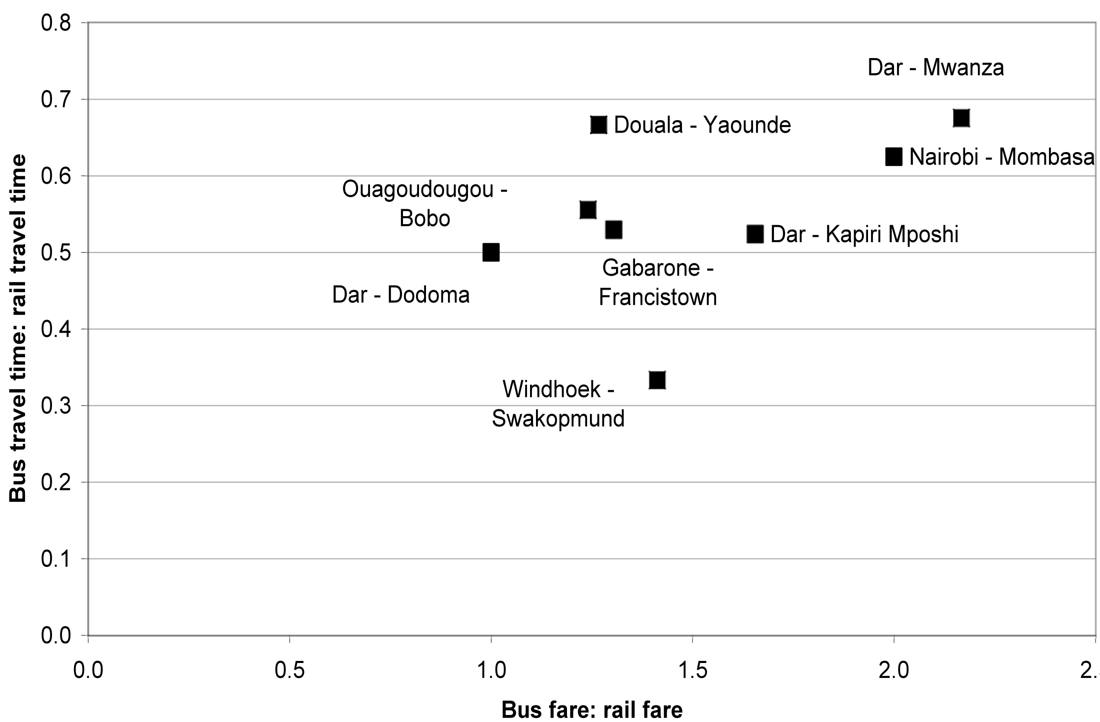
[44] Generally termed the "backloaded" direction.

Box 4.2 Rail passenger market share in Botswana and Burkina Faso

In Botswana in 2002, there were two trains (one day, one overnight) between Gabarone and Francistown; each took about eight to nine hours for the 435 km trip. The connecting road was a two-lane sealed road in generally fair-to-good condition, with moderate traffic levels. There were 35 to 40 buses in each direction each day, which took four to five hours and left at regular intervals during the day but without any overnight services. The day rail service charged Pula 19 (economy) and Pula 37 (business); the night service charged Pula 28 (economy), Pula 107 (business), and Pula 125 (sleeper). The competing bus fare ranged from Pula 30 to Pula 38, depending on the type of vehicle and speed. (The exchange rate at the time was Pula 5.5 = US$1). Both rail and bus provided reasonable links to the local urban bus services at each end of their journey. In spite of the much cheaper rail fares, the bus had about 70 percent of the market at the time. The day train was subsequently taken off in 2006 and the night train in 2009.

Between Ouagoudougou and Bobo Diassollou in Burkina Faso, there are frequent buses, taking about 5 hours. There is a single train that runs three times a week, providing service between these two cities en route from Abidjan and Ouagoudougou. The trip by rail takes nine hours and is often heavily delayed. Perhaps not surprisingly, the bus is reported to have 95 percent of the market between the two cities.

Figure 4.12 Comparison of bus and rail fares and travel times



Source: Bus and rail schedules and tariffs.

The local trains serving villages with no road connection pose a different problem. In Malawi the local services are primarily used by traders bringing goods to and from regional centers. The passenger train is really a mixed train with some two or three large open wagons loaded with goods. This is a highly inefficient way to bring goods to market. Though the trains are well loaded, revenues barely cover 30 percent of the avoidable cost. While such services can be funded through government subsidies, an alternative long-term solution is to develop feeder roads that can provide basic motorized access. Such roads are a far more cost-effective means of transporting freight and also greatly improve the general accessibility of such locations.

Freight services

Comparing road and rail freight tariffs and market share data needs to be done with some caution. The economics of rail transport is significantly affected by whether the ultimate origin and destination of the freight —for example, a mine or cement works or port—are directly connected to the rail line by sidings. Local access to and from the railway and transshipment between road to rail can be surprisingly expensive, often up to the equivalent of 200–300 km of line-haul transport, negating any advantage rail may have in pure line-haul tariffs. New sidings are sometimes constructed, but these need a minimum traffic volume to be economical. Traffic arriving from disparate origins at a central rail depot is thus more vulnerable to road competition; conversely, minerals and other bulk traffic with an existing siding or loading point tend to use rail as long as the service is available and has sufficient capacity. But even bulk traffic is not immune to road competition (box 4.3); road has also been used for the relatively short-distance intermine traffic in the Zambian copper belt, even though the mines and processing plants are connected by a rail network specifically designed for the purpose.

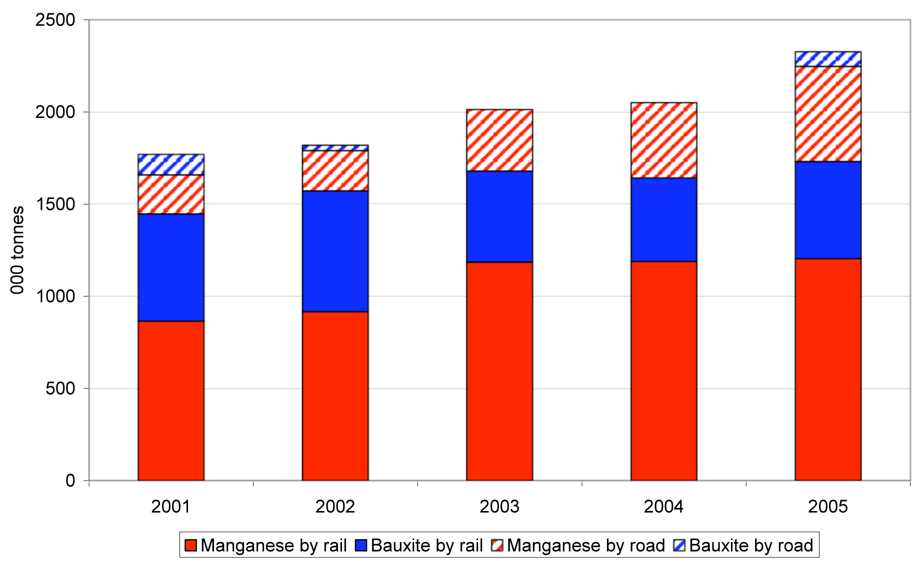
Rail has faced additional difficulties in many countries over the past 20 years or so, including the general liberalization of national economies and the abolition or restructuring of the many statutory agricultural organizations. These were often the only means of bringing crops to market. Growers brought their products for storage and subsequent dispatch to these organizations' network of depots located at key points on rail networks. Now channels for bringing crops to have become more diversified. The railways have often been slow to respond to such changes, and have steadily lost market share. The deserted rows of rail-connected warehouses for export cash crops at ports such as Dar es Salaam bear silent testimony to these changes.

Inland-distribution networks for consumer and intermediate products have developed similarly. Although there are still inland depots for petroleum products, increasingly products are delivered directly from main depots and refineries to end-users, with consignment sizes that are far better suited to road. General freight, whether containerized or not, is dispatched in relatively small consignments and mixed loads, with freight from two or three suppliers to the same destination a common occurrence. Again, the costs of pickup and delivery for such traffic work against rail in its traditional mode. In many cases such traffic almost disappeared from the railways while they were state operated (box 4.4).

Box 4.3 Minerals transported by road in Ghana and Botswana

Bauxite and manganese headed to the port of Takoradi have been the dominant freight traffics on Ghana Railways for over a decade, representing about 90 percent of the tonnage loaded. But in most years, GRC has been unable to carry all the traffic due to a lack of rolling-stock (aggravated by poor infrastructure that has limited operating speeds and thus extended cycle times) or, as in 2008, due to a strike. The excess demand has gone by road at an additional cost of $1 per tonne for the manganese ore and rather more for the bauxite. The figure below shows that the railway could have carried an additional 30 percent of traffic if the capacity had been available.

Minerals transported by road and rail—Ghana



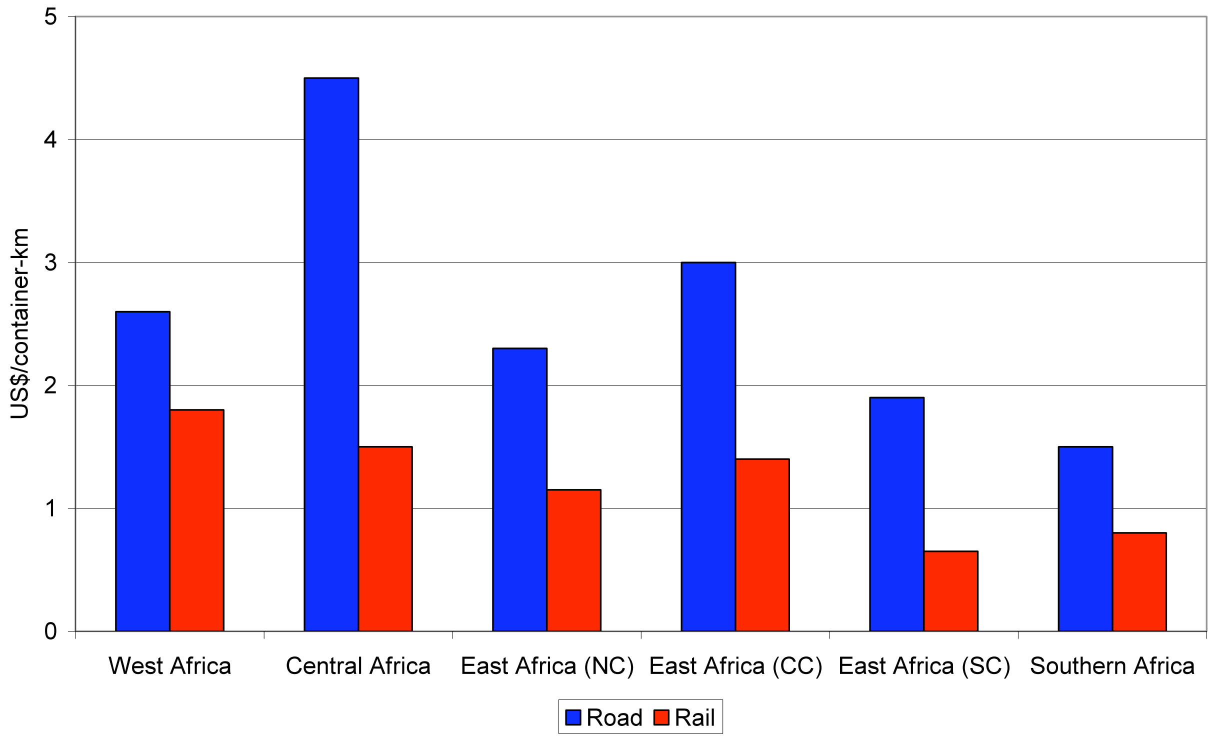
In Botswana, a copper mine north of Francistown was producing copper concentrate, which was then sent to a smelter at Selebe Phikwe, a round trip of 400 km. The concentrates were carried in flexi-tippers (2 x 5-axle trailers), each carrying 50 tonnes net and making up to two round trips per day on the public road system, for the last 150 km of which it paralleled an existing railway. Rail would have been lucky to make one round trip per day and would also have required a storage and transshipment facility. Annual tonnage was forecast to reach 450,000, unfortunately insufficient to justify constructing a new connecting line to the mine.

Box 4.4 General freight to and from Niger

The primary export and import corridor for Niger's products links Niamey to the port of Cotonou in Benin. But the combined road-rail service offered by OCBN has lost many of its customers to private road carriers, decreasing from 88 percent of Niger's total imports in 1992 to 77 percent in 1998 and 34 percent in 2005. Niger's key imports include petroleum products, cereals, sugar, sulfur, and other containerized products. The transport of cereals highlights this trend: OCBN's share of the traffic dropped from 98 percent in 1992 to 3 percent in 2005; for other products, such as petroleum products and sugar, road market share is now 100 percent.

Comparison of freight rates and market shares between countries needs to take into account not only physical factors, such as infrastructure and vehicles, but also the type of freight, the direction of travel (forward loaded or back loaded), the prevalence of overloading, and institutional factors. Figure 4.13 compares road and rail rates for a number of corridors for the year 2003 or thereabouts. Even with a standard basis of comparison—the cost of transporting a 12-meter container inland from a port—there is a wide variation between different geographical areas, reflecting the varying standard of infrastructure, types of road vehicles, and institutional factors such as unofficial en-route charges, border-crossing procedures, and the impact of the freight associations common in Central and West Africa.

Figure 4.13 Indicative freight rates—12-meter container ***ex port***, 2003 or similar



Source: UNCTAD Development of Multimodal Transport and Logistics Services (2003) and various.

Some of the reasons for the regional variations are straightforward: the poor condition of roads in Central Africa and (although they are now being improved) the Central Corridor in East Africa between Dar es Salaam, Burundi, and Rwanda; the very large trucks[45] operating throughout southern Africa; and the impact of the freight associations.

Rail line-haul rates for general freight in the forward direction are generally about 50 percent of the road rate. Part of the difference is because of the extra cost of pickup and delivery by rail.[46] Service quality (transit time, reliability, and security) is also a major factor—as it is for all but a very few railways in the developing world. Both road and rail rates in the backloaded direction are generally around half to two-thirds of those in the forward direction. Most state-owned railways also face considerable difficulties in competing against road operators because of the constraints of public ownership. Concessioning can be expected to bring much greater commercial flexibility, as well as sharp improvements in the level of service. Nevertheless, the road rates (discounted by maybe 15 percent for the road-access legs for a typical corridor and a further 10–15 percent for level of service) will nearly always act as an upper limit in most corridors.

[45] Much of the long-distance freight in southern Africa is carried on large double-trailer, seven-axle combination rigs, with a nominal maximum gross vehicle mass (GVM) of 56 tonnes. Typical payloads for dense traffics such as cement or steel are 30 to 40 tonnes. However, payloads of up to 100 tonnes have been reported for certain traffics (notably cobalt from the Copper Belt).

[46] In competitive markets, rail line-haul rates must allow for the additional pickup and delivery costs, as well as for the better level of service.

Due to the wide range of characteristics of freight traffic, there is often a wide variation in the modal share of particular commodities; it is not uncommon to get market shares of 100 percent for one traffic and zero for another.[47] Overall, rail typically carries 20–50 percent of the nonmineral freight in a corridor; for example, it carries 19 percent between Mombasa and Uganda and more than 60 percent between Douala and Cameroon/Chad. Some of the smaller state-owned railways have a negligible share; CDE carries around 3 percent of the traffic between Djibouti and Addis Ababa.

Many African railways also face competition from other corridors. In West Africa, for example, the inland countries (Mali, Burkina Faso, and Niger) all have a choice of ports:

- Bamako, in Mali, can access Dakar, Senegal, by rail or by a relatively poor road; it can also access Abidjan, in Côte d'Ivoire, either directly by road or by road to Bobo–Dioulasso in Burkina Faso and then by Sitarail to the port. In the past times, it has also used Conakry in Guinea.
- Niamey, in Niger, and Ouagadougou, in Burkina Faso, can access Abidjan, Takoradi and Tema, both in Ghana, by road, Lomé, in Togo, and Cotonou, in Benin.

The Great Lakes region has the choice of Mombasa or Dar-es-Salaam; Malawi uses Dar-es-Salaam, Nacala, Beira, and South Africa; and Zambia can use Dar-es-Salaam (via Tazara) or South Africa. Some of these alternative corridors are served by rail; others are not.

The SDI proposals described earlier have the potential to improve rail infrastructure and services in a number of key corridors but are also likely to provide an equal, if not better, improvement to the parallel road infrastructure. As a result, although rail will remain competitive for mineral traffic, it will face even stronger competition for general freight. This has been the experience in the Maputo Development Corridor, the principal example of the SDI concept. A toll road was concessioned there in 1997, but the railway has seen little improvement, with even an attempted concession abandoned. The poor rail infrastructure found in most corridors is often not the main obstacle to providing a competitive service. In the main north-south corridor from South Africa to the DRC and Tanzania, rail transit times of 38 days from the DRC to Durban have been quoted. Travel accounted for 9 days and interchange and border crossing for the remainder. Given that this corridor is effectively under a single operator from the DRC border to South Africa, there is considerable potential for improvement. Competing road trucks reportedly only take four days at the border crossings and eight days overall. With such poor performance, it is clear that for rail to compete in the SDI corridors, as much effort has to be put into trade facilitation and cross-border coordination as into investment in physical assets.

A recent study extensively analyzed the road transport business in Sub-Saharan Africa, highlighting the differences in organization, structure, costs, and prices (figure 4.13) across West Africa, East Africa, and southern Africa, which are reflected in the differing levels of freight rates and modal competition in the various countries. There is little doubt that road competition is strongest in southern Africa, which has the most liberal market structure, the largest trucks and the best roads. Two major factors affecting road competitiveness are the level of user charges and the prevalence of overloading. Few governments directly charge trucks with road-user fees that fully compensate for the cost of providing and maintaining the arterial road network. Requiring rail, on the other hand, to fund 100 percent of its maintenance and

[47] For example, in northern Botswana, rail carries 100 percent of the soda ash traffic from Sua Pan to South Africa, but none whatsoever of the general freight from Johannesburg in the opposite direction.

improvements may help government budgets in the short run but creates an almost impossible handicap for most general-freight railways to overcome in the medium and long term.

