

THE INTERNATIONAL UNION OF RAILWAYS  
UNION INTERNATIONALE DES CHEMINS DE FER



INTERNATIONAL UNION  
OF RAILWAYS

# **THE RAILWAYS OF AFRICA “VISIONS 2025”**

**Background paper, UIC strategy**

**Preliminary version**

12. July 2007

## 1 Introduction

The paper is a start-up document concerning UIC's future strategies for the African railways.

This paper is prepared for the International Union of Railways by a working group reporting to Secrétaire Général Mr. André Michel, UIC. The project manager is Mr. Stig Nerdal. The project team consists of staff from Transportutvikling AS; Mr. Kjell Heggelund, Mr. Jan Terje Henriksen and Mr. Jean Manirakiza and Mr. Adame Diagne from UIC. During the working period, the project team has been assisted by the following experts from the African railways:

- Mr. Devan Naidoo, Executive Manager, Spoornet, South Africa
- Mr. Adam Tamou Tabe, CEDEAO, Nigeria
- Mr. Ahamado Ouedraogu, Technical Director, Sopafer-B, Burkina Faso
- Mr. Said Chaidid, ONCFM, Morocco
- Mr. Linford Mboma (or Kesy), TRC, Tanzania
- Others to be included

X expert group meeting have been held as well as several meeting with African railways and organizations.

A preliminary report/structure was presented for the UIC Regional Assembly for Africa in Rabat on April 17. 2007.

The final report will be presented for the General Assembly of UIC Africa in Johannesburg, South Africa, on November 21-2007.

Information obtained from the railways of Africa is of different quality and for some countries satisfactory figures is not possible to obtain. During the next phases of UIC's strategic work for the African railways, the information should be assessed and refined through UIC's organizational network according to future requirements

The study has been made during January through August 2007.

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**3 Executive summary**

To be completed

**4 Résumé exécutif**

To be completed

## 5 Background and objectives

The preparation of the UIC strategy for the African railways should be linked to a common vision for these railways. This is not a simple task, due to various and heterogeneous conditions among these countries and railways.

A vision document is not a plan. It is background document for future strategies and work. The document will include a brief overview of the African railways, major conditions which is believed to have impact on railway development and prospect for the future.

Furthermore, an ambition is to generate additional and updated information which is relevant for UIC's strategy for the development of the African railways.

There is a strong focus on economic growth perspectives, development within the energy sector, population growth, urbanization as well as environmental issues.

However, the future strategies for UIC and the African railways should be identified, be clearly stated and contribute to UIC's various sub-strategies for Africa. Further development has to be done by UIC-Africa together with the UIC HQ in Paris.

All relevant African railways/countries are included. However, many countries do not have easy accessible information and the reliability of some information can be questioned.

For the purpose of this report, Africa is defined as 53<sup>1</sup> countries.

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<sup>1</sup> See enclosure I



## 6 Methods and hypothesis

The relationships between transportation and the economic/socio-economic conditions are very complex and poorly understood. Some of these relationships are also clearly circular. Transportation is a massive enterprise with substantial direct and indirect effects on economic productivity and economic growth. Transportation industries, the provision of transportation services, the manufacture of vehicles, and the construction of infrastructure, are major economic activities in themselves.

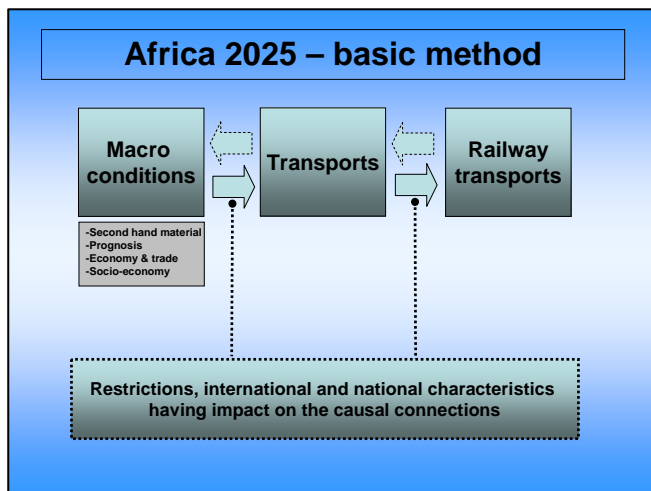


Figure 6-1: Relation between transport and macro-conditions

Transportation is a cost, to a greater or lesser extent, of virtually any commercial activity. Transportation is also an enabler of economic activity and a facilitator of international trade.