In sum, while most railways are generally able to carry bulk minerals competitively, they must also offer a reasonable level of service for general freight if they are to compete with roads without offering a significant price discount. In general, freight markets in Africa require reliable rather than high-speed services; a two-day transit for a trip of 1,200 km, equivalent to a commercial speed (that is, including en-route stops) of 25 km/hr does not require a maximum speed of much more than 60 km/hr. It does, however, require that infrastructure and rolling-stock is maintained "fit for purpose," that en-route stops do not disrupt schedules, and that commercial arrangements ensure agreed rolling-stock turnarounds (often a limiting factor for small railways).

Providing an acceptable level of service, flexible pricing policies, and a transport-service strategy (as opposed to merely a line-haul operation) are the major potential benefits a concessionaire can offer over the typical state-owned railway. With such improvements, the price differential between rail and road can be reduced, increasing the contribution that freight can make to maintenance and infrastructure renewal.

Concessionaires have shown they will take a range of initiatives to achieve these improvements. Some are physical, such as the proposed construction by Sitarail of an intermodal terminal in Ouagadougou to service the surrounding region. Others are procedural, such as the introduction by ZRS of company customs bonds to sharply reduce waiting times for import traffic at Victoria Falls. Such actions make rail more competitive in the marketplace and work to realize its potential advantages in practice. There is another important factor: increasingly, being a rail operator is not enough. Operators need to provide a transport service covering the full journey from origin to destination. Conventional railways are poorly equipped to do this, both physically and bureaucratically. They have neither the equipment nor the operational and commercial flexibility to respond to issues along the whole length of the logistical chain. Concessionaires have greater freedom to do so—and to successfully operate railways not as an end in themselves but as a part of an integrated transport business.[48]

[48] Note Bolloré's classification of its railway business as an "activity connected with transport" or the mining companies, who often relegate their railways to a "surface equipment engineer."

5 Institutional arrangements

Most transport in Sub-Saharan Africa is government organized, typically through a ministry of transport mandated to develop and implement policy ensuring that transport contributes to overall economic and social development. Until the 1980s almost all African railway companies were publicly owned corporations with varying degrees of financial and management autonomy. The first step toward commercialization was the introduction of Contrat plans, initially in West Africa. These plans defined relations between governments and railway companies, but governments rarely, if ever, met their obligations to the companies' management.

Many systems have also been subject to management contracts of one form or another. RITES supplied senior management to Zambia in the 1980s and Botswana Railways in the 1990s and had a full management contract with Nigerian Railways between 1979 and 1982. Togo was managed by CANAC for some years and is currently managed by RITES in association with a local cement company. The Democratic Republic of Congo (DRC) has seen two attempts at such contracts: the first, known as Sizarail, ended with a change in government, and the second is in progress. In addition, there have been various partial contracts in which particular functional areas, such as locomotives and rolling-stock, have been managed under contract. But in all these cases, the responsibility for investment remained with the government.

A new wave of reform in the African rail sector began in the 1990s with railway concessions.[49] The state generally maintains ownership of some existing assets (typically infrastructure) and transfers the other assets (normally rolling-stock) and the responsibility for operating and maintaining the railway to a concessionaire under the terms and conditions stipulated in a concession agreement. In some cases, such as the Sitarail concession, the government is also responsible for purchasing new rolling-stock, which is then financed by the concessionaire through annual payments.

Most countries in Central, East, and West Africa have moved all or part of the way toward concessioning, often under the pressure of multilateral and bilateral organizations, which have until recently been the only source of large loans for asset rehabilitation and renewal. With the exception of southern Africa (South Africa, Namibia, Botswana, and Swaziland) and countries suffering or recovering from civil disruption (Angola, the DRC, and Zimbabwe), Sub-Saharan African countries are at various stages of reform. Of the 30 countries with publicly owned railways, 14 have opted for a concession arrangement and 2 operate under a management contract. Another 4 have begun the process (table 5.1).

Legal and regulatory framework

The introduction of concessions has required substantial changes in the legal and regulatory framework of many countries. In the francophone countries, which inherited French legal systems, concessions could generally be done without new legislation, but the English-speaking countries

[49] In practice, few railway concessions fit the neat textbook definition; some assets are sold to the concessionaire (normally the rolling-stock), sometimes with residual rights over their use (for example, they cannot be sold without permission from the government), while others (normally the infrastructure) are leased. "Concession" in this chapter has been used as a general term to cover all these different arrangements.

generally have, or should have, amended their various railway acts. Tanzania passed a new railway law in 2003, and Zambia has drafted a new one that has not been implemented. Malawi plans to amend its act but, as of yet, has not.

Regulatory frameworks have also had to be amended to regulate the economic and safety aspects of concessions. Historically, as railways were state owned, economic regulation was imposed through the relevant ministry while railway safety was effectively[50] self-regulated (as were any independent operators on the networks). The advent of concessions meant that many governments had to consider more transparent regulatory procedures.

At the same time, as concessions are almost always for a defined length of time, infrastructure (and sometimes rolling-stock) is generally leased to concessionaires, and successor bodies to the existing railway organizations (who then become the asset owners) need to be established. In francophone Africa, these are the "patrimony" organizations (for example, the Société Ivoirienne de Patrimoine Ferroviaire, SIPF, in Côte d'Ivoire; and the Société de Gestion du Patrimoine Ferroviaire du Burkina, SOPAFER B, in Burkina Faso) with parallel bodies set up in some, but not all, of the anglophone countries (for example, Reli Assets Holding Company or RAHCO in Tanzania).[51] These organizations have varying powers but, generally speaking, are able to oversee the concessionaires. As the ultimate owners of the assets, they are responsible for ensuring proper maintenance is undertaken, as well as capital expenditure that is not the concessionaires' responsibility. These organizations also function as safety regulators, their main function in this regard being to award operating licenses on the basis of technical competence. The regulatory bodies should be funded (at least in theory) by concession fees but this is rare in practice, severely handicapping their ability to regulate effectively.

Where there is strong modal competition, there is little need for sector-specific economic regulation, which can normally be done through the general powers of a competition commission or similar body.[52] In at least one case, however, a sector-specific authority (SUMATRA in Tanzania) has been established to regulate[53] all land-based and marine transport. Meanwhile, in Senegal and Mali, railway regulatory agencies were created and subsequently converted into a common railway-monitoring agency for both countries.

Many existing regulatory and legal frameworks stipulate that applicable tariffs for the transport of passengers and their luggage be freely determined. But railways must communicate to the supervisory authority, usually the ministry of transport, any change in tariffs and obtain its agreement before implementation. The result is usually strong state influence over passenger tariffs, particularly in state-owned companies. It is not unusual for governments to take several years to approve an increase in passenger tariffs proposed by railway companies; when increases are finally approved, they may not cover cost increases, particularly when inflation is high.

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[50] In many cases, the independent government inspector of railways has been seconded from within the railway, to which he will subsequently return. This inherent conflict of interest is not conducive to a frank and fearless inspection of incidents for which a possible future superior is ultimately responsible.

[51] In some countries this function has been left to the ministry of transport.

[52] For example, in Zambia, the Competition and Fair Trading Act (CFT Act) as administered by the Zambia Competition Commission (ZCC) has broad powers of referral for the abuse of market power by dominant suppliers.

[53] In this case, SUMATRA is also the safety regulator for both railways in Tanzania, while RAHCO only currently deals with the concessioned ex-TRC system.

Governance and management of state-owned railways

Most of the remaining state-owned railways are subject to significant political and governmental influence. Specific arrangements vary across countries, but usually the sectoral ministry (normally transport) exercises political and administrative control, while the ministry of finance exercises financial control. Boards of directors generally combine ministry officials and internal senior management, themselves often appointed by the government, with occasional staff representation.[54] Oversight is nominally assigned to parliament, but all too often parliamentary control is limited to an audit of company accounts as presented in annual reports, often several years in arrears. Short parliamentary sessions also hinder the detailed review necessary for effective oversight.

Although the governing regulatory frameworks of the state-owned railways generally provide financial and management autonomy, and management methods are similar to those of private businesses, in practice they are considerably limited by the many opportunities for state intervention allowed under legal and regulatory frameworks at both the institutional and jurisdictional levels. This conflict between control and decision functions—and political authorities' frequent review of initiatives and decisions taken by the government's authorized representatives in the corporation—does much to discourage effective management.

This is aggravated by the multiple objectives of governments and politicians, motivated by often conflicting social, electoral, and economic interests, which complicate both the management of state-owned companies and the evaluation of their performance. In executing their imposed public-interest missions, state-owned companies' management strategies often focus on merely breaking even on a cash basis, leading to financial difficulties when asset renewals eventually fall due.

Structure of concessions

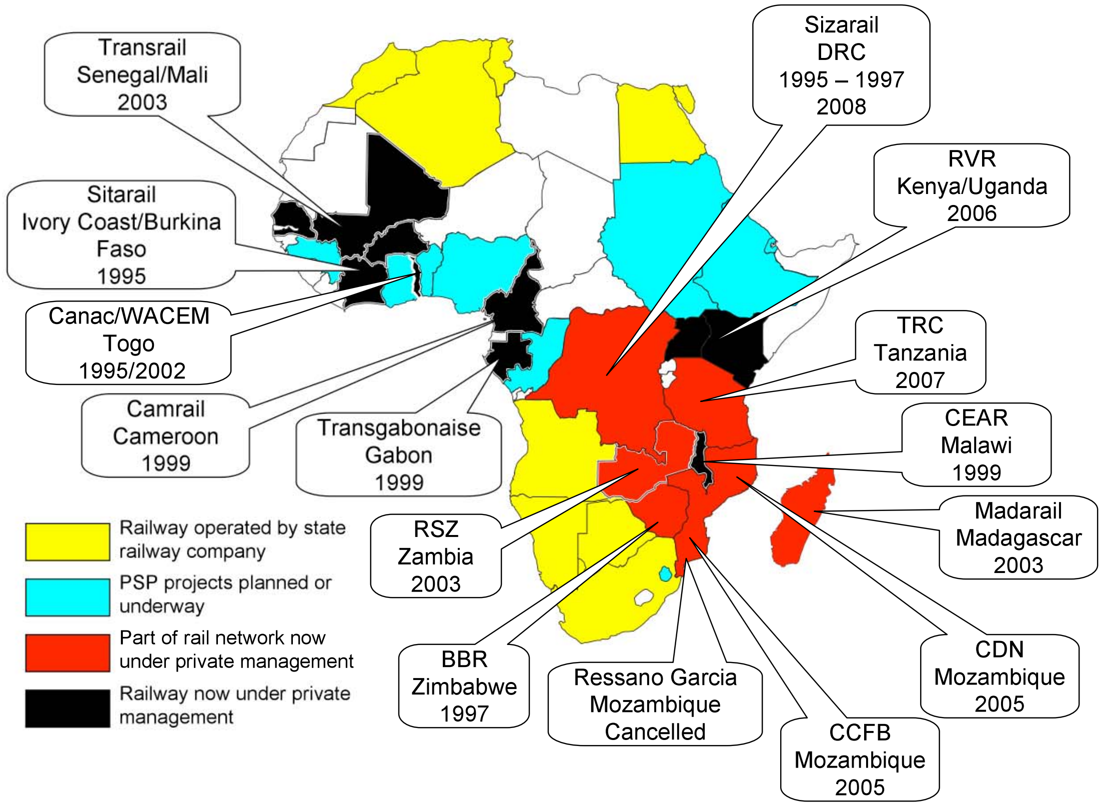
There are several different models for railway concessions; in the most common, the state remains the owner of some or all of the assets (especially the infrastructure), but transfers the responsibility for operating the railway to a concessionaire under the terms and conditions stipulated in a concession agreement. The concessionaire operates the railway as a business activity at its own risk, cost, and expense.

The contractual arrangements range from a lease contract, in which the private operator assumes only the risks to the operation's revenue and costs but not the risks to investments (as in the case of Sitarail), to a traditional concession, in which the private operator assumes all risks and some or all of the assets revert to the state at the end of the concession period.

The first railways to be concessioned were in West Africa. The Abidjan-Ouagadougou railway linking Côte d'Ivoire and Burkina Faso was concessioned in the early 1990s, followed at the end of that decade by the railways in Cameroon, Gabon, and Malawi. The reform momentum accelerated in 2000, as several countries felt the need to introduce similar reforms in their railway companies. Overall, since 1993, 14 concessions and 2 management contracts have been awarded in Africa, with a further 4 in process and others planned (table 5..1 and figure 5.1).

[54] But this is not always the case—the board of Botswana Railways generally includes at least three members from the private sector, including the chairman.

Figure 5.1 Railway concessions awarded in Africa since 1990



In many countries this restructuring has been a slow process, lasting typically three to five years, and sometimes much longer:

- The Sitarail concession was completed following three years of negotiations between Côte d'Ivoire and Burkina Faso and a private consortium.
- In Cameroon, the original process of concessioning took three years but the contract concerning passenger services was subsequently renegotiated four years later.
- The signing of a concession contract (in 2005) for the Transgabonais (Gabon) railway took six years. The government had previously signed a concession contract with forestry companies in 1999 and a lease contract with a local mining company.
- Preparation for concessioning in Tanzania began in 1997, and a concession was finally signed in 2007.
- Ghana began the concession process in 2002, and it is still not well advanced.

Due to their relatively small networks and traffic volumes, most African networks have little scope for on-rail competition; few governments have seriously considered the European model of full vertical separation. There are, however, some examples of third-party operators running over government lines: the Magadi soda works ran its own trains to Mombasa over the KRC line in Kenya (and still does, over the concessioned RVR), and TransAfrica ran a through-container service for some years from Johannesburg to Mwanza[55] on Lake Victoria, including a gauge transfer at Kidatu. The Transrail concession excluded the Dakar suburban service (box 2.2) and the SEFICS traffic, which both pay track charges to Transrail. In the case of Zambia, where there were extensive intermine operations in the Copper Belt, the concession offered some or all of three options: the mainline operations, the intermine operations, and the passenger service (although the selected bidder subsequently cut back on the intermine services).

Concessions do not always include the entire network. In some cases, branch lines were excluded, for example, the Mulobezi and Njanji branches in Zambia, the Lumbo branch near Nacala in Mozambique, and the St. Louis branch in Senegal.

Table 5.1 summarizes the key features of the concession contracts to date. Their initial duration varied from 15 to 30 years, although this has been subject to renegotiation in some cases. The concessionaire is free to operate its activity as a business, with tariffs generally determined by supply and demand, although in some cases certain tariffs (for example, passenger fares) are subject to some form of indexation.

Formal regulatory structures with real power are far from universal in Sub-Saharan Africa. As a result, many Sub-Saharan African rail concessions are open to market abuse even though the concession agreements generally include protections, the two most common of which are the power to refer rail tariffs to either the government or an independent authority and the power to allow third-party operators onto the railway.

In practice, these protections are likely to be used infrequently. The level of market power that most concessions can exercise is generally limited by competition from roads along most or all of the routes they serve at tariffs which are generally competitive with rail (and make rail in many cases a price-taker). While freight rates have occasionally increased following concessioning, the rail market share of freight (unless it is an administered monopoly such as fuel in some countries) is not sufficiently large for such changes to significantly affect the retail price of commodities. In most cases, rate increases have been accompanied by improvements in service level, balancing out in terms of total cost to the consumer. Rail has few natural monopolies except for some mineral traffics (for example, manganese on the Transgabonais)[56] and, in most cases, freight rates are effectively set by the competition, whether in the form of parallel roads or an alternative port (such as Beira in the case of the Nacala corridor and Abidjan, Lomé, and adjacent ports in the case of Transrail).

Some contracts also include access clauses (as previously existed for SEFICS in Senegal and Magadi in Kenya) whereby third parties can run their own services on the concessioned infrastructure. The Camrail and Sitarail concession contracts contain track-usage exclusivity periods of five and seven years, respectively, during which no other rail operator can operate trains on their networks. Other contacts, such as those for Madarail and Transrail, have allowed access from the start.

[55] It also hauled cement traffic, using only the TRC network, for a few years.

[56] And even here there is the (long-term) threat of an alternative rail route through the Republic of Congo.

Table 5.1 Key features of concessions, 1993–2008

Countries	Concessionaire	Effective date of contract	Initial duration of contract	Initial capital of concession (US$ million)	Planned 5-year investment (US$ million)	Public service obligation (PSO)
West Africa						
Burkina Faso Côte d'Ivoire	Sitarail	1995	15	8.8	63.3	Yes but renegotiated
Mali Senegal	Transrail	2003	25	17.2	55.4	No
Togo	Canac[2] WACEM[2]	1995 2002	– 25	–	–	No
Central Africa						
Cameroon	Camrail	1999	20	18.5	89.6	Yes
DRC	Sizarail[2] Vecturis[2]	1995 2008	– 2	– –	– –	– –
Gabon	Transgabonaise Setrag	1999 2005	20 30	– –	– 157	– Yes
East Africa						
Kenya Uganda	RVRC	2006	25	–	About 100	Yes
Tanzania	TRC	2007	25	–	88	Yes
Southern Africa						
Malawi	CEAR	1999[3]	20	–	–	Yes
Mozambique	CCFB	2004	25	19.7	152.5	Yes
Mozambique	CDN	2005	15	–	–	Yes
Madagascar	Madarail	2003	25	5	36.1	Yes
Zambia	RSZ	2002	20	6.1	14.8	Yes
Zimbabwe	NLPI	1998	30	–	85[1]	No

Source: Data collected from companies, di Borgo and others (2006).

Note: 1. Reported construction cost; 2. Management contract; 3. Transfer finally occurred in 2005. 4. Excludes Ressano Garcia concession in Mozambique, which was awarded but never finalized.

The general lack[57] of market abuse by rail was confirmed by a World Bank study in 2006 (di Borgo and others 2006), which examined four transport corridors with railway concessions (and in some cases

[57] The only examples encountered are anecdotal reports that the Comilog mineral trains on the Transgabonais systematically received priority over passenger services. This is not so much a concessioning issue as an access regime issue. It is an inherent risk that occurs when one operator has control over another's services, as is effectively the case at present in Gabon, and can only properly be resolved by a strong regulator.