Transportation is a measure of economic activity and it may often be a leading indicator.

The method is based on the development of a simplified model where the basic input is second hand macro data produced by global organizations like UIC, United Nations, African Development Bank, World Bank, IMF etc. Macro data like population- and GDP growth are considered most important. The perspective in time is 2025.

The output from the model intends to indicate any connection between these macro variables and railway transport; -passenger transport as well as freight transport.

Furthermore the projections will be refined and restrictions established. These restrictions are established based on general theory as well as first hand information collected from market players and governmental institutions. The output intends to indicate prospects for railway transport in Africa as well as strategic decisions that might be taken.

It is not an objective, and it is not possible, to produce exact data's for the future. The ambitions are to generate some information and initial guide lines for UIC's further work in Africa, together with its members and cooperation partners, by looking into a few macro variables and empirical information.

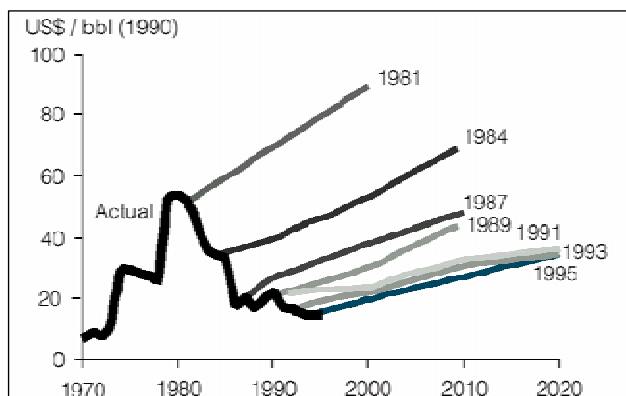


Figure 6-2: Projection for the future - difficulties

The purpose is not necessarily to pinpoint the most likely future actions, but to highlight the forces that push the future in different directions.

Millions of probability prognosis has been made through history without success. Even though historical data can give us an indication of the future, unforeseen incidents often arise.

Previous oil price predictions are an example. When the price hike reached 60 US \$ /bbl in the late seventies, many predicted this trend to continue into the next decade (see figure left). The actual

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progress after 1980 turned out to be a significant decrease and the prognosis failed. This illustrates the difficulties making prognosis when several multi- variables are included, such as the oil price.

This paper aims to look into different drivers<sup>2</sup> influencing the future of railway traffic in Africa towards 2025. These drivers are uncertain and complex.

The list of drivers will never be complete and analysts will have different views. For the purpose of looking into the railways future, freight and passengers, the main focus have been put on variables which is possible to identify, quantity and rank, -like GDP, energy, population etc. Drivers which are discussed are:

- Transportation issues
  - competition, technology, infrastructure and operational conditions
- Demographical and environmental issues
  - population, urbanization and environmental development
- Energy and economy
  - oil prices, energy security, GDP, market, international trade and economic structure
- Other conditions – restrictions
  - political conditions, security etc

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<sup>2</sup> The drivers are those variables which have an effect on how the future will unfold in a particular area. In other words, -variables that will have impact on the future of the African Railway.

## 7 The world and the African market

### 7.1 African continent and regions

Africa is the world's second largest and second most-populous continent, after Asia. It covers 6.0% of the Earth's total surface area, and 20.4% of the total land area. Its area, including Madagascar and the other adjacent islands, is more than 30 million km<sup>2</sup>, or three times that of Europe. The coastline is regular, with no deep seas or bays. Africa has longer coastlines than any other continent, total length being about 25,600 km.



To the North lies Sahara, the largest desert in the world. Equatorial area is covered by tropical rain forests. Farther South there are areas of highlands and coastal plains, several huge lakes to the East. Some of the world's longest rivers drain the continent, including the Nile, Niger, Congo and Zambezi.

Africa is connected with Asia by the Isthmus of Suez, and separated from Europe by the Mediterranean Sea. Africa is a submerged continent surrounded by the Atlantic Ocean to the West, the Indian Ocean and the Red Sea to the East and the Mediterranean Sea to the North. Its greatest length from North to South is 8,000 km and its breadth from Cape Verde to Ras Hafun is 7,440 km.

Figure 7-1: The size of Africa (Source: The Times Atlas)

Africa has a rapidly growing population of more than 900,000,000 people (as of 2006) living in 61 territories (14% of the world's human population). Africa constitutes of 53 countries where 7 are islands (Madagascar, Cape Verde, Comoros, Mauritius, Re-Union, Seychelles and Sao Tome & Principe) and 15 are landlocked (Botswana, Burkina Faso, Burundi, Central African Republic, Chad, Ethiopia, Lesotho, Malawi, Mali, Niger, Rwanda, Swaziland, Uganda, Zambia and Zimbabwe).

Most people still live a traditional life rural lifestyle, though many Africans move to cities in search of employment. Most people live where water is available, in the Nile Valley, the coasts of North and West Africa, along the Niger, in the eastern highlands, and in South Africa. More than 3,000 unique ethnic groups are recognized in Africa. The customs, languages, religions and cultural mores of people on the continent are quite different from country to country and from region to region. Due to their colonial pasts, the majority of the countries have adopted French, English, Spanish or Portuguese as national languages.

In 1963 (May 25) the Organization of African Unity (OAU) was established in Addis Abeba to promote unity and cooperation among Africa states. From 32 independent Member States in 1963, the independent Member States of Africa are now 53. The OAU initiatives paved the way for the birth of African Union (AU) in July 2002 in Durban (South Africa). The new scope of AU is to unify its 53 member states politically, socially and economically, and attract foreign aid and investment through the promotion of democracy, human rights and good governance. The African Union (AU) constitutes

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all African countries except Morocco which withdrew from OAU in 1982. The AU has its headquarters in Addis Abeba (Ethiopia) and is now modeled on the European Union (Assembly, Executive Council, Pan-African Parliament, Court of Justice, Commission, Permanent Representatives Committees, Specialized Technical Committees, Economic, Social and Cultural Council, Peace and Security Council and Financial institutions). There is a policy in effect to decentralize the African Union's institutions so that they are shared by all the states.

The African Union is expected to develop stronger integration in Africa, in the context of globalization and the world economy. Results will prove that the AU is the right means to shape Africa's future in changing the current hypothetical situation. Indeed, failed state policies, inequitable global trade practices, and the effects of global climate change have resulted in many widespread famines, and significant portions of Africa remain with distribution systems unable to disseminate enough food or water for the population to survive. What had before colonialism been the source for 90% of the world's gold has become the poorest continent on earth.

Despite numerous hardships, there are positive signs. Democratic governments seem to be spreading, though they are not yet the majority (The National Geographic Society claims 13 African nations can be considered truly democratic). Many nations have recognized basic human rights for all citizens and have created independent judiciaries. There are also clear signs of increased networking among African organizations and states.

While rapid growth in China and now India, and moderate growth in Latin America, has lifted millions beyond subsistence living, Africa has not followed the same path in terms of market development,



Figure 7-2 African regions

foreign trade, investment, and per capita income. This poverty has widespread effects, including lower life expectancy, violence, and instability as well as numerous challenges related to transportation and trade between different geographical regions in Africa.

African economies need to be revitalized to meet the challenges of the global economy. The continent needs to produce high quality goods for its use and for export. Member states need to increase trade among them. That's the objective of the different regional organizations initiated in the different African regions to facilitate the integration. Africa is divided in 5 main regions (figure 7-2): The Northern Africa, The Western Africa, The Central Africa, The Eastern and the Southern Africa.

|                              |  |
|------------------------------|--|
| <b>Northern:</b>             | Arab Maghreb Union (AMU).  |
| <b>Western:</b>              | Economic Community of West Africa States (ECOWAS)<br>Community Sahel-Saharan States (CEN-SAD)      |
| <b>Central:</b>              | Economic Community of Central African States (ECCAS).  |
| <b>Eastern:</b>              | East Africa Community (EAC).<br>Intergovernmental Authority on Development (IGAD) (Horn of Africa) |
| <b>Eastern and Southern:</b> | Common Market for Eastern and Southern Africa (COMESA)   |
| <b>Southern:</b>             | Southern African Development Community (SADC).   |

Table 7-1 African regional organizations

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An integrated Africa has always been an ambition of the African Union. This political, social and economical integration is expected to be built at continental level (The African Union) and at regional level; for this purpose, Regional Economic Communities or African regional organizations (figure 7-2) have been created with the prospect of widening domestic markets towards credible regional integration communities:

- In the **Northern region**, the treaty establishing the Arab Maghreb Union was signed by the heads of state of Algeria, Libya, Mauritania, Morocco and Tunisia in February 1989, as a Pan-Arab trade agreement aiming economic and political unity in the northern Africa.