A second example arose in Zambia, where the concessionaire gave priority to longer-distance traffic from the Copperbelt to South Africa at the expense of local intermine movement of bulk minerals and feeder traffic to Tazara. This presumably reflected a decision by the concessionaire, who was short of rolling-stock, to concentrate assets on the most profitable freight. In this case, the mines had the alternative of road transport but, if the right rate had been established, they presumably could also have made a case for ZRS (or themselves) to invest in additional rolling-stock to handle the traffic.

an associated port) and could not find any evidence of abuse of monopoly. Only one contract out of the four (that is, Sitarail) did not incorporate a clause that explicitly defined what constitutes evidence of undue market power. The other three contracts defined it as:

- When the tariffs applied by the operator are more than twice as large as the costs incurred (including the depreciation and capital costs associated with the operation of the rolling-stock);
- When an operator openly discriminates against a client in terms of the transport conditions offered; or
- When an operator refuses to provide services to a client.

The first test is useful only if a regulator has access to the relevant information and the skills to undertake an independent analysis. Even in the best of circumstances, information asymmetry between concessionaires and government authorities creates endemic oversight problems that are multiplied when concessionaires actively refuse to cooperate.

Contracts normally stipulate that the concessionaire is free to set tariffs for services other than public services, thus distinguishing between the generally deregulated freight tariffs and passenger tariffs, which tend to be controlled by the state. Regulated passenger services are often managed using preagreed schemes under which operators are eligible for financial compensation (the "public service obligations" in table 5.1) whenever the regulated tariffs do not cover their operating costs. But in practice these schemes have often failed to protect private operators, as governments have not always honored their subsidy commitments. Passenger tariff indexation, where relevant (for example, Sitarail, CEAR, and Transrail), is triggered by changes in conventional indices such as inflation.

Most concession contracts also stop rail operators from using promotional tariffs for more than a year if these tariffs do not cover their operating costs. The definition of *operating costs* in this context is open to considerable interpretation (preconcession tariffs could fail this test on many of the region's railways); the enforceability of this requirement thus seems doubtful, and its necessity is in any case debatable.

When a concessionaire fails to comply with the terms of a concession, whether by design or by force of circumstances, there are procedures by which the concession can be terminated. These have rarely been applied to date; only two[58] concessions (Ressano Garcia, which never became operational, and Transgabonais) have been terminated, while two other concessions (Transrail and Rift Valley) were forced to change operators. If a government wishes to terminate a concession—through no fault of the concessionaire—defined financial penalties usually apply. These provide some protection to the concessionaire by requiring the concessioning authority to take over and/or service the debt related to any investment it has made and, in some cases, also making it liable for the projected earnings that each concession could generate for the remainder of the contract, as well as for one-time payments. These conditions are substantial in many cases but still insufficient to deter a government intent on termination, though it would also need to consider the indirect costs of the impact of any such move on any international financial institutions (IFIs) that participated in the concession financing and the private investor community in general.

[58] Other than the special case of Sizarail in the DRC, following a military coup.

Concessionaires

The Sub-Saharan African rail concessions tend to attract a limited pool of mainly foreign and South African private operators. These operators fall into two distinct categories: those that seek vertical integration of the distribution chain by acquiring dominant positions in specific production and transport sectors, and those that specialize in a single transport activity (for example, railways or ports). Members of the first category appear to accept low rates of return from individual elements of the distribution chain activities they operate (especially railways) as long as their overall control yields sufficient benefits. The main example of this type of operator is the Bolloré group; previously one of the largest shareholders in several Sub-Saharan railway and port concessions, it has also had a freight forwarder and agricultural production subsidiaries.

The second category of operators—among whom the most prominent are Vecturis from Belgium (a successor to the now-defunct Comazar), Sheltam from South Africa, NLPI from Mauritius, and RITES from India—focuses on investment in transport operations, suggesting that these operations can be sufficiently profitable to attract specialist private transport operators. But the business cases for these rail investments often appear weak;[59] it seems that the companies that pursue these concessions are sometimes focused on the financial benefits that can be extracted from managing large investment plans (financed for the most part by governments) rather than long-term business cash flows.

Private companies[60] are the majority shareholders of all concessions to date (table 5.2). State participation is highest in Mozambique, which holds 49 percent of both CCFB and CDN and is also a significant shareholder in the adjacent CEAR concession. In Madagascar, the government holds 25 percent of Madarail, while governments own 10–20 percent in Sitarail, Transrail, and Camrail.

Local private participation in concessions has generally been relatively limited, and often fraught with problems during the bidding process; the highest level is in Madarail, with 24 percent, and there is 10–20 percent in Sitarail, Setrag, and Camrail. Employee shareholding remains very weak—under 5 percent where it exists at all.

The board composition of concessioned companies generally reflects shareholders' interests, but in some cases, boards also include government-appointed members.

[59] One of the bidders for the Beira concession, awarded to RITES in 2004, was a Chinese consortium whose financial proposals had a calculated return on equity of only 2 percent.

[60] For the purposes of this paper, RITES has been classified as a private company

Table 5.2 Initial concession shareholdings

At time of concessioning (1996–2008)

Concessionaire	Shareholding
Sitarail	SOFIB [a] 67%; Côte d'Ivoire and Burkina Faso governments 30%; employees 3%
Transrail	Canac-Getma (Franco-Canadian) 78%; Mali and Senegal governments 22%
Camrail	SCCF [b] (Cameroon) 85%; Cameroon government 10%; employees 5%
Setrag	Comilog (France) 84%; Local private operators16%
RVRC	Sheltam (South Africa) 61%; other foreign 15%; local investors 25%
TRC	Rites 51%; Tanzania government 49%
CEAR	Edlow Resources/Railroad Development Corporation (United States) 51%; Mozambican investors (including CFM) 49%
CCFB	Ircon [c] 25%; Rites 26%; Mozambique government (through CFM) 49%
CDN	As for CEAR
Madarail	Madarail [d] 51%; Madagascar government 25%; Manohisoa Financière 12.5%; other private operators 11.5%
RSZ	NLPI (majority); Transnet (South Africa) (minority)

Note: Ownership has since changed in a number of concessions.

a. SOFIB is majority controlled by Bolloré (France); 16 percent of this was intended to be sold on the Abidjan Stock Exchange.

b. Société Camerounaise des Chemins de Fer, a holding company controlled by Bolloré but in which Comazar, a privately operated and managed company that included South Africa's Spoornet and Transurb Consult (a subsidiary of the Belgian National Railways), had a substantial shareholding. Comazar has since sold its interests, in Cameroon and elsewhere, to a Belgian firm named Vecturis, set up by two ex-Comazar employees.

c. Ircon = Indian Railways Construction Corporation.

d. Madarail is majority owned by Comazar.

6 Operational performance

Overview

Both labor productivity and rolling-stock productivity of Sub-Saharan African railways are low compared to railways elsewhere. This is primarily due to the poor condition of the infrastructure and rolling-stock, low traffic levels, and government ownership of many networks. Concessions, however, have brought about sharp improvements in these indicators, partly because of a growth in traffic but mostly due to major reductions in workforce size and scrapping of surplus rolling stock.

Labor productivity

Almost all railway companies have streamlined their workforces over the past 10 to 15 years, often as a prelude to concessioning (when staff is always reduced further) but in some cases as a general policy to improve efficiency. Nevertheless, labor productivity on most African systems is relatively low by world standards (figure 6.1), with few railways achieving more than 500,000 traffic units per staff per year.[61]

Spoornet is in a league of its own, with an average productivity over the period of 2.5 million traffic units per employee. But this average is boosted by the intrinsically high productivity of mineral-oriented lines: in 2005, when the average labor productivity of Spoornet was 3.3 million traffic units per employee, the productivity of the dedicated iron ore and coal export lines (Orex and Coalex) were 25 million and 14 million, respectively, while that for the residual general freight business (about 40 percent of Spoornet's traffic) was only about 1.5 million.

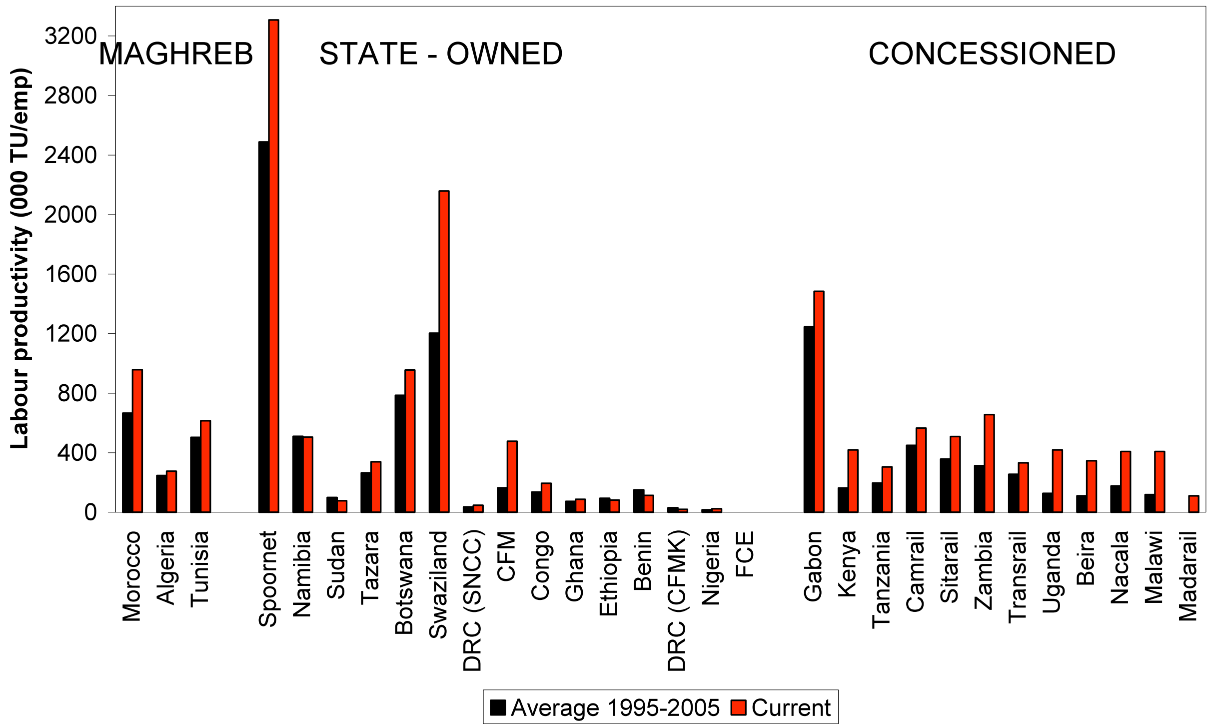
Gabon had the next-highest average labor productivity over the period, followed by Swaziland and Botswana. Gabon's productivity is helped by its high proportion of mineral traffic, which was, moreover, for a large part of the period transported on trains that are owned and operated by a third party. Swaziland and, to a lesser extent, Botswana both carried substantial proportions of transit traffic during the period (75 percent in the case of Swaziland); in both cases the wagons were owned and maintained by third parties and the services were relatively simple to operate. All three of these railways are either relatively new or, as in the case of Botswana, had received substantial investment in the previous 30 years, extending the life of their infrastructure.

Elsewhere, productivity is low—in many cases very low. By contrast, in North Africa, the railways in Morocco (ONCFM) and Tunisia (SNCFT) have been improving in recent years and by 2007 could boast labor productivity rates of 1.16 million and 749,000 traffic units per employee, respectively, well above all state-owned Sub-Saharan African railways other than the southern African trio of Spoornet, Botswana,

[61] Comparisons of productivity between railways need to be done with some care, as the staff employed in any individual system will be a function of how much work (especially major asset maintenance) is outsourced and how much is done in-house. Measures of the work done by a railway are also difficult; the measure almost universally used is traffic units (the sum of net tonne-km and passenger-km), but as a passenger-km generally requires more resources than a net tonne-km, this favors railways that predominantly carry freight, particularly those that transport a high proportion of minerals.

and Swaziland. The Algerian railway (SNTF), however, was similar to most Sub-Saharan African railways, with a labor productivity of only 224,000 traffic units per employee.

Figure 6.1 Labor productivity on African railways (average, 1995–2005 and current, typically 2007)



Source: AICD database.

Note: There are no data available for FCE. Some railways in the concessioned group were not concessioned until around 2005 or later; this figure should therefore not be used to compare the impact of concessioning on productivity. "Current" figures are for the latest available year, typically 2005.

Following concessioning, labor productivity has generally increased due to a reduction in surplus labor. Most of the concessioned railways substantially improved during the period, the main exceptions being railways that were concessioned from the start of the period.

In some cases, low to medium labor productivity reflects the continuing use of labor-intensive methods with relatively little outsourcing (as a comparison, in 1958 the labor productivity of the then-fully-integrated U.K. railway industry was only 117,000 traffic units per employee). But very low labor productivity is usually a consequence of a decline in traffic without any adjustment to staff levels. When wages are very low, the direct financial impact is not always catastrophic, but a large body of under-employed staff has a corrosive effect on morale and is a strong disincentive for those who have the opportunity to improve efficiency. Low-wage railways also find it hard to recruit and retain technically competent staff and to introduce the technology required to improve service levels.

Rolling-stock productivity

Although rolling-stock productivity is commonly presented in terms of passenger-km and tonne-km per rolling-stock unit within the fleet, it represents the combined effect of five factors, some of which are under management control and some of which are not:

- The proportion of the fleet that is potentially usable.
- The proportion of the usable fleet that is available for use on any given day. This is normally termed "availability."
- The extent to which the available fleet is actually used. This is normally termed "utilization" and is usually measured in hours per day.
- The commercial speed of the services operated by the railway. This determines utilization in terms of vehicle-km.
- The power of the locomotives and the size and loading of the carriages and wagons. This determines utilization in terms of passenger-km or net tonne-km. Loading refers to the rated capacity of the vehicles (in number of tonnes or passengers).

The low utilizations reported by many Sub-Saharan African railways are a product of problems in all five of these areas. Many fleets include vehicles that exist on paper only, such as vehicles involved in accidents and never repaired, specialized wagons that have become obsolete, or locomotives that have been cannibalized to provide otherwise unobtainable spare parts. Even though many such vehicles may exist only in the form of a makers' plate, it is often difficult to write them off in a state-owned railway; thus, they remain in the nominal fleet until their accounting life has expired.

"Availability" reflects a railway's ability to maintain its useable rolling-stock. This ability is influenced by how reliable the rolling-stock is in the first place, the competence of the maintenance staff, and the supply of spare parts. Many Sub-Saharan railways have a disparate collection of rolling-stock, with a variety of makes and models. Some of these vehicles are relatively reliable, but others are not, especially as they age (for example, diesel locomotives more than 30 years old). Maintenance problems are often compounded by a lack of spare parts. In the case of locomotives, spare parts are almost all imported and thus require foreign exchange, adding another level of bureaucracy to the already long and slow supply chain. As a result, it can take a year or more to get a spare part. In the case of locomotives so old their production has been discontinued, spare parts are almost unobtainable and the railway then has no choice but to resort to cannibalism.

Utilization of the available fleet in terms of hours is often very high, particularly for locomotives, as shortages of rolling-stock lead railways to use what is available. But utilization in terms of distance traveled is a function of the commercial speed (that is, the average speed of travel including the time spent waiting at intermediate stations en route), and commercial speeds on most Sub-Saharan African railways are relatively low. Where a railway has surplus assets for which there is no demand (normally these are particular subfleets of carriages and wagons), utilization may also be low.

Finally, rolling-stock productivity, in terms of traffic units, is heavily influenced by the power of the locomotives and the average load of the carriages and wagons. A 1,000 horsepower (HP) locomotive will only ever be able to haul half of what a 2,000 HP locomotive can. Carriages on many of the remaining passenger services in Sub-Saharan Africa are often heavily loaded (in spite of low axle loads), but a wagon on a railway such as Tanzania's will generally carry a maximum of 30 tonnes, compared to the 55-60 tonnes that can be carried on a railway with a 20-tonne axle load.

The combination of these factors means that overall rolling-stock productivity on most Sub-Saharan railways will always be low by world standards. Better management can certainly improve productivity by disposing of surplus assets and improving the supply chain for spare parts (as several concessions have shown), but it can do relatively little to overcome the basic problems of low axle load and low commercial speeds.

Locomotive productivity

Locomotive productivity is generally low in Sub-Saharan railways, with the exception of Swaziland (figure 6.2).[62] The fundamental problem is fleet availability; many railways face availability rates under 40 percent. In the case of SNCC, which has fleets of electric and diesel locomotives, an average of only 10 of the 22 mainline electric locomotives and 13 of the 47 diesel locomotives were available in 2008 (equivalent to rates of 45 percent and 28 percent, respectively).

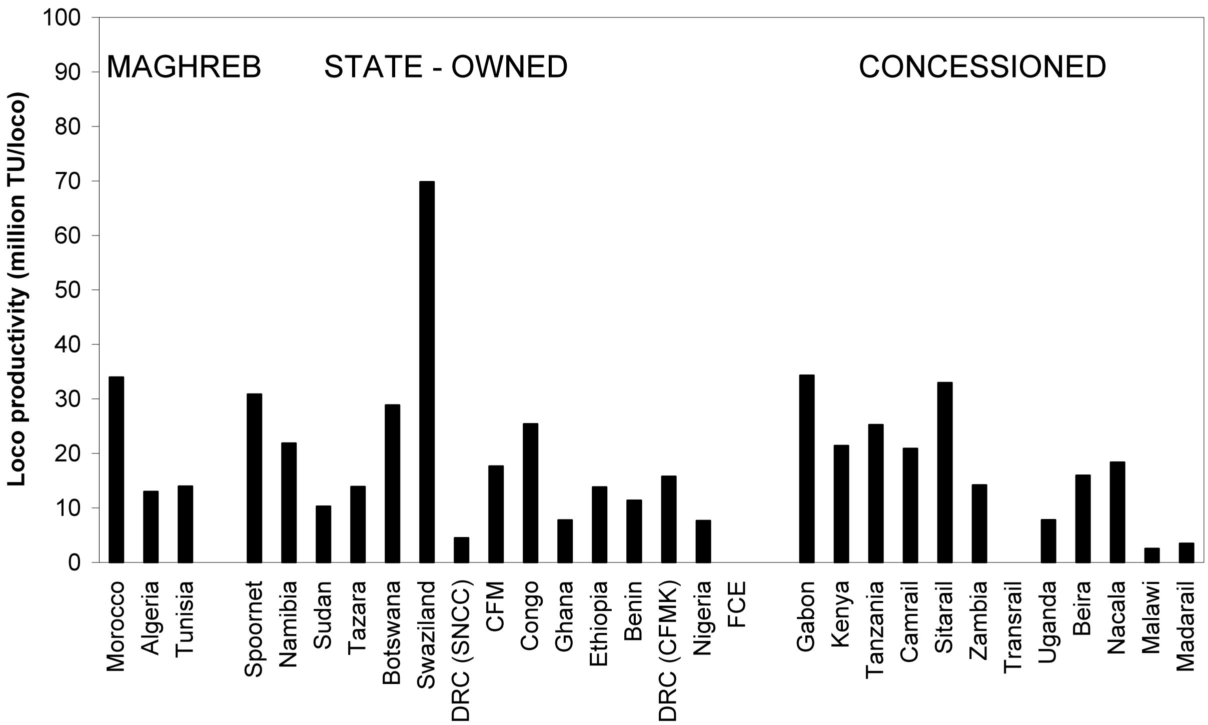
Table 6.1 presents detailed availability statistics for a better-performing railway (Tanzania in 2001 prior to concessioning) to demonstrate how "dead" locomotives affect utilization and availability statistics. Out of a total fleet of 121 locomotives, only 96 were active; the remainder were either undergoing long-term repair or were not capable of being repaired.