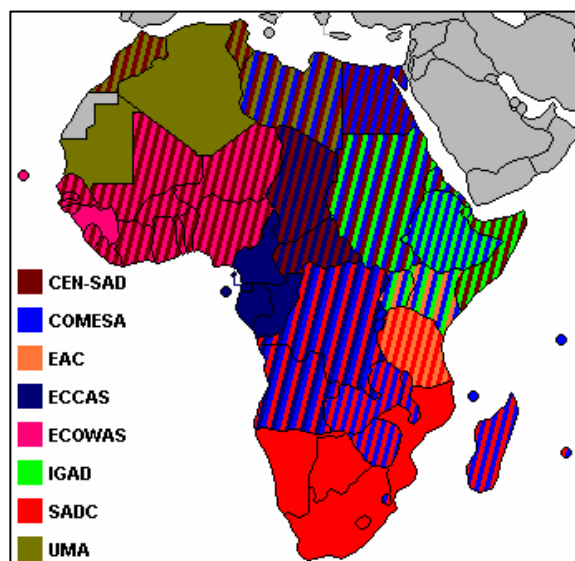


Figure 7-3 African regional organizations

- In the **Western Africa** are founded two organizations:
  - The Economic Community of West African States (ECOWAS) was founded by a treaty in May 1975 and includes 15 West African countries (Benin, Burkina-Faso, Cape Verde, Côte d'Ivoire, Gambia, Ghana, Guinea, Guinea-Bissau, Liberia, Mali, Niger, Nigeria, Senegal, Sierra Leone and Togo. The treaty aims an economic integration and a political cooperation.
  - The community of Sahel-Saharan States (CEN-SAD), a framework for integration and complementarities was established in February 1998 to strengthen peace, security, stability and to achieve global economic and social development. The headquarters of the community is in Mali (a West African Country), but gathers together eighteen countries from four different regions (West, North, East and centre). Those countries are Benin, Burkina Faso, Central Africa Republic, Chad, Djibouti, Egypt, Eritrea, Gambia, Libya, Mali, Morocco, Niger, Nigeria, Senegal, Somalia, Sudan, Togo and Tunisia.
- In the **Central Africa** there is the Economic Community of Central African States (ECCAS) created in October 1983 to establish a Central African Common Market. Members are Burundi, Cameroon, Central African Republic, Chad, Republic of Congo, Democratic Republic of Congo, Equatorial Guinea, Gabon, Rwanda, Sao Tome and Principe and Angola.
- In the **Eastern region** are settled two organizations:
  - The East African Community (EAC): Originally formed in 1967 by Kenya, Uganda and Tanzania, the organization will count two more members, Burundi and Rwanda by July 2007 when a newly signed treaty will come into force. The main goal of the community is the cooperation in the priority areas of transport and communication, trade and industry, security and immigration, and the promotion of investment in the region.
  - The Intergovernmental Authority on Development (IGAD): Formed in 1986 around the issues of drought and desertification, the organization was revitalized in 1990 to become a vehicle for regional security and political dialogue and counts 7 countries: Djibouti, Eritrea, Ethiopia, Kenya, Somalia, Sudan and Uganda.

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- In the **Eastern and Southern regions**: The Common Market for Eastern and Southern Africa which succeeded the Preferential Trade Area (PTA) in 1994 links 20 countries from the South, East, even the North of Africa: Angola, Burundi, Comoros, Democratic Republic of Congo, Djibouti, Egypt, Eritrea, Ethiopia, Kenya, Libya, Madagascar, Malawi, Mauritius, Rwanda, Seychelles, Sudan, Swaziland, Uganda, Zambia and Zimbabwe. The COMESA aims to strengthen the process of regional economic integration in order to help member states to achieve sustainable economic growth.
- In the **southern region** is situated the Southern African Development Community (SADC) in existence since 1980. The vision of SADC is to ensure economic well being, improvement of standards of living and quality life, freedom and social justice and peace and security for the peoples of the member states: Angola, Botswana, DR Congo, Lesotho, Malawi, Mauritius, Mozambique, Namibia, Seychelles, South Africa, Swaziland, Tanzania, Zambia and Zimbabwe.

It appears that those regional organizations cover the whole continent and bring together the different African Nations. Some countries are members of more than one organization and this is an affirmation of a common will to come together for integration and for enlargement of national markets beyond frontiers.

To deliver a significant benefits, the economic development within and among those regional organizations supposes an operational transportation system. Unfortunately, transport is a serious challenge to the economic development in different regions. The problem arises in terms of inadequate transport infrastructure, missing links within and between regions, inefficient transport operations, etc. To deliver a significant benefits, the economic development within and among those regional organizations supposes an operational transportation system. Unfortunately, transport is a serious challenge to the economic development in different regions. The problem arises in terms of inadequate transport infrastructure, missing links within and between regions, inefficient transport operations, etc (See chapter 9.1: Transportation issues).

### 7.2 The market

The global trade is growing and particularly container transports. The fastest growing markets are in Asia, - intra Asia as well as Asia's international relations. Europe, Asia and North America are the dominating trade regions of the world.

The 53 countries of Africa count for a marginal share of the world trade. (2.6% in 2005) while Europe alone counts for 43% of the world trade. The trade volume in Europe is 16 times the African trade volume while there are 20% more inhabitants in Africa then Europe.

Figure 7-4 shows world merchandise export and imports measured in billion USD. Africa<sup>3</sup> counts for only 2.9% of the world merchandise exports, 2.4% of the imports and 14% of world population.

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<sup>3</sup> Africa is defined as 53 countries

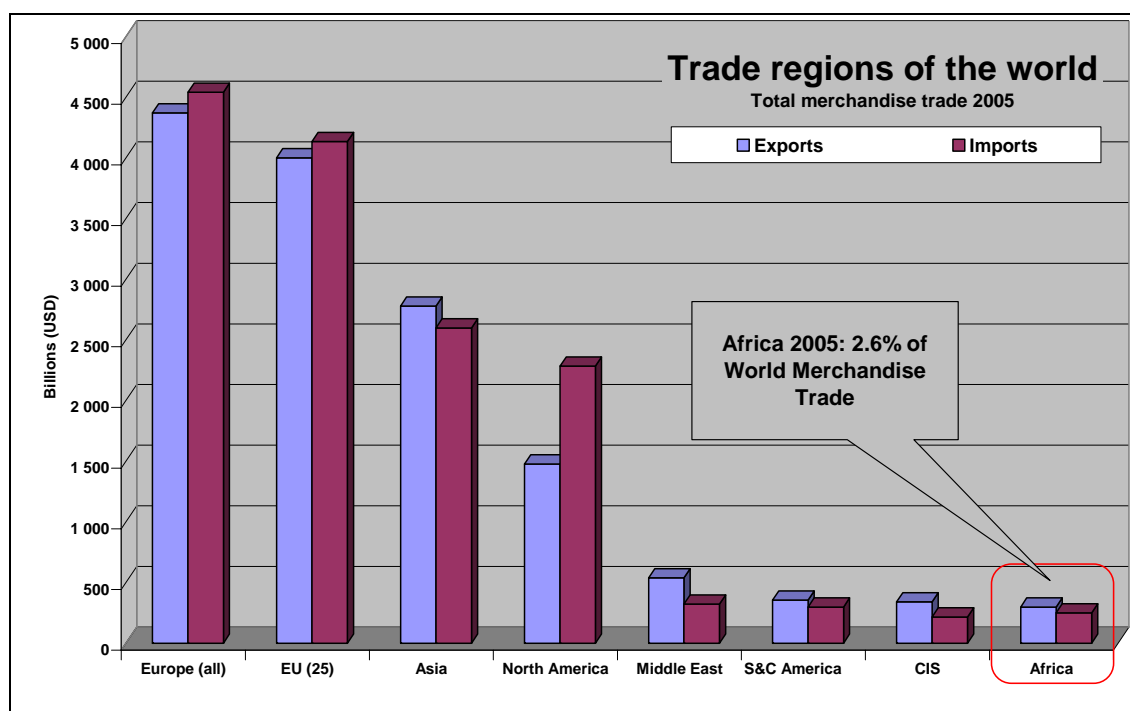


Figure 7-4: Trade region of the world, 2005

The merchandise trade of Africa has been growing below world average. Coming back to history, we note that the Africa's share of global GDP has stagnated since 1970s and has actually declined since 1980. While Africa achieved quite respectable economic growth in the first independence decade-GDP per capital growth of 2, 6% per annum during 1965-74, the trend since then has been generally downward. However, there was modest recovery in the second half of 1990s (Figure 7-5: from 1995) and the growth started to accelerate in 2003 and this situation has continued, but not enough to translate into meaningful increases in per-capita incomes or reduction in poverty.