Of the active fleet, 74 percent were available on any given day, with this proportion ranging from 50 percent for some of the shunting locomotives to more than 80 percent for some of the mainline locomotives. But when the nonactive fleet is taken into account, availability dropped from 74 percent to 59 percent. Locomotives that were in use (excluding the shunting fleet) traveled an average of 291 km per day; as the average commercial speed at the time was around 18 km/hr, this implies that each locomotive was operated for around 16 hours per day. Thus, the locomotives that were working were used relatively intensively, but because of the low commercial speed, overall productivity was low—less than 100,000 km every year for the active nonshunting fleet and less than 70,000 km per year for the total fleet.

Table 6.1 also shows a final trap in assessing locomotive productivity. The inclusion or exclusion of shunting locomotives, around 25 percent of the fleet in this case, will have a significant effect on productivity statistics. Therefore it must be established whether these have been included or excluded before comparing figures.

[62] But Swaziland is essentially a transit railway, and it uses Spoornet locomotives (which are probably not included in the reported fleet) on many of its operations.

Figure 6.2 Locomotive productivity (average, for total fleet, 1995–2005)



Source: AICD database.

Note: There are no data available for FCE and Transrail. Some railways in the concessioned group were not concessioned until close to 2005 or later; this figure should therefore not be used to compare the impact of concessioning on locomotive productivity.

Table 6.1 Locomotive utilization and availability in Tanzania, 2001

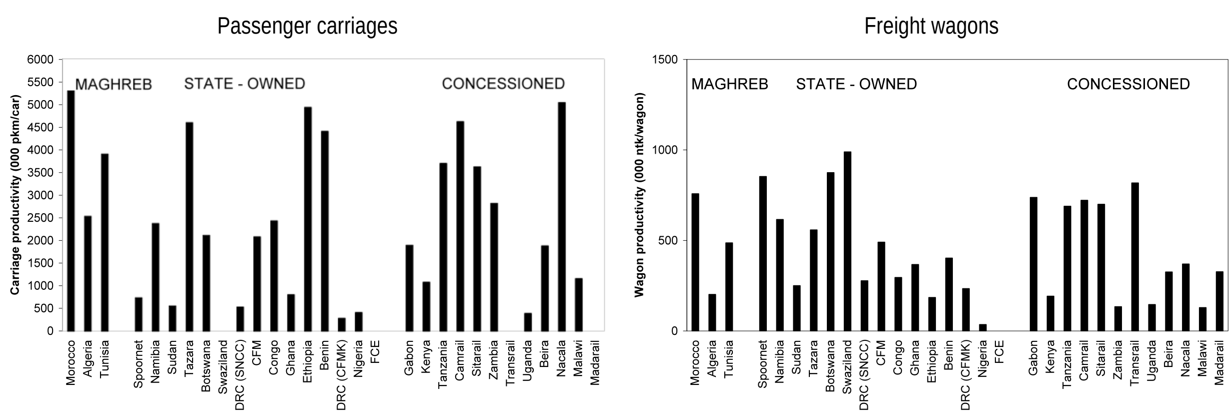
Class	Type	Age	Number of locomotives			Km/loco/day		
			Total	Active	Available	Available	Active	Total
Diesel electric								
36	Shunter	22	20	16	8	–	–	–
73	Main line	26	15	10	8	210	168	112
87	Main line	34	7	2	1	123	53	15
88	Main line	26	35	31	26	344	289	256
89	Main line	9	9	8	5	362	232	206
Subtotal			86	67	48	315	247	191
Diesel hydraulic								
35	Shunter	29	4	2	1	–	–	–
37	Shunter	16	5	5	4	–	–	–
64	Branch line	22	21	17	13	235	183	148
65	Branch line	9	4	4	3	231	192	192
Subtotal			34	28	22	234	185	155
29	Steam	46	1	1	1	–	–	–
Total			121	96	71	291	229	181
Availability			59%	74%				

Source: TRC.

Carriage and wagon productivity

Carriage productivity shows a very wide range, from an average over the period of 5 million passenger-km per car annually for Nacala, Camrail, Ethiopia, and Tazara, to less than 500,000 passenger-km per car in the Democratic Republic of Congo (DRC) and Sudan. Some cases of high productivity reflect very small fleets of carriages, which are extremely overcrowded when the railways are in service. More useful figures are from railways such as Camrail, which operate a regular service with reasonable load factors. For such a railway, the productivity is typically the product of an annual distance traveled per vehicle of 100,000 to 130,000 km and an average load of 40 to 50 passengers. Availability is generally reasonable if there is sufficient demand to keep most of the fleet operating, often more than 80 percent.

Figure 6.3 Passenger car and freight wagon productivity (average, 1995–2005)



Source: AICD database.

Note: No data are available for FCE and Transrail. Some railways in the concessioned group were not concessioned until close to 2005 or later; this figure should therefore not be used to compare the impact of concessioning on rolling-stock productivity.

Wagon productivity is around 1 million net-km (ntkm) per wagon in Swaziland (which is largely due to the fact that the country's transit traffic is carried in "foreign" wagons), with productivities of more than 500,000 ntkm/wagon on several other systems. But on many state-owned railways (including some only concessioned at the end of the period), wagon productivity is very low—less than 200,000 ntkm/wagon. In such cases, demand has declined while the size of the wagon fleet (which can easily have a life of fifty years or more) has remained unchanged. On a busy railway, wagon availability should be well over 80 percent, as maintenance is straightforward and normally only a few basic spare parts are required. A wagon should be able to travel at least 50,000 km every year on a typical railway,[63] but to do so the "cycle time," or the interval between successive loadings, must be kept to a minimum; this requires tight operations by the railway and efficient loading and unloading by the customer. The average load in a wagon (taking empty running into account) is about 20 tonnes on the 15-tonne-axle-load systems and about 30 tonnes on the 18-tonne systems. A well-run railway should thus be able to easily achieve 1 million ntkm/wagon every year.

[63] And much more if the train is a dedicated train carrying a single commodity between two locations. In the early 1980s, Zimbabwe Railways ran such a "block train" carrying coal between Hwange and the Zisco steel plant at Kwekwe, with the wagons traveling around 200,000 km every year.

Impact of concessioning on productivity

Both labor productivity and asset productivity are higher in concessioned companies than in state-controlled companies in Sub-Saharan Africa. Labor productivity of concessioned companies is on average twice as high as in public companies.

Figure 6.4 summarizes four key indicators: (i) traffic units (passenger-km plus net tonne-km) per staff, an indicator of labor productivity; (ii) traffic units per locomotive;[64] (iii) net tonne-km per wagon; and (iv) passenger-km per carriage—for each of the five years prior to concessioning and the period since. As discussed above, all these indicators have weaknesses as they stand (for example, they take no account of locomotive or wagon capacity, nor of passenger car occupancy) and could be considerably improved with more detailed data. But they are sufficient to provide a broad picture of the impact of concessioning.

Labor productivity increased steadily in all the concessions. In the case of Sitarail, the improving trend was interrupted by the service suspensions caused by the civil war in 2003–4, but it resumed when the situation stabilized. Camrail labor productivity increased sharply on concessioning as traffic grew; it then stabilized but now appears to be increasing again. CEAR productivity grew sharply on concessioning when it reemployed about two-thirds of the previous workforce while growing traffic by about 30 percent on an adjusted annual basis. Productivity in 2003–4 fell because of the disruption caused by flood damage to the Rivi Rivi bridge, which left the northern half of the network with very little traffic and the associated staff with little to do.[65] The takeover of the Nacala line in 2005 and the reopening of Rivi Rivi have probably given a substantial boost to the figures for subsequent years. Similar productivity improvements are likely to accompany most of the other recent concessions: Madarail reduced its workforce by 50 percent, both the Mozambican concessions did so by about 60 percent, the Zambian concession cut more than 30 percent, and the Senegalese concession eliminated about 40 percent.

Locomotive productivity increased sharply in Sitarail and Zambia, mostly due to the scrapping of surplus equipment. Productivity in Cameroon has increased steadily as traffic has increased; in addition, a major jump (not shown in figure 6.4) occurred in 2007, when new and more powerful locomotives were introduced, approximately halving the fleet size and thus doubling productivity. There has been little change in CEAR's locomotive productivity, but much of its fleet has not been used and some locomotives have been bought specifically as sources of spare parts.

Both the carriage and (especially) wagon fleets also show improvements in productivity following concessioning, again partly because traffic has increased and partly because surplus stock has been scrapped.

Although such workforce and rolling-stock reductions feed directly into the productivity figures, they paint a misleadingly gloomy picture of the competence of the middle managers of the previous government railways. In many cases key managers—who frequently remained after concessioning—were not allowed to reduce workforces, which were kept artificially high by governments for political reasons.

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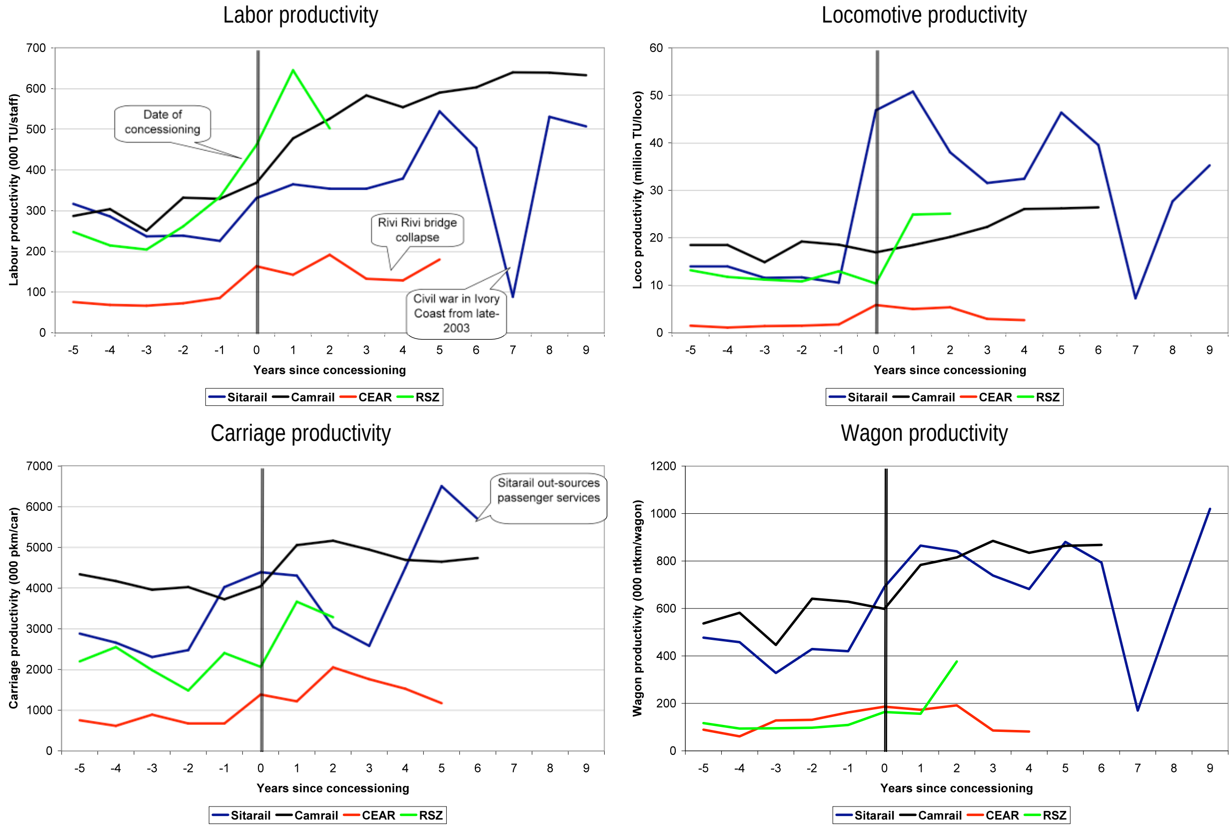
[64] The CEAR locomotive productivity figures do not include the scrap locomotives that were purchased for spare parts.

[65] These statistics also demonstrate one of the traps in such broad measures of productivity, as during 2004 the CEAR locomotives did 25 percent of their work on hire to CFM, which is not reflected in the traffic statistics.

But this is not a special characteristic of the rail industry; it is common in many parastatal organizations, both in Africa and elsewhere.

Figure 6.4 Impact of concessioning on labor and asset productivity

Year of concessioning = Year 0; index at Year 0 =100



Source: AICD database.

Concessionaires, almost without exception, also make more productive use of their assets. In some cases this reflects an increased use of assets that were previously lying idle (this is particularly true for wagons); in others it illustrates how difficult it was for governments to write off surplus assets. Nevertheless, both infrastructure and rolling-stock are achieving better productivity under concessioning than under state control.

Service quality

The quality of service offered by many Sub-Saharan African railways is poor. The key attributes of both passenger and freight services are adequate quantity (supply), quality (safety, security, cleanliness, speed, reliability), and timeliness (availability). Few state-run systems score well in anything other than isolated cases, as discussed in earlier chapters. Concessioned railways cannot necessarily improve transit time, but they do generally try to address other aspects of service quality such as safety, security, and reliability.

Safety in particular is a major weakness of many railways. In the past ten years there have been several major accidents on Sub-Saharan African railways, some due to basic operating failures, with major losses of life. There are also many derailments on most systems. While derailments are an occupational hazard on all railways, their frequency is high by any standard. Many Sub-Saharan African railways report having more than a hundred derailments per year, and some report more than two hundred or even three hundred. The definition of a derailment varies from railway to railway, and many often occur at slow speeds in yards and pose little, if any, threat to safety. Nevertheless, the whole of the U.S. system typically has only around two thousand derailments each year, of which one-third are on mainlines as opposed to yards and sidings. Canada has around 150 mainline derailments each year and India less than 100. Relative to the volume of traffic, derailment rates are an order of magnitude greater than those of most other railways. Even controlling for track quality does not close the gap: in the United States, for every 10 million wagon-km, there is one derailment on the Class 2 track of non–Class 1 railways (railways with a 40 km/hr speed limit, broadly equivalent to the poorer parts of the Sub-Saharan African mainline network); the comparable rate for Sub-Saharan African railways appears to be some thirty times as high.

7 Financial performance

This chapter first describes the revenue and revenue structure of the African railways. It then reviews financial management and some key financial ratios. Finally, it outlines the financial structure of the main concessions and future investment needs.

Revenue and cost structure

Chapter 4 discussed freight and passenger traffic, the two main sources of revenue on almost all Sub-Saharan railways. In addition, most railways earn revenue from minor operational activities. For example, several railways earn revenue from trackage (or access) charges levied on third parties running over their network; sales of scrap, rentals, advertising, and the like also generally bring in some money. But these ancillary sources of income rarely generate more than about 5 percent of the total revenue of a railway. In order to break even on a cash basis, some publicly owned railways receive annual payments from the government; such payments are often included as revenue in the published accounts.

The cost structure of railways can be analyzed in two ways:

- By cost type (salary, materials, fuel and sundries, which normally include maintenance undertaken by third parties). This is the standard presentation in most annual reports.
- By functional area (maintenance, operations, administration). This information is sometimes available, particularly when there has been some internal reorganization, but normally it can be found only in the general ledger (and not always then). It is, however, the basis for any analysis of financial performance, especially the benchmarking of costs against other railways. Figure 7.1 gives the functional cost structure of three Sub-Saharan African government railways around 2002: two from low-income countries (Tanzania and Zambia) and one from a medium-income country (Botswana).

Terminal costs represent about 10 percent of total costs, train operations costs (locomotive crew, guards, and signalmen and safeworking staff[66]) make up about 15 percent, and locomotive and vehicle maintenance constitute about 20 percent. Fuel accounts for about 20 percent of total costs, on average, although the percentage varies from railway to railway depending on terrain and general operating characteristics (a railway in flat terrain may use only half of the fuel used by one in hilly terrain). Infrastructure and signal maintenance costs about 20 percent of the total, and, finally, corporate administration and overheads are the remaining 15 percent.[67]

This overall structure, which covers recurrent cash costs only, is not dissimilar to other railways. It excludes depreciation, which in many Sub-Saharan African railway accounts is virtually meaningless but which is typically about 10–15 percent on well-managed railways. It also excludes pension payments,

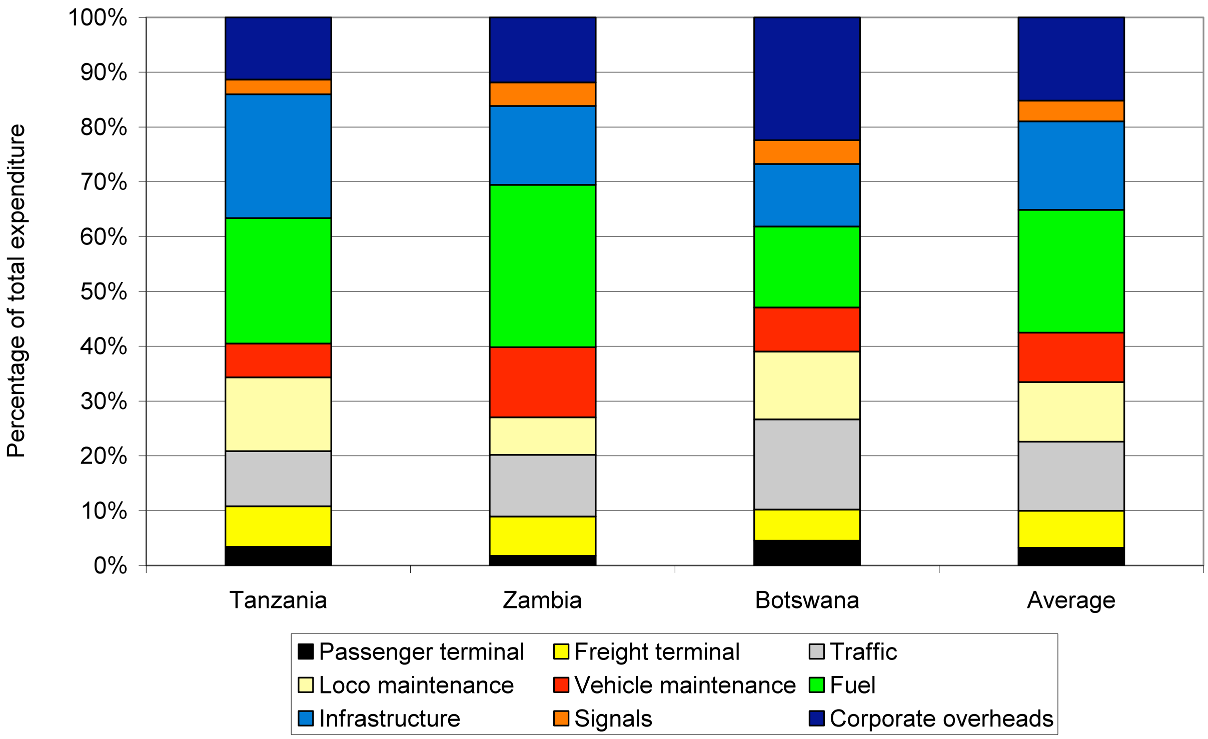
[66] Safeworking staff (or dispatchers) are signalmen without signalboxes.

[67] Comparable figures for the Indian railways in 2004–5 were as follows: train operations (including terminal), 33 percent; locomotive and vehicle maintenance, 18 percent; fuel, 26 percent; infrastructure and maintenance, 17 percent; and corporate administration, 6 percent.

which on many railways are cash payments to past employees rather than a contribution to a funded scheme for current employees. These would typically add a further 10 percent to total costs.

The precise cost structure of any given railway is a reflection of the traffic mix, operating conditions, and management capability. It is also a function of asset condition and funding capacity. On many railways periodic maintenance (for example, track renewal or the replacement of locomotive engines) can be done only when funds are available; such expenditures may account for up to half of the long-term maintenance costs. Low maintenance expenditure is just as often a sign of deferred maintenance and asset deterioration as it is of skillful management.

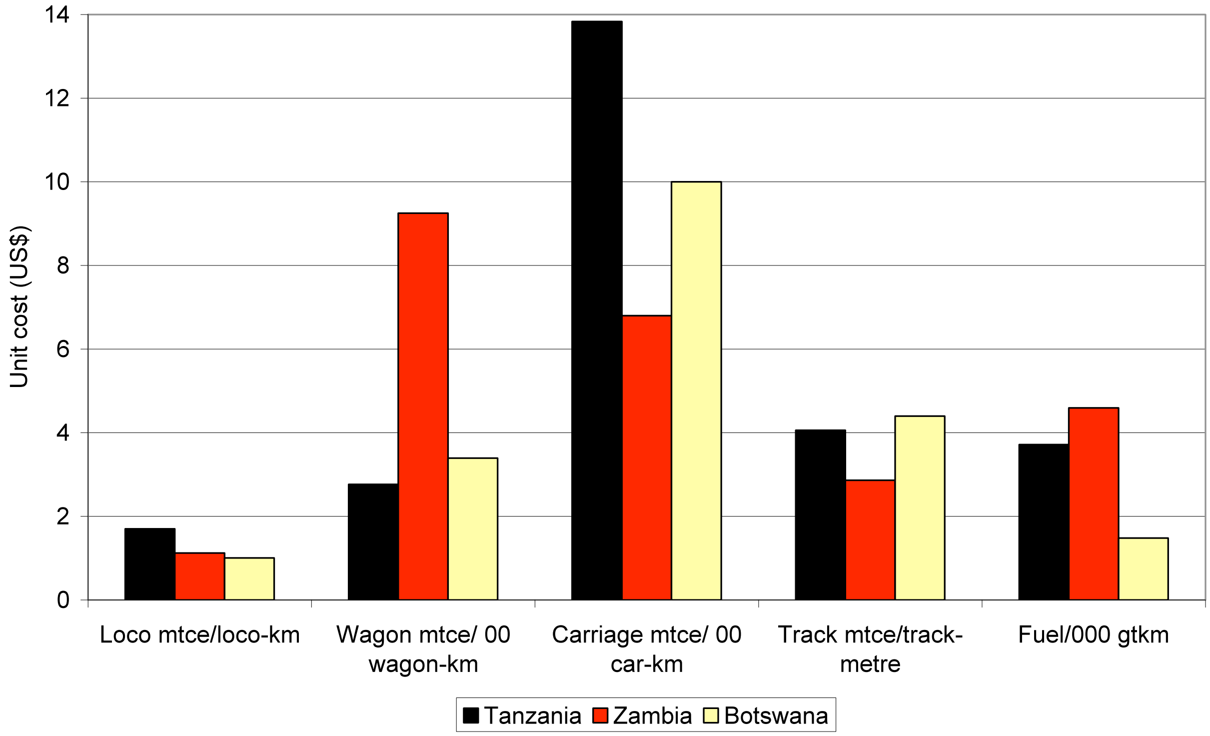
Figure 7.1 Cost structure—select systems, 2002



Unit costs[68] for select activities for the three railways are compared in figure 7.2. In terms of the absolute level of expenditure, these costs are comparable with those of other railways worldwide (for example, $1.50 per locomotive kilometer (loco-km) is a reasonable figure for a fleet of old locomotives, and even better for the small mixed fleets that are common on many Sub-Saharan railways). However, this expenditure generally only achieves low levels of availability and utilization. This is not necessarily the fault of the individual engineers or mechanics but is largely a consequence of the age of the assets, in many cases being well past their economic life.

[68] That is, the cost per unit of output, normally defined in terms of measures that have a direct causal relation, such as loco-km for locomotive maintenance and so on, as shown in figure 7.2.

Figure 7.2 Unit costs—select systems, 2002

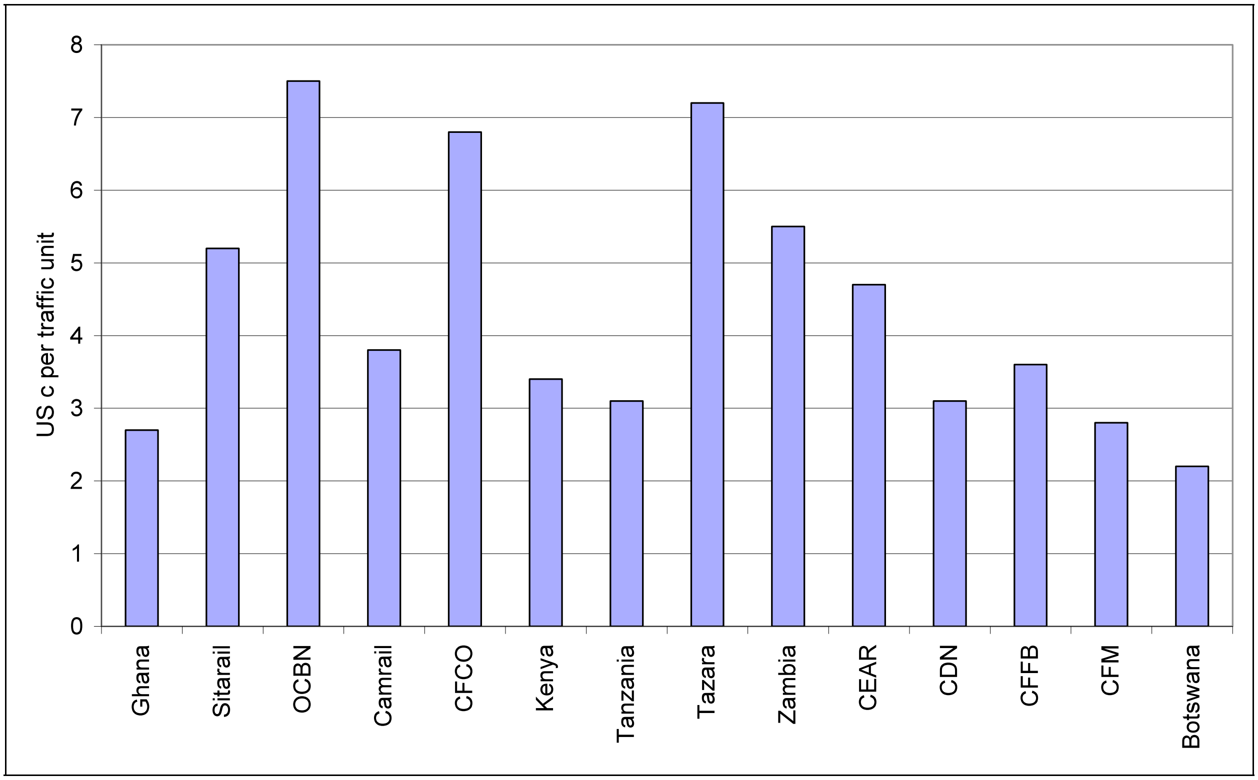


Source: Railway annual reports.

The actual cost per unit of traffic is made up of the following expenditures:

- The unit costs for functional activities, which vary with managerial efficiency, the age and condition of assets, and the extent to which necessary maintenance is actually carried out.
- The mix and type of traffic, which determines how many resources are required to haul traffic. For example, mainline passenger trains may need 15 carriages, while branch-line trains may need only 4.
- The utilization and occupancy of services such as the extent of backloading, the carrying capacity of wagons (which is generally a function of the axle load but also varies from commodity to commodity), and the passenger load factors achieved. For example, the cost of a passenger-km in a sleeping car is clearly much greater than the cost of a passenger-km in a crowded economy carriage.

Figure 7.3 Cost per traffic unit (average), 2000–05



Source: AICD database.

These factors need to be taken into account when interpreting figure 7.3, which gives the average expenditure per unit of traffic for a range of Sub-Saharan railways between 2000 and 2005.[69] Most railways lie in the range 2 to 5 c/traffic unit, with the lowest cost in Botswana, a relatively flat railway with modern equipment, good track, and an abundance of base mineral traffic. The highest costs are in the low-volume systems of Benin and Republic of Congo and the troubled Tazara system.

Financial results

Although almost all railways produce annual accounts, these are generally of little value other than as an official record of revenue earned and expenditures made. Cash shortfalls are generally made good by grants from governments (which are often included as revenue), while depreciation is recorded on a number of bases; as a noncash item, however, it is of little practical consequence for most railways. As a result, most railways just about break even on a cash basis after receiving government support, with the proviso that a substantial amount of maintenance is almost always deferred. When the maintenance backlog becomes too great, it is typically addressed using a loan, with the expenditure being treated as investment.

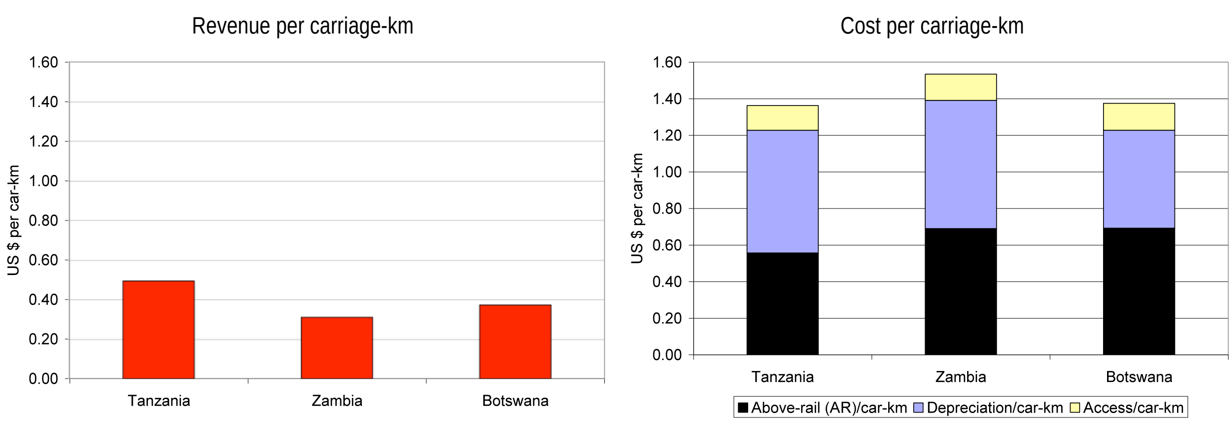
[69] The figures are averages for the years for which data are available. The cost, excluding depreciation and concession fees for the concessioned railways where possible, is expressed per traffic unit—that is, the sum of net tonne-km and passenger-km .

The two railways that have been concessioned the longest (Sitarail and Camrail) both make a modest profit.[70] CEAR, which suffered long delays in finalizing the companion CDN concession in Mozambique, posted working losses for several years. The performance of RSZ is unknown, and it is too early to judge the concessions in Tanzania and Kenya, although the omens are not good.[71] One minor, but positive, feature is that most concessionaires take a vigorous approach to the dubious practices entrenched in some railways. Railways have traditionally provided many opportunities for employees to operate "businesses within businesses." Examples range from small-scale theft, such as stealing locomotive fuel or pocketing cash fares on passenger trains, to larger-scale operations such as systematically overlooking demurrage, rationing wagon supply, and charging carriers for expedited transit. Staff have sometimes been allowed to continue these practices to supplement their relatively low government salaries, but this often has a negative effect on rail operations, particularly in cases where employees attempt to ration wagon supply.

Passenger services

Passenger services are widely regarded as loss-making activities. But some are less loss-making than others: while few, if any, contribute significantly to the cost of maintaining infrastructure or covering corporate overheads, neither are they all major loss makers on a marginal basis.

Figure 7.4 Revenue and cost per carriage-km (select systems), 2002



Source: Railway annual reports.

Figure 7.4 shows absolute levels of revenue and cost per carriage-km for the three Sub-Saharan African systems in figure 7.1. The cost per carriage-km is the basic driver of passenger operating costs and probably the best single measure of how successful the railway is at balancing price, capacity, and demand.[72] The figure shows three components of cost:

[70] The financial performance of these two companies is discussed in detail in di Borgo and others (2006).

[71] It is sometimes suggested that although published profits are low, concessionaires have charged significant fees for providing management services and the like. This claim is also discussed in di Borgo and others (2006).

[72] For passenger railways, as with airlines, operating costs are primarily determined by the number of services offered, regardless of whether or not passengers are using them. Unit costs per seat-km or per carriage-km are therefore a more useful measure than costs per passenger-km, which reflect marketing decisions that have comparatively little impact on operating costs.

- The avoidable costs of train operation—that is, the costs that would disappear if some of the services ceased operation. These include the costs of train crew, rolling-stock maintenance, fuel (or power), and passenger-handling costs (ticket-selling/commission and some station staff).[73]
- Rolling-stock capital renewal costs,[74] which can be derived by converting the capital cost into an equivalent annual sum, based on the asset life and using a real discount rate.[75] These costs are effectively sunk[76] until replacement rolling-stock is required.
- An allocation of infrastructure operation and maintenance costs, which are termed "access charges" in this report. Although a wide variety of procedures have been devised for determining how much should be charged to the different types of service, for simplicity's sake a straightforward full-cost allocation method has been used.

A final potential component (not shown in figure 7.4) in the cost base is the capital cost of infrastructure renewal. This cost occurs very infrequently on most low-density railways (assuming routine maintenance has not been completely neglected). Only a few passenger services are ever able to make any contribution to this cost even though it is at least partly variable with usage.[77]

Although the three railways have rather different operations, with average train sizes ranging from 9 to 16 vehicles, and with commercial speeds[78] ranging from 28 km/hr to 50 km/hr, the average revenues and costs are relatively similar. Revenue per carriage-km is the product of tariff and occupancy—similar results can be obtained from a high-occupancy, low-fare railway as from the reverse. Cost per carriage-km is also a function of average speed and, particularly for depreciation, the annual utilization of rolling-stock.

The rolling-stock renewal costs (termed "above-rail depreciation charges") depend on the amount of rolling-stock assigned to passenger services on each system (excluding that which is obsolete and/or surplus) and the estimated replacement costs. Unlike the above-rail (AR) working expenses and the allocated infrastructure costs, these costs are independent of labor costs and productivity; instead, they primarily depend on the average utilization of the rolling-stock. This in turn depends on the average train operating speed, the intensity of services (the interval between consecutive services), and the amount of rolling-stock that is out of service for repair. Not surprisingly, railways with low operating speeds and low service frequencies (typical of most of Sub-Saharan Africa) have very high depreciation charges compared to operating costs. These can be dramatically reduced by improved utilization; an efficient railway is able to achieve a cost per km of around 25–30 percent of the levels in figure 7.4. But on most Sub-Saharan African railways, such improvement requires capital expenditure to increase commercial

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[73] A proportion of infrastructure costs is also variable with usage and should strictly speaking be included. But for many of the more basic low-density railways the incremental impact of passenger services on infrastructure is relatively small unless the services are withdrawn in their entirety, in which case some significant changes in track and signaling standards can often be made.

[74] For convenience, these costs have been termed "above-rail depreciation" in the discussion that follows, assuming depreciation is based on the renewal cost of assets rather than the historic cost. Costs calculated in this way are unlikely to appear in the accounts of any Sub-Saharan African railway.

[75] This assumes a 4 percent real rate of return.

[76] Although there is an international market in used rolling-stock, most of that currently in use in Sub-Saharan Africa (outside South Africa) is probably unsaleable.

[77] Even fewer are able to make a contribution to the initial capital cost of construction.