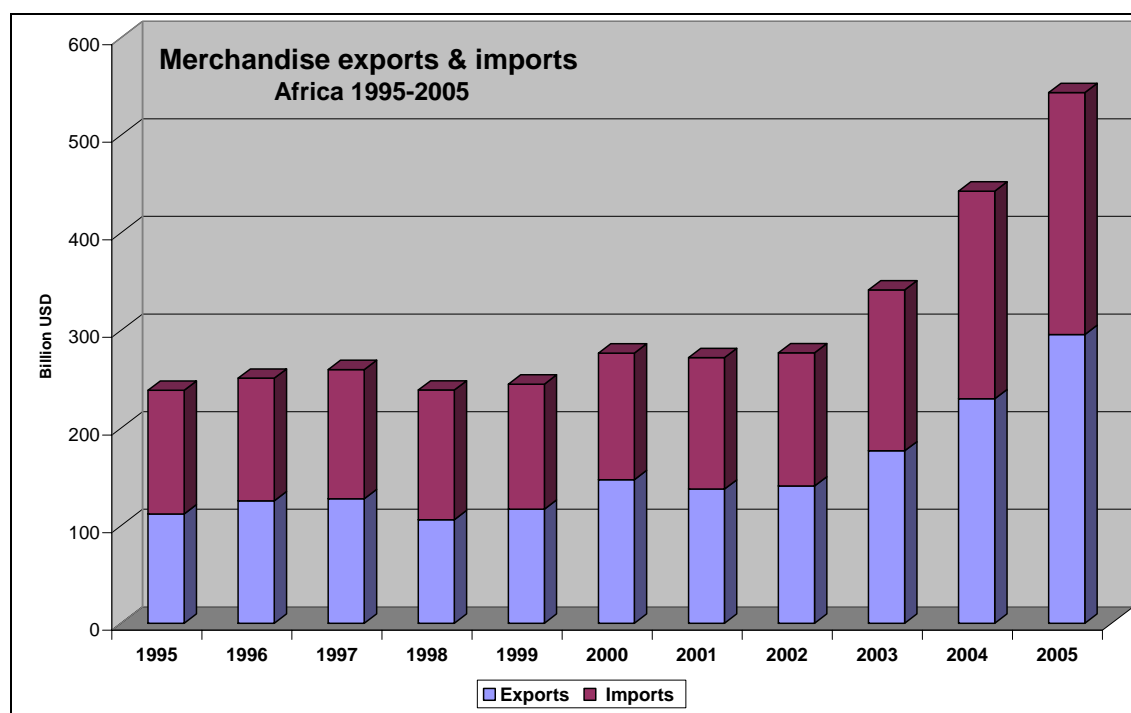


Figure 7-5: African exports and imports 1995-2005

Source: WTO, March 2007



Furthermore, one additional variable which has a strong impact on export growth as well as on foreign investment is the quality and competitiveness of physical infrastructure, and in particular transport infrastructure. Africa transport costs were higher than for other developing regions (for Sub-Saharan Africa 20% higher than for similar goods shipped from other countries) and that the differential has been rising. For landlocked African countries freights costs exceeded 30% of export earnings. The median cost of intra-African trade is much higher than in other regions- 65% higher than in Latin America and 95% higher than in East and South Asia. Customs formalities greatly increase transaction costs for businesses, particularly in landlocked countries. Those differentials are attributed to Africa's inadequate infrastructure. Finally, other transport modes can also confront exporters, as well as producers for local market, with high costs and delays. From 1995 to 2005, the exports increased 1.6 times while imports almost doubled. The main share of this growth is more perceptible after 2002. (Source: Economic Commission for Africa, Report on regional integration trade and infrastructure, 2005)

As a result of the globalization, world trade volume has continued to grow with the gradual removal of trade barriers under the World Trade Organization (WTO) and through regional trade agreements (RTA).

Globalization creates new and longer transportation routes. Africa is generally not included in most global projections and the main focus has been the main trade lanes between Asia, Europe and North America. Asia, is by most projections put in the center of the future development, -particularly when it comes to production of processed goods and parts. The figure below is an indication of routes which are, and may further develop into, major trade and transportation lanes in the future.