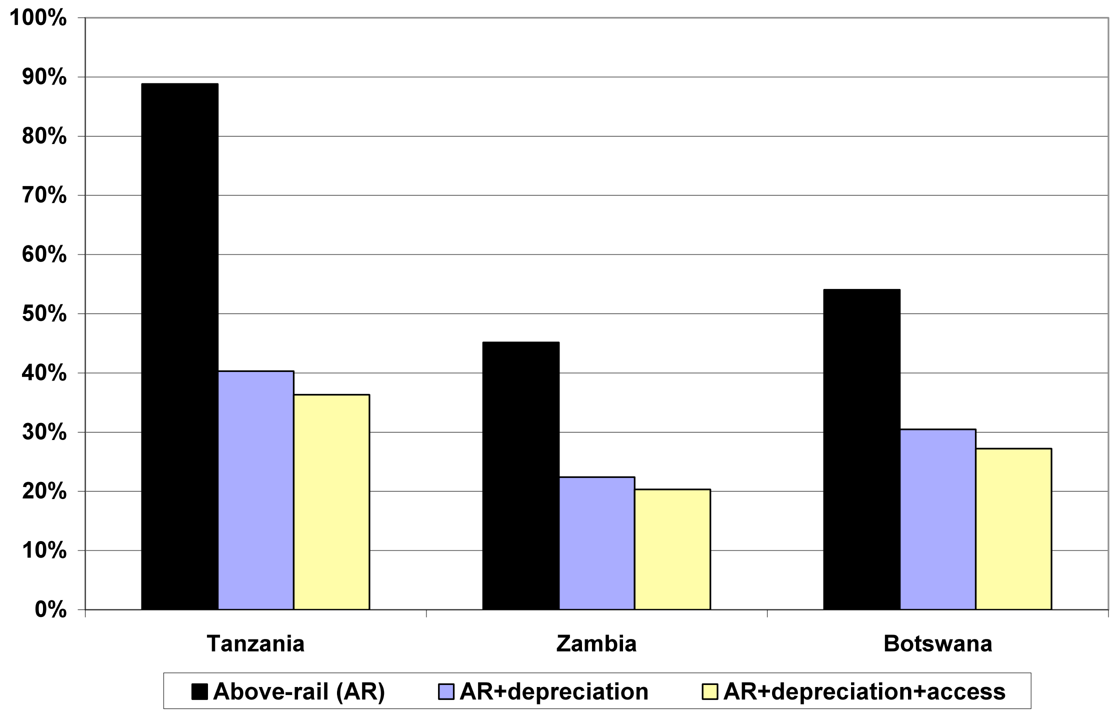
[78] Commercial speed is the end-to-end time including stops at stations and for operational reasons.

speeds (and hence kilometers traveled per hour operated), more intensive services, and reduced maintenance downtime.

Figure 7.5 combines the costs and revenues of figure 7.4 to show three indicators of financial cost recovery:

- The most basic indicator compares revenue with the above-rail working expenses (AR), which exclude infrastructure costs and depreciation. If the revenue only just covers the expense of the day-to-day operation of the train, it clearly cannot contribute to rolling-stock capital or infrastructure costs.
- The second indicator includes rolling-stock capital renewal costs in the cost base (AR working expenses plus depreciation). If revenue covers this cost threshold, then the service will be able to pay for the replacement of its rolling-stock when due, but it will still require another funding source (either the taxpayer or freight traffic) to pay for infrastructure.
- The third indicator includes an allocation of infrastructure operation and maintenance costs (conceptually equivalent to an access charge). This shows whether an operator would be able to operate commercially without any contribution from third parties for infrastructure.

Figure 7.5 Passenger cost recovery—select systems, 2002



None of the three railways is able to cover its AR working expenses. The only railway to come close is Tanzania, which has the highest earnings per carriage-km. The other two railways cover about 50 percent of their AR working expenses.

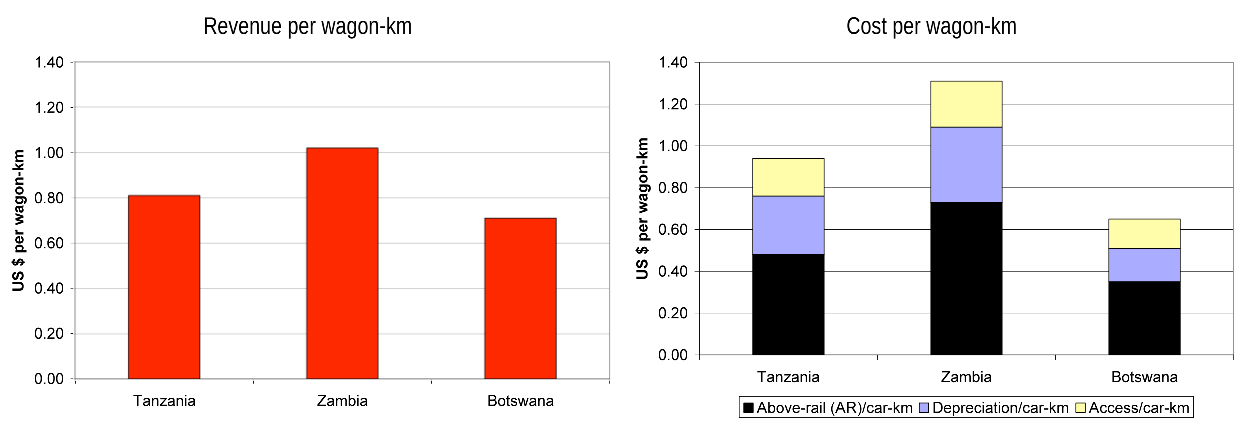
When rolling-stock capital is included, even Tanzania performs poorly, based on current levels of rolling-stock utilization. If depreciation charges could be reduced, either through assuming cheaper secondhand equipment or by increasing utilization, cost recovery could possibly be improved to 50 percent. When full-access charges are included (but without infrastructure renewal), the cost recoveries fall to between 20 and 40 percent, which might improve to between 30 and 65 percent with improved utilization. Some of the tariffs (including those in Tanzania) are set within a framework that includes only a subset of the costs included in figure 7.5. Nevertheless, many of the poorly performing Sub-Saharan African systems would be unable to cover their AR working expenses, no matter how much freedom they had to set their own tariffs.

In the early 2000s, long-distance passenger railways needed to earn around $1 per carriage-km to ensure their long-term viability. Earnings of 75 cents per carriage-km would have been enough to cover recurrent operating costs and a reasonable amount of the periodic maintenance required for the rolling-stock, but all asset renewal costs (that is, new locomotives and new carriages) would have had to be funded by grants from third parties. Most third-class coaches on Sub-Saharan African railways can carry about 80 passengers, and a dynamic load factor of 70 percent is a realistic, if challenging, target, taking into account short trips, seasonality, and so on. This, then, implies a minimum unit tariff for third-class travel of about 1.5 to 2 US cents per passenger-km; if the tariff were any lower, government support would be essential.[79]

Freight services

In contrast to passenger services, freight services are normally capable of at least covering their avoidable operating costs and, with luck, earning enough to also cover infrastructure costs and even rolling-stock capital costs. Figure 7.6 shows absolute levels for the same three systems analyzed in the preceding section of revenue and cost per wagon-km (the basic driver of freight operating costs), with cost being divided into the avoidable costs of train operation, rolling-stock capital renewal costs, and an allocation of infrastructure operation and maintenance costs.

Figure 7.6 Revenue and cost per wagon-km (select systems), 2002



Source: Railway annual reports.

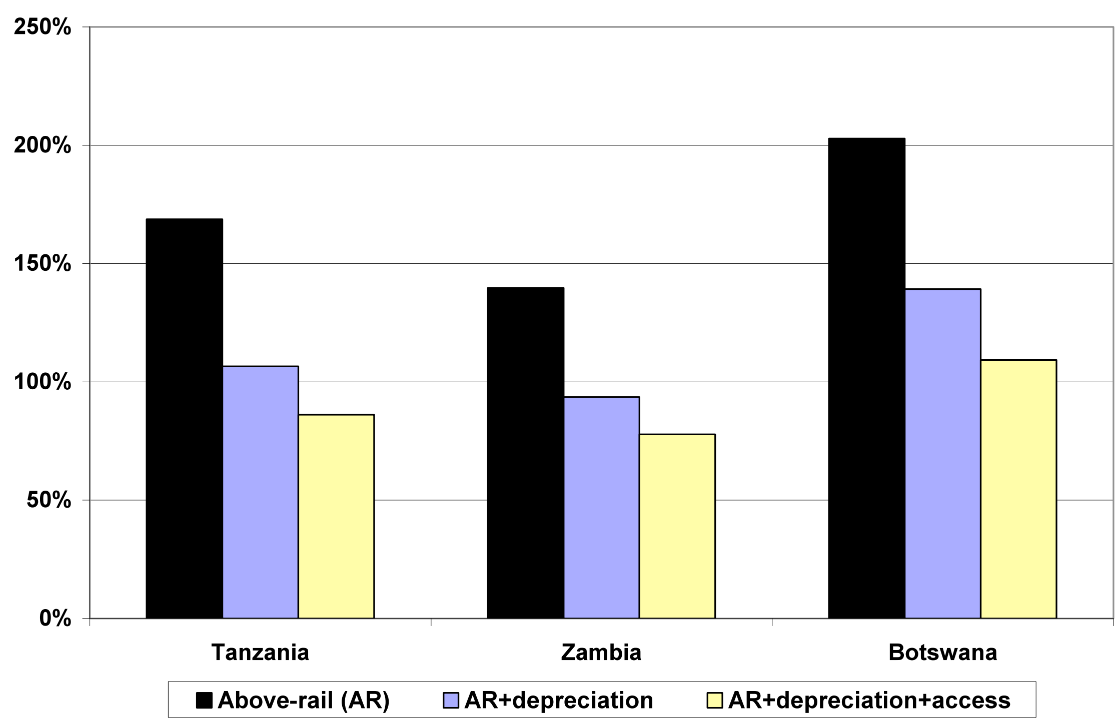
[79] Lower load factors (which are a function of service frequency and train size) would increase this minimum, although in most cases it would still be comparable with bus fares. Passenger rail's main difficulties remain service frequency and travel time.

The cost range reflects the differences in train operations, with average train sizes ranging from 18 to 27 wagons and commercial speeds ranging from 18 to 37 km/hr (the larger the train and higher the speed, the lower the cost per unit of output). Revenue per wagon-km is the product of tariff and average loading, the latter being the product of the wagon capacity in tonnes, the density of the freight, and the percentage of empty running.

As with passenger services, the rolling-stock renewal costs primarily depend on the average utilization of the rolling-stock, itself a function of the average train operating speed, the intensity of usage (interval between consecutive wagon loadings), and the degree to which rolling-stock is unserviceable because it is under repair. Railways with low operating speeds and slow wagon turnaround thus have higher depreciation charges. Improved utilization will reduce the depreciation charges shown in figure 7.6, and an efficient railway should be able to reduce the cost per wagon-km to around 70 percent of Botswana's levels, given some investment in infrastructure and maintenance facilities.

Figure 7.7 combines the costs and revenues of figure 7.6 to show the freight equivalents of the three indicators of financial cost recovery that were presented for the passenger services.

Figure 7.7 Freight cost recovery—select systems, 2002



All three railways comfortably cover their AR working expenses. They more or less cover their AR and rolling-stock charges, but if depreciation charges can be reduced (either through assuming cheaper secondhand equipment or by improving utilization), cost recovery would probably be comfortably above 100 percent. But when full-access charges are included (but without infrastructure renewal), only Botswana has a cost recovery above 100 percent. The other two operations are thus not sustainable in the long term unless depreciation charges can be reduced or the government contributes to the cost of infrastructure. Even the best-performing railway, Botswana, does not earn enough to cover the cost of renewing infrastructure.

Freight railways at the date of the analysis (2002) therefore needed to earn between eighty cents and a dollar per wagon-km, while keeping their operating costs to around sixty to eighty cents if they were to be self-sustaining.[80] This can be achieved, but it would require two-way loading and higher-yield traffic, which in turn demands strong marketing and a higher level of service.

An order-of-magnitude estimate of the unit revenue required to break even in 2002 can be made by assuming that 40 percent of wagons were backloaded (this depends on the type of freight—specialized rolling-stock carrying traffic such as petroleum products or bulk cement has to return empty except in very unusual circumstances) and had a carrying capacity of 30 tonnes. Assuming that backloaded tariffs were 60 percent of forward-loaded tariffs, earnings would be 93 cents per wagon-km from a forward rate of 5 cents per net tonne-km. The forward unit rate has clearly been achievable; the key is finding sufficient backloads and achieving good rolling-stock utilization. Concessionaires are normally good at both.

Concession financing issues

Many of the concession contracts have two important features: (i) a substantial contribution from low-interest sovereign loans that are provided to concessionaires on terms that are not available commercially[81] and (ii) relatively low proportions of equity being provided by concessionaires.

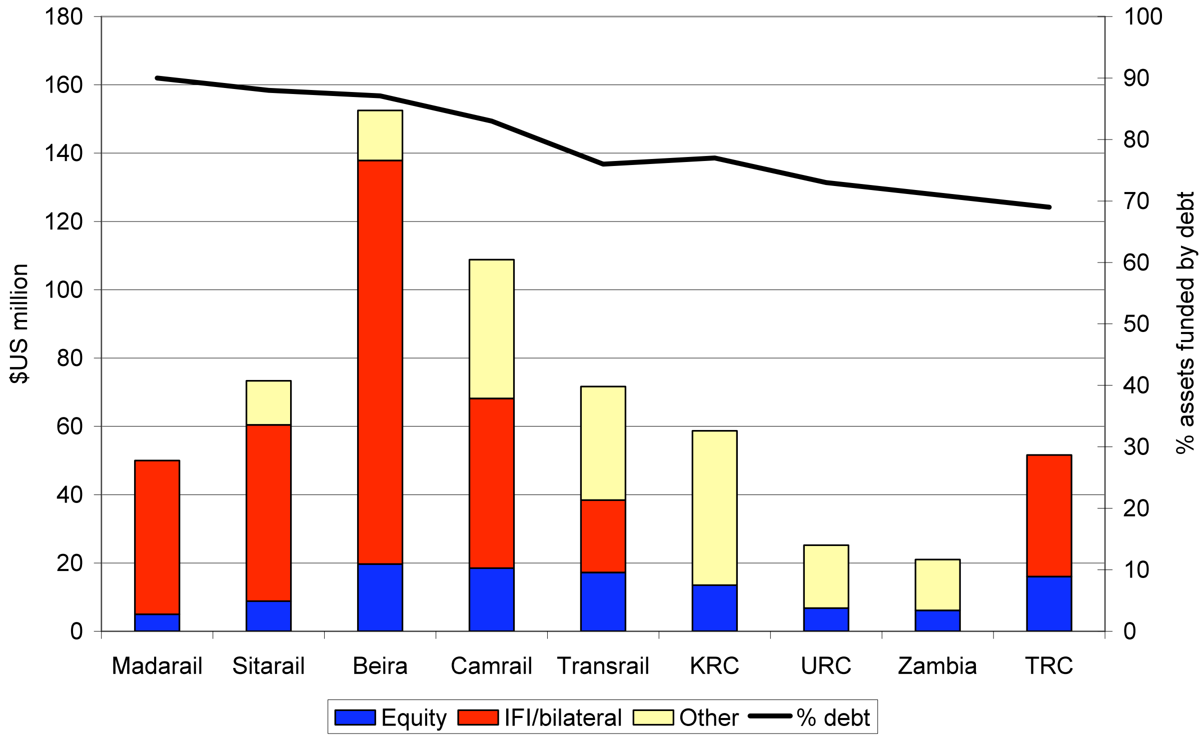
Figure 7.8 shows the considerable investment contributions that international financial institution (IFI) and bilateral funds make in these concessions. In a way, this is inevitable: few of the railways carry enough traffic for investment to be commercially worthwhile, and yet, as shown in Chapter 3, there are sound economic reasons for investing at rather lower levels than those required for strict commercial viability. But using public funds to cover such a large proportion of the investment does raise three issues that need to be addressed:

- Heavy government involvement inevitably creates a conflict between its roles as a lender and as a regulator, as was the case when the railways were in public ownership. Projects are unlikely to be allowed to collapse and contracts are likely to be renegotiated rather than canceled.
- Concessionaires may be more attracted by the construction opportunities than by the railway operations, especially when a railway is more or less moribund at the time of concessioning.
- Given the limited investment funds provided by concessionaires, management contracts may be a more effective (and certainly less complex) way of structuring private sector involvement than a concession.

[80] This analysis excludes concession fees, which would typically represent around $0.05 per wagon-km.

[81] Transport concession financing in Sub-Saharan Africa is usually based on government sovereign loans from IFIs, which are on-lent to the concessionaires—the same practice as used in many other countries for loans to publicly owned railways. In the mid-1990s, this was usually carried out at a premium (for example, the Sitarail loan was an International Development Association, IDA, loan to Côte d'Ivoire with an interest rate of 0.75 percent per year but it was on-lent to Sitarail at 8 percent per year). This premium has been reduced sharply in subsequent transactions to attract potential operators, sometimes to 0 percent as in the case of Madarail. As a result, the average interest of the Madarail operator's debt is only 1.73 percent with a 7-year grace period and a 25-year tenor.

Figure 7.8 Financing structure of select concessions



Source: di Borgo and others (2006).

Note: The Madarail concession is shown as it existed after the September 2005 restructuring, the main consequence of which was transform into a grant what was originally an IFI Euro 21 million loan on-lent from the government to Madarail. This has been included in the IFI/bilateral funds in the chart. Because the Sitarail concession is an *affermage*, Sitarail does not carry the debt contracted by the state holding companies (that is, $56.7 million out of $63.6 million). Nevertheless, since Sitarail services the debt, it has been included in the chart.

All the concessions planned to finance more than 80 percent of their investments with debt,[82] a proportion that is at the top end of what is normally deemed desirable for any financial venture. The share of the investments that is privately financed is in many cases well below 50 percent, and concessions that promised a substantial contribution from commercial borrowings (Transrail, Kenya/Uganda, and Zambia) have faced criticism for not having followed through with their plans.

The relatively low amount of equity put into the concessions is in most cases exceeded by the value of the rolling-stock transferred to the concessionaire. Even though much of this stock has been in poor condition, such transfers have shifted the financial risks associated with infrastructure investment from the private to the public sector. This practice reflects the weak financial basis of many of the concessions, whose business fundamentals were — and in many cases still are, in spite of the projections made during the bidding process (see box 7.1) — insufficient to support major investment on a commercial basis and are all too prone to significant liquidity problems. Thus, major asset maintenance and reinvestment are always likely to be a problem.

Concession fees are often divided between a fixed component and a variable one, generally computed as a percentage of gross revenues. In some cases they are intended to reflect the cost to the government

[82] In practice, even this level of reported equity tended to be exaggerated as the governments' share usually involved in-kind contributions (for example, rolling-stock, spare parts, or buildings) with a limited cash value.

authority of providing assets to a concessionaire (as in a leasing agreement), but more generally they are designed to ensure that private operators share their businesses' projected financial benefits with governments. Successful railway concessions normally also pay a series of taxes (for example, value added tax, personnel social taxes, income tax), which in many cases are greater than the concession fees when taken over the projected life span of a concession.

Figure 7.9 is based on the projected concession fees, income tax, and net profit margins for eight concessions over their operational lifetime (typically 20–25 years). Both concession fees and income tax range from 2 to 14 percent of gross revenues. Meanwhile, net profit margins for these concessions (defined as total operating revenues minus total operating costs minus depreciation and interest on debt capital minus taxable income) range from 0 percent (Madarail) to 25 percent (Zambia) of net revenues.

Box 7.1 Robustness of bid financial projections

In many cases, initial concession operations have not met the profitability expectations projected during the bidding process. The most extreme example is Madarail, which experienced unfavorable economic and political conditions (including currency devaluation, economic recession and civil disturbances) during the first 18 months of its operations. Much lower revenues and higher costs during this period than projected translated into a liquidity crunch that made it technically bankrupt and forced a major restructuring of the terms of its concession, with two-thirds of the initial $40.1 million five-year investment program being financed as a grant by the Malagasy government.

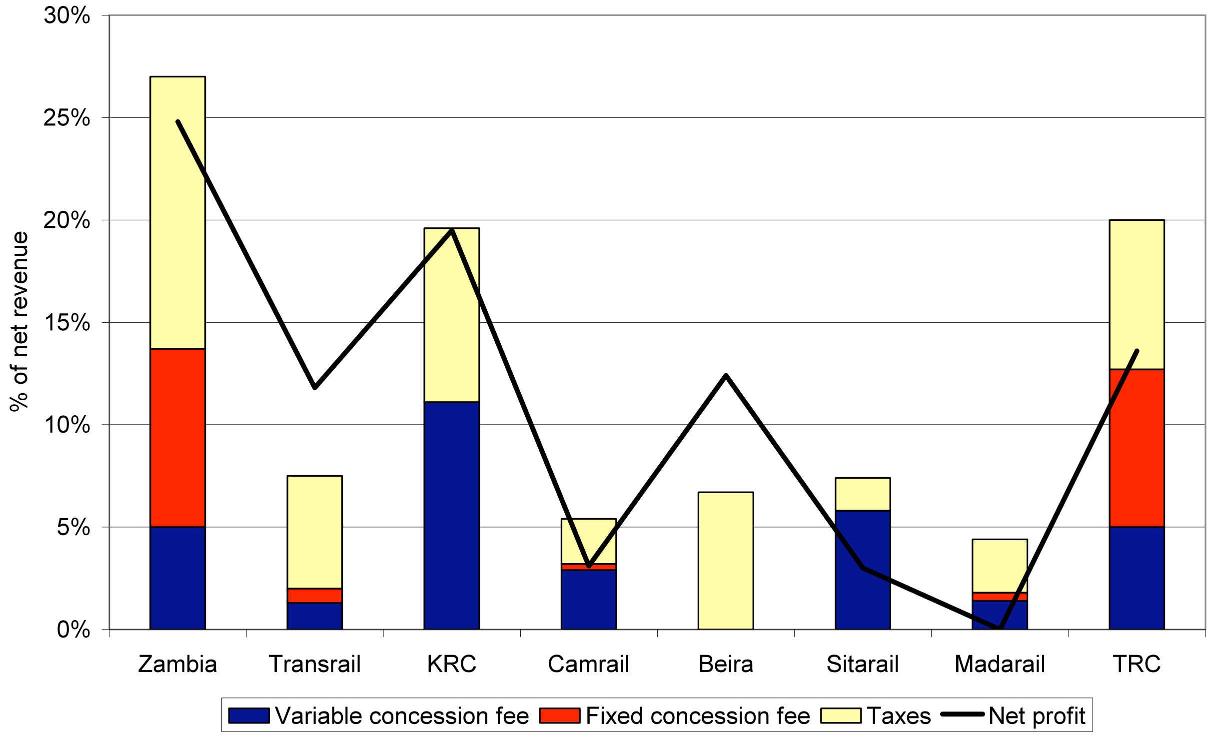
Even when initial traffic and revenue projections are met, other cash flow problems (for example, unforeseen increases in investments needs, delayed availability of loan funds or nonpayment of compensation for passenger-service obligations) can quickly trigger liquidity problems. Camrail suffered from just such a combination of events during its first five years of operations and was forced to take out short-term loans from local banks, with a sharp deterioration in its debt-to-equity ratio. Transrail, currently is its sixth year of operations, is suffering from similar problems: outstanding track usage and other charges owed by parastatal train operators reached the equivalent of 60 percent of it annual operating revenues by the end of 2008.

Two of the more recent concessions, RVR and TRC, also appear to be in serious financial trouble and are far from achieving their financial projections.

Bid projections need to be carefully interpreted. In the case of Zambia, the "fixed fee" in the concession agreement actually increases steadily through the concession period; however, it is paid in full only if the very ambitious traffic projections included in the reference financial model are achieved to within 3 percent; otherwise, it is adjusted downward. The Zambian government has most likely not received anything substantial from this fee. A clear distinction must also be made between the well-established Camrail and Sitarail concessions, with their current expectations of modest profit margins, and the more optimistic forecasts of the Zambia, Kenya/Uganda, and Tanzania concessions. The aggregate of the returns to government (through concession fees and taxes) and to the concessionaires (in the form of profit) in these three latter cases range from 35 to 50 percent of net revenue, equivalent to an operating ratio of 50 to 65 percent. Such a ratio is achieved by very few railways worldwide, normally much larger ones with modern infrastructure and equipment and with traffic flows that are much denser than those of Sub-Saharan African railways.

Given the relative size of taxes (largely income tax) and concession fees, governments should consider the combined impact of both revenue streams when negotiating a concession. A concession fee based on net revenue is undoubtedly a clearly defined measure,[83] but income tax does provide more flexibility in years in which there are unforeseen difficulties.

Figure 7.9 Concession fees, taxes, and projected profits



Source: di Borgo and others (2006).

But regardless of the mix of fees and taxes, and of any promises made during the bid process, a concessioned railway's strategy will always be ultimately constrained by the business fundamentals of the proposed railway privatization deal. It is critical that both governments and advisers recognize this when they are devising a railway privatization strategy: concessionaires can only support a finite financial outflow — irrespective of whether it is in the form of concession fees, borrowing costs, or rolling-stock acquisition costs — and concessions with high levels of both debt and concession fees will be prime candidates for renegotiation.

Two good examples are Madarail and Camrail. In the case of Madarail, the initial investment plan represented debt by year 5 (that is, 2008) of 18 cents per net tonne-km (c/ntkm), which would have been impossible to service given an average revenue of only 5 c/ntkm. This became clear when, in June 2005, after less than two years of operations, the Malagasy government agreed to take over two-thirds of Madarail's debt to reduce it to a sustainable level. Likewise, in the case of Camrail, the fifth-year debt was about 8 c/ntkm. In 2005 Camrail and the government agreed on a concession amendment whose primary effect was to transfer, until 2015, the cost of future track financing to the government and to cap the concession fee to under 4 percent of net revenue.

[83] There are a number of ways in which funds can be extracted by a concessionaire under the guise of costs, such as inflated "technical assistance" fees for providing management.

8 The way ahead

Over the past 40 years, governments in Africa have abandoned the explicit and implicit subsidies once granted to the rail industry and instead have directed most of their transport investment into the road sector. At the same time, economic liberalization has brought about the replacement of many long-established parastatal trading organizations with smaller and more nimble trading groups. But the rail sector for many years saw very little restructuring, other than some attempts to reduce the overstaffing that resulted from declining traffic volumes.

By the 1990s, many Sub-Saharan railways, including several that have since been concessioned, were badly run down. Both their infrastructure and rolling-stock were in need of substantial rehabilitation. Even major lines carried volumes that were very low by world standards, often no more than a branch line would carry in many countries. A few railways had substantial mineral traffic, but most were carrying semibulk freight between the ports and the interior; in only a few cases were there significant internal flows.

Private involvement in general-purpose railways[84] began in earnest in 1992 with the "*affermage*"[85] of the railway operations between Abidjan and Ouagadougou (Côte d'Ivoire/Burkina Faso). Fourteen systems in Sub-Saharan Africa are currently concessioned or contracted[86] (table 5.1). Of these, arrangements in three have been canceled (and subsequently revived with different operators), one has been badly affected by war, and one has suffered from natural disasters and long procedural delays. Six have operated for five years or more, but only two of these have done so without a significant dislocation of some kind. Another four systems are in the process of concessioning their lines.

Except for the railways immediately adjacent to South Africa (Botswana, Swaziland, and to a limited extent, Namibia), those railways that have not been concessioned have continued to deteriorate over the past decade, and in a number of cases the decline may be terminal. Because many governments in Africa consider concessions a last-ditch solution, some railways have been left to deteriorate so long that it will be a struggle to resurrect them.

The concessions, however, have not been free of problems. It has been difficult in many cases to find more than a few bidders, and in some cases the concessionaire's financial resources have been insufficient to finance the major investments required. As a result, the state has had to guarantee investments, but even then, the process of mobilizing finance has been slow. Concessionaires have generally been unenthusiastic about running passenger services, which do not generate the same revenues as freight and tie up scarce motive-power, and this reluctance has been exacerbated by delays in and disputes over government compensation for nonprofitable services. Further conflicts have arisen around the level of

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[84] This does not include railways built and operated by private companies for their exclusive needs (see box 2.1).

[85] *Affermage* is a type of concession contract in which the operator leases assets from the public authority, while the latter provides major investments.

[86] This paper uses the term *concessioning* to cover both leasing agreements (affermage) and pure concession contracts, in which the private sector carries both investment costs and commercial risks related to the operation and/or construction or rehabilitation of rolling-stock and/or infrastructure for a fixed period. The total quoted includes the SNCC and Togo management contracts.

concession fees, the length of the concessions, and payments to staff no longer required after concessioning.

Despite these and other problems, the results to date are encouraging, even if expectations have not been met. Most, but not all, of the concessioned railways have improved both their traffic levels and their productivity and are providing a better service to users, albeit after a solid injection of investment by donors and international financial institutions (IFIs). Some of this improvement might have occurred even without concessioning, given the investment provided. Not all concessions have been as successful as, say, Camrail appears to have been, and most have been in existence for only a short time relative to typical railway asset lives. In addition, responsibility for the ongoing rehabilitation and maintenance of track is rapidly emerging as a contentious issue between concessionaires and governments. In many railway concessions, governments' chief objective is to obtain financing (either private or through IFIs) to rehabilitate track infrastructure. But for most private operators, track rehabilitation and, especially, track renewal — which together constitute about half the long-term cost of track maintenance — are both a severe drain on available funds and deferrable at the cost of a few extra speed restrictions and derailments.

So is concessioning a long-term answer, or merely a short-term fix that appears successful thanks to temporary investment by third parties but will prove unsustainable in the long run? And what more needs to be done to ensure a sustainable railway sector?

Concession performance

The concessionaires' biggest impact to date has been in improving operations. Given the weak investment and regulatory climate in many African countries, investment flows have been limited. The nature and size of the privatized transport operations and infrastructure have also required a range of incentives (financial, economic, commercial, and regulatory) to secure private operators' interest; the scope and scale of these practices have raised many questions about the actual viability of the completed transactions. Nevertheless, the overall impact of concessioning on operations has been broadly positive:

- Productive efficiency has clearly improved (chapter 6). Labor productivity has increased steadily in all the concessions that have operated for five years or more, and similar figures are likely to come from most of the other recent concessions. Asset productivity has also generally increased.
- Allocative efficiency is difficult to measure directly, but the evidence is generally positive. By increasing railway productivity, actively searching for new traffic, and improving their internal business practices, concessionaires have improved railway cost and pricing structures and, perhaps most important, lifted the level of service, thus helping to attract traffic to the mode that can carry it most efficiently and improving intermodal competition.[87]
- In general, with two significant exceptions (Zambia and Transrail), concessionaires have lived up to the passenger service requirements in their concession agreements, even when it has been

[87] The combination of technical efficiency and improved level of service has generated particular economic benefits in West Africa, where some of the inland countries have bonded warehouses at the ports; transport is then organized through a group of accredited transport operators. In the past, these operators have been virtually free to set their own prices, as the competition from rail has been supply-constrained. As rail's capacity has expanded, direct pressure has been brought to bear on the road operators.

operationally difficult for them to do so, or when promised public service obligation (PSO) payments have not been forthcoming. But many of these services are a hangover from previous times, and the passengers who use them would often be far better and more economically served with a basic road-based system. Concessionaires faced with significant losses on these residual passenger services are likely to be proactive in pushing for such alternatives.

- Most concessions face competition from roads, except for isolated cases in which roads have still to be constructed or there are heavy mineral movements. A 2006 review of four concessions found little evidence of any monopolistic behavior by concessionaires. Service changes were made in response to changing traffic patterns, but freight rates were not manipulated and services were not reduced so that resources could be redeployed to favored users.
- Similarly, there is no evidence that personal travel has been made more expensive for the poor, other than in the case of Transrail services between Bamako and Keyes.

While concessionaires generally have a more appropriate cost structure than their predecessors, the cost structure is still not ideal. The operating cost of a railway is a function of capital invested and operating efficiency, but many of these railways have historically been starved of capital, leading to increased overall operating costs. Rail is generally competitive with road over medium to long distances, but not if trains can travel at only 10–20 km/hr. For rail to compete effectively, it must not only get up to speed — 40 km/hr is often considered "fit for purpose" — but also provide a reliable and secure service.

Probably the single largest disappointment to governments has been the lack to date of non-IFI-related funding of infrastructure. With the exception of the Sitarail *affermage*, concession agreements clearly put the responsibility of financing track maintenance and renewal on private operators.[88] Likewise, all rolling-stock financing has been left to concessionaires. But with the exception of the Beitbridge Railway (which relies on "take or pay" clauses), Nacala (which was being funded at semicommercial rates), and Zambia (where the investment program is modest and being funded directly by the concessionaire), most concessions rely heavily on IFI loans, with below-market borrowing costs, lengthy loan tenors and lengthy grace periods, to finance infrastructure. Loans have been provided to purchase new rolling-stock in some cases, but for many of the low-volume operators the sensible alternative is to find secondhand equipment.[89] Much of the investment to date has been spent on maintenance and renewal backlogs that must be completed to keep the railways functioning; it can thus be characterized as "one-time" investment needed to get the systems back on their feet. Even when investment has been made, it has often been slow to mobilize, for example, over four years in Cameroon and five years on the Nacala line. This is a long time to wait when a business is barely breaking even.

In sum, few if any concessions have been generating the cash flow needed to make infrastructure investments from their own resources. Another shot of investment will be required in many cases, either during the current concessions or at the end, to prepare them for the next concessionaire. However, would-be investors are clearly averse to paying for infrastructure with a life span significantly beyond the length of the concession and for which they may not be adequately compensated, given the rapid pace at which the political and economic environment can change.

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[88] Even Sitarail has been financing track renewal, as it has had to service the government debt linked to it.

[89] Secondhand equipment is not always readily available for low-axle-load narrow-gauge lines, however.

Four key issues

It is becoming clear that classic concession schemes (that is, those that require the private operator to take on a significant debt burden in relation to revenues) in Sub-Saharan Africa are unlikely to be financially attractive to bidders, except in cases in which concessionaires can secure financial benefits not directly linked to the railway operations (for example, by controlling the entire distribution chain or through the supply of rail equipment). Consequently, unless the financial structure of Sub-Saharan African rail concessions is changed and/or the market environment in which they operate is favorably altered, the limited interest shown by private operators in railway concessions will continue. Two major operational issues are how to provide passenger services and how to do major track renewals and rehabilitation in a cost-effective way; most concessions require public funding for both. However, if such funding is provided, governments will need to strengthen their regulatory capacity to ensure that concession conditions are met. Finally, they must also consider how policies under consideration in other sectors of the economy will impact the rail sector in general, and concessionaires in particular.

Passenger services

As discussed in chapter 6, few passenger train services cover even their above-rail operating costs. Their contribution to infrastructure costs is generally minimal and few services would justify investment in new rolling-stock, be it locomotive-hauled or self-propelled. If these are to be operated for more than the initial years of a concession, governments will need to develop a simple compensation scheme, for which payments need to be made in a timely manner and with a minimum of fuss. Any scheme should be capable of being easily audited and should be reviewed periodically (say, every five years). One option is to allow the concessionaire to keep all the revenue but be given a contribution by government on, say, a per carriage-km basis toward the cost of running the passenger service.

If such schemes are not introduced, passenger services will be a constant bone of contention between the government and the operator, diverting the focus of the concessionaire from freight services, the improvement of which is of far greater economic importance to the country.

Capacity and/or willingness of private operators to finance track renewal

It is unclear whether, having been gifted or loaned (at concession rates), investment, rail systems will be able to finance major future infrastructure renewals themselves, either through concessionaire injections or from their internally generated returns. The evidence to date is that few, if any, concessions are generating significant profits for their operators and certainly not enough to fund long-term renewals. While most concessionaires pay concession fees into general government revenue, none could probably afford to if they were properly accruing funds for future renewals. This is particularly true now, when for the first time in over a decade, overall traffic has reduced due to the global economic slowdown. Even though traffic will undoubtedly recover in the medium term, it is unclear if a privately financed rail-concession model would be sustainable in much of Sub-Saharan Africa in the long term.

One of the main problems is that track structures have (or should have) lives of several decades for the traffic volumes typically carried on an Sub-Saharan railway. If track is renewed with new 43 kg/m welded rail and concrete sleepers, it should have a service life of at least 50 years and probably more, for a railway carrying up to 5 million net-tonnes (or traffic units) every year, which is well beyond the term of most concessions. Even the existing track on some Sub-Saharan railways has lasted for 100 years, in spite of being obsolete and made of weaker material than that used in the present day. On a small system, therefore, track renewal is an irregular event than occurs somewhere on the network only every 20 years or more. Conversely, it is almost always possible to defer renewals for several years, albeit at the cost of deteriorating track conditions and reduced operating speeds. For any concessionaire uncertain of the future, the safest decision is generally to do as little track renewal as possible.

Even if they wish to renew track, and have public-backed debt-financing instruments at their disposal, concessionaires will often struggle to generate sufficient cash flow to undertake track renewal (which costs $200,000 or more per km) in addition to paying concession fees. Few concessions have strong underlying business fundamentals. Meanwhile, governments' inclination to make the level of concession fee and/or rolling-stock purchase price the ultimate measure of a successful deal further limits the successful bidder's ability to renew infrastructure. On a large network, track will be renewed somewhere almost every year and this can be financed on a regular basis from current earnings. But when the expenditure may not take place for 5 or 10 years, it is unlikely that any concessionaire is going to earmark funds on an annual basis and let them just sit in a bank account. And financing the debt for such an expenditure (with limited resale value for a lending institution) would only be possible through a general corporate loan, which would be almost impossible to obtain for a small stand-alone railway financially ring-fenced from its shareholders.

This problem is not unique to Sub-Saharan Africa. When the New Zealand railway was sold in 1993, its infrastructure was in extremely good condition. By 2004, when the infrastructure was bought back by the government, the infrastructure was in poor shape. In both Victoria and Tasmania in Australia, the concessionaire also put almost no money into either maintaining or improving the infrastructure before returning it to the state (in the case of Victoria), or requiring the government to provide annual maintenance funding (in the case of Tasmania).

While it is desirable that concessions limit up-front cost to governments while putting the financial responsibility of the planned infrastructure investment squarely on private operators, the reality is that few concessions actually have the capacity or inclination to finance this under current policies. Either returns from the concession need to be boosted, or supplementary funding sources developed, or both.

The region's railway concessions currently offer two models for financing infrastructure:

- Governments finance the initial track rehabilitation and renewal costs, generally by securing specific-purpose loans from IFIs. These loans are on-lent to concessionaires and tend to cover only the initial five-year investment plan, with the hope that traffic growth will enable the concessionaire to self-finance future track investments. This approach is commonly used for railways with a high ratio of initial track investment to revenues, and which are thus unlikely to mobilize sufficient private financing.
- Governments do not finance initial track renewal but commit to compensate concessionaires for their investment by the end of the concession (for example, KRC/URC, TRC, and Zambia railways). The initial investment is relatively small in relation to expected revenues, and private operators are assumed to be able to secure private financing on the merits of their business case.

Under both models, governments usually agree to purchase the concessionaires' nonamortized portion of any infrastructure investment financed by the end of the concession. The ability of many governments to make such payments is, however, uncertain and this often affects infrastructure investment in the later stages of concessions in other sectors. One solution, used by Uganda and Kenya in the KRC/URC concession, is to obtain a partial risk guarantee (PRG) from the World Bank to securitize payment obligations to the concessionaire.[90] Although this solution considerably strengthens governments' commitment to the reimbursement of track investment , the surest way for a government to secure privately financed track investment remains ensuring that: (i) the concession (and thus the proposed track investment) is financially sound; (ii) the nonamortized value of the assets owed to the concessionaire by the government at the end of the concession period remains reasonable; and (iii) the concession agreement allows for a possible extension of the concession period.

Many concessions, however, are likely to fail at the first hurdle of underlying financial soundness. If the government still wishes to pursue a concession because of the external benefits of rail transport (chapter 3 showed these can be about one-third of the total benefits of track renewal if a significant volume of road freight transfers to the rail following the investment), it will then need to contribute grant funds. One option is to partly finance infrastructure renewal independently from the concessionaire through a land transport renewal fund, which could be an extension of a road fund with a common pool covering both the road and rail sectors (for example, concession payments could be paid into the fund rather than into general revenue). A rationale for this could be the savings in external costs generated by using rail rather than road, representing about one-third of the total benefits from typical rail investment.

Effective and efficient regulation of private rail operators

While, in theory, there are government-established bodies as counterparties to the concessions, in practice many concessionaires ignore their reporting obligations. This is due, in some cases, to operator intransigence (for example, the concessionaire in Zambia initially refused to acknowledge the authority of the counterparty) and in others to a lack of expertise and/or initiative (in one case, after four years, no annual report had been filed by the concessionaire or pursued by the relevant ministry). In such circumstances, it is not surprising that both politicians and bureaucracies are often ill-informed about the problems facing concessionaires or how these are being handled. Most concession agreements have a long list of requirements with which the concessionaire must comply (there were 34 in the case of Zambia, at least in the initial years of the concession). A lack of reporting will inevitably create scope for argument sooner or later. The main need here is to strengthen the regulatory bodies' capacity as well as to ensure annual independent financial and operational audits are clearly stipulated in concession contracts. Funding regulatory bodies is a problem for cash-strapped governments. One option is to use the concession fees for this, but it is probably preferable not to rely on such an uncertain source and instead use funding from a land transport fund, if one can be established.

As well as analyzing the financial and operational reports provided by railway operators, regulators should gather information from users (particularly freight customers) to monitor tariff and service-quality performance as well as review the level of intermodal competition.

[90] This guarantee also made it possible for the governments to waive the fees normally paid by the operator during implementation in favor of an end-of-contract payment by the operator for the amortized value of the assets transferred to the operator by the government. Although this option was not taken up, it provided a partial solution to the problem of generating cash for investment during the early years of the concession (section 7.5).

Consistent government oversight of railway concessionaires aligned with good business practices

The performance of a number of concessions has been negatively affected by uncoordinated actions from various government ministries. Examples range from administratively imposed salary increases to restrictions on access to container facilities and unfunded public service requirements imposed on rail operators. Most of these actions could have been avoided if a properly staffed, funded, and authoritative oversight body had existed (the concession counterparty is generally the obvious choice for this). Governments should ensure that such a body has the necessary political and technical powers to control government actions toward private rail operators. In practice, this means that the body should meet frequently (say, monthly) to discuss any pending issues with the concessionaire. They should include, or have ready access to, a railway technical expert, a railway financial expert, and a head whose sole work should be to monitor the railway concession and who should report directly to the transport and finance ministers.

At a more strategic level, governments should also develop a coherent and realistic policy for infrastructure cost recovery. Road operators in Africa, as in many other places, are notorious for overloading, which damages road infrastructure. But road operators have an articulate and well-organized lobby; counterarguments from government railways, if existent, are generally ineffectual and poorly prepared. However, the lower the road tariffs are (and the greater the degree of overloading permitted), the lower the freight rates for both road and rail will be and the less funds will be available from a concessionaire to maintain and upgrade the railway whilst at the same time the greater the damage to the road system.

In spite of these problems, well-run railways still offer the most economical solution to transporting non-time-sensitive general freight over distances greater than 500–800 km (and over much shorter distances for bulk commodities). As such, their revival through concessioning is warranted whenever the relevant business fundamentals are sound. At the same time, better solutions must be devised to ensure that while governments continue to benefit from the substantial economic rates of return from these concessions, private operators' financial returns are high enough to attract broader and more competitive investor participation.

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Appendix 1 Rail networks in Africa

Countries	Companies	Lines (km)		Network density		Gauge mm
		Total	Operating	Km/000 km^2	Km/ million pop.	
North Africa						
Algeria	SNTF	3,973	3,572	1.5	104	1,435/1,055
Egypt	ENR	5,063	5,063	5.1	61	1,435
Morocco	ONFCM	1,907	1,907	4.3	55	1,435
Tunisia	SNFT	2,165	1,991	12.1	190	1,435/1,000
West Africa						
Benin	OCBN	579	438	5.1	66	1,000
Burkina Faso	SITARAIL	611	639	2.2	39	1,000
Ghana	GRC	947	947	4.0	40	1,067
Guinea Conakry	ONCFG	662	383	4.3	104	1,000
	Bauxite (3)	383				1,435/1,000
Côte d'Ivoire	SITARAIL	611	639	1.9	30	1,000.000
Liberia	Iron ore (3)	428	0	3.8	124	14,35/1,067
Mali	Transrail	*584*	*584*	0.5	51	1,000
	RCFM	*57*	*57*			
Mauritania	SNIM	704	704	0.7	225	
Nigeria	NRC	3,505	3,505	3.8	23	1,067
Senegal	Transrail	645	645	5.4	77	1,000
	SNCS/SETINCS	408	408			1,000
Sierra Leone	MMR	*84*	*0*	1.2	13	1,067
Togo	CFT	*492*	*77*	9.2	87	1,000
	CFTB	*30*	*30*			1,000
Central Africa						
Cameroon	CAMRAIL	1,100	1,016	2.3	58	1,000
Congo, Rep. of	CFCO	795	610	2.3	198	1,067
Congo, Dem. Rep. of	SNCC	3,641	2,200	2.1	73	1,067
	CFMK	366	366	1.9		1,067
	CFU	1,028	0			760
Gabon	SETRAG	649	649	2.4	428	1,435
East Africa						
Djibouti	CDE	100	100	4.3	194	1,000
Eritrea	ERA	117	n.a.	1.0	21	950
Ethiopia	CDE	681	681	0.6	8	1,000
Kenya	RVRC	2,065	2,065	3.8	57	1,000
	Magadi	171	171			
Tanzania	TRC	2,605	2,605	3.8	87	1,000
	TAZARA	969	969			1,067
Uganda	URC	1,244	261	5.3	38	1,000

Southern Africa						
Angola	CFB	1,333	246	2.3	222	1,067
	CFL	479	181			1,067
	CFMO	907	425			1,067
	Amboin	122	0			760
Botswana	BR	882	882	1.5	443	1,067
Malawi	CEAR	797	797	6.7	56	1,067
Madagascar	MADARAIL	723	723	1.5	43	1,000
	Other	163	163			1,000
Mozambique	CCFB	987	314	3.9	144	1,067
	CDN	871	611			1,067
	CFM	1,129	1,129			1,067
	Other	140	0			760
Namibia	Transnamib	2,382	1,683	2.9	1,129	1,067
South Africa	SPOORNET	20,247	20,247	17.7	440	1,067
	METRORAIL	1,318	1,318			1,067
Swaziland	SR	301	301	17.3	268	1,067
Zambia	RSZ	1,351	1,351	3.2	203	1,067
	TAZARA	893	893			1,067
	ZR	163				1,067
Zimbabwe	NRZ	3,077	2,759	8.3	283	1,067
	BBR	150	150			1,067

Appendix 2 Production structure (average, 1995–2005)

		Transport task (million units)		Proportion of total task		Average haul (km)	
		Passenger-km	Net tonne-km	Passenger (%)	Freight (%)	Passenger	Freight
Algeria	SNTF	1,190	2,060	37	63	35	250
Morocco	ONFCM	2,098	4,927	30	70	253	171
Tunisia	SNFT	1,172	2,262	34	66	32	188
Egypt	ENR	40,837	4,067	91	9	91	388
Benin	OCBN	85	131	39	61	160	591
Botswana	BR	96	854	10	90	182	398
Congo, Rep. of	CFCO	178	254	41	59	234	436
Congo, Dem. Rep. of	SNCC	145	407	26	74	323	340
Congo, Dem. Rep. of	CFMK	16	87	16	84	98	328
Ethiopia	CDE	118	100	54	46	229	400
Ghana	GRC	124	187	40	60	73	152
Kenya	KRC	330	1,406	19	81	633	675
Madagascar	FCE	7	1	88	13	68	89
Mozambique	CFM	58	423	12	88	41	155
Mozambique	CCFB	40	235	15	85	38	281
Namibia	Transnamib	49	1,000	5	95	401	592
Nigeria	NRC	131	59	69	31	66	699
South Africa	Spoornet	1,386	104,049	1	99	326	575
Sudan	SRC	104	1,250	8	92	462	783
Swaziland	SR	0	673	0	100	0	169
Tanzania	TRC	470	1,297	27	73	647	993
Tazara	Tazara	400	822	33	67	290	1,334
Uganda	URC	5	187	3	97	155	241
Cameroon	Camrail	314	946	25	75	245	592
Gabon	Setrag	81	1,716	5	95	392	551
Côte d'Ivoire	Sitarail	118	491	19	81	360	773
Madagascar	Madarail	9	26	26	74	145	212
Malawi	CEAR	24	61	29	71	55	170
Mozambique	CDN	100	143	41	59	110	521
Senegal	Transrail	269	606	31	69	519	1,650
Zambia	RSZ	186	533	26	74	284	337

Appendix 3 Freight composition, select railway companies (as % of total tonnage)

Country	Company	Timber	Cement and constr. material	Fertilizer	Petroleum products	Ores and minerals	Agric. products	Others	*Total*
West Africa									
Ghana	GRC	3	–	–	–	92	1	4	100
Benin	OCBN	–	22	–	31	–	–	47	100
Côte d'Ivoire–Burkina Faso	Sitarail	–	11	7	23	1	43	15	100
Mali–Senegal	Transrail	–	9	14	14	2	13	48	100
Central Africa									
Cameroon	Camrail	37	2	4	26	–	19	12	100
Congo, Rep. of	CFCO	41	2	1	12	1	2	41	100
Congo, Dem. Rep. of	CFMK	11	6	–	4	24	–	55	100
Gabon	SETRAG	30	–	–	–	60	–	10	100
Congo, Dem. Rep. of	SNCC	2	3	–	8	85	–	2	100
Southern Africa									
Malawi	CEAR		23	6	2	5	42	22	100
Ethiopia	CDE				12		62	26	100
Zambia	RSZ		7	1	13	43	7	29	100
Mozambique	All		4		1	52	23	18	100
Tanzania	TRC	1	7	–	14	2	27	49	100
Uganda	URC	–	11	3	5	4	38	39	100
Botswana	BR	–	14	–	20	37	9	20	100
Madagascar	Madarail	–	9	–	24	38	14	15	100

Sources: Various.

Appendix 4 Average yields (1995–2005)

Country	Company	Passenger (US cent/pkm)	Freight (US cent/ntkm)
Algeria	SNTF	1.7	2.7
Morocco	ONFCM	2.8	3.3
Tunisia	SNFT	2.2	1.9
Benin	OCBN	2.0	5.8
Botswana	BR	1.3	2.4
Congo, Rep. of	CFCO	5.6	10.7
Congo, Dem. Rep. of	SNCC	3.1	12.5
Congo, Dem. Rep. of	CFMK	4.2	13.7
Ethiopia	CDE	3.1	12.5
Ghana	GRC	2.4	4.4
Kenya	KRC	0.6	3.8
Mozambique	CFM	1.0	3.0
Mozambique	CCFB	0.5	3.3
Swaziland	SR		1.6
Tanzania	TRC	1.6	4.0
Tazara	Tazara	1.1	3.0
Uganda	URC	2.3	15.2
Cameroon	Camrail	2.2	5.2
Gabon	Setrag	8.6	2.5
Côte d'Ivoire	Sitarail	3.3	5.5
Madagascar	Madarail	–	5.1
Malawi	CEAR	1.0	5.8
Mozambique	CDN	0.9	5.4
Senegal	Transrail	2.2	3.3
Zambia	RSZ	0.8	3.9

Appendix 5 Rail links proposed by the Union of African Railways in 1979

	Route	Countries
1	(i) Bamako–Sissako–Bobodioulasso	Mali–Burkina Faso
	(ii) Sissako–Ouagadougou	Mali–Côte d'Ivoire
	(iii) Parakou–Niamey–Ansongo–Gao	Benin, Niger, and Mali
	(iv) Ouagadougou–Dori–Niamey	Niger–Burkina Faso
2	(i) Ouagadougou–Koupela–Diapaga–Dosso	Niger–Burkina Faso
	(ii) Anecho–Segboroue	Togo–Benin
	(iii) Pobe–Ilaro	Benin–Nigeria
3	(i) Kaura Namoda–Dosso–Niamey	Niger–Nigeria
	(iii) Zaria–Gaya–Dosso	
4	Maiduguri–Ndjamena–Nyala	Nigeria, Chad, and Sudan
5	Dimbokro–Man–Nzerekore–Tambacounda–Nouakchott–Nouadhibou–Marrakech	Côte d'Ivoire, Liberia, Guinea–Senegal–Mauritania, and Morocco.
6	Kousoussa–Bamako	Guinea–Mali
7	(i) Sunyani–Ouagadougou	Ghana–Burkina Faso
	(ii) Accra–Tema–Lomé	Ghana–Togo
	(iii) Abidjan–Takoradi	Côte d'Ivoire–Ghana
8	Blitta-Pama–Diapaga–Dosso	Togo, Burkina Faso, Niger
9	(i) Yaoundé–Bangui	Cameroon –CAR
	(ii) Dein–Bangui–Belinga	Sudan–CAR–Congo–Cameroon–Gabon
		Gabon–Cameroon
	(iii) Belinga–Yaounde	
10	Aswan–Wadi Halfa	Egypt–Sudan
	Wau-Suba–Gulu	Sudan–Uganda
	Juba–Mugbere	Sudan–DRC
	Gulu–Arua–Mugbere	Uganda–Sudan–DRC
11	Sfax–Tripoli–Salum	Tunisia–Libya
12	Salima–Lilongwe–Michindji–Mpika	Malawi–Zambia
13	(i) Akordat–Tessenei	Ethiopia
	(ii) Addis Ababa–Nairobi	Ethiopia–Nairobi
14	Ilebo–Kinshasa and Brazzaville	DRC–Congo
15	Serpa-Pinto (Angola)–Kataba (Zambia), linking Angola and Zambia	Angola–Zambia
16	Gobabis (Namibia) and Francis-Town (Botswana), linking Namibia and Botswana	Namibia–Botswana
17	Tsumed–Serpa Pinto–Kinshasa–Brazzaville–Mbinda- Franceville	Namibia, Angola, DRC, Congo, and Gabon.
18	Gao–Abadla	Mali–Algeria