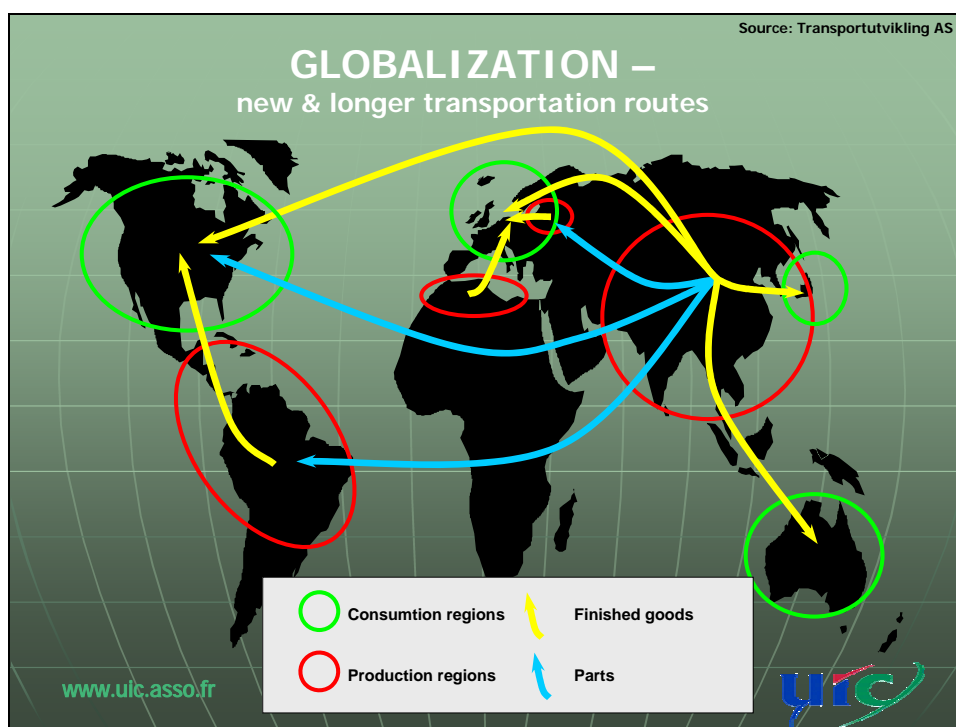


Figure 7-6: Globalization, new and longer transportation routes

The main reason for the development in Asia is related to low production costs and that many developing Asian Countries have adapted to market requirements, liberalized trade barriers and created political and administrative political conditions which are favorable for foreign investments and trade.

It is possible to look at Africa as a global potential production market for the future. The labor costs are favorable and growing labor costs in Asia may put Africa into a relatively better position. However, capturing this opportunity do also depend on the development of a favorable climate for international trade and production in Africa.



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While the rate of world economic growth fluctuated greatly during the post-world war II period, the relationship between economic growth and growth in the value of international trade remained almost constant until 1980s: the value of trade grew approximately 1.5 times as fast as the world economy. However, the 1990s and early 2000s have seen a major change in this ratio: the value of trade is now growing at around 2.5 times the rate of growth of the world economy. As this pattern continues, trade and transportation may be an ever more crucial component of Africa's economic activity and development.

Even though Africa's projected economic growth are lower than the most expansive regions of the world (Asia, CIS etc), this growth, transformed into transportation at a pace on 2-2.5 times, will have a tremendous impact on the entire transportation system in Africa.

By looking at container transport, where the intermodal unit (the container) is perfectly fit for railway transport, the world experienced during the 1990s and in early 2000s that the growth of world container trade accelerated to an average growth rate of more than 9% per year. Ocean transport is dominating the transports between Africa and the rest of the world. Due to geographical conditions ocean transport will continue to dominate the transportation between Africa and Europe/North America/Asia. However, the possible future development is a most relevant opportunity for the African Railways, as regards freight as well as passenger transport.

## 8 The railways of Africa – short description

This chapter includes a historical introduction to the African railways and an overview of the railway system, network density, projects, corridors and production. The last sub-chapter (8.8) is an overview of the new dimension of UIC and UIC's role in Africa.

### 8.1 Historical introduction

#### *8.1.1 Glimpse of railway history in Africa.*

Only few decades after the first successful locomotives were built in Europe respectively in Great Britain and France early in 1800, the British Empire completed the first African rail line in Egypt in 1856, joining Alexandria and Cairo.

On that submerged continent with its coastal ports, most of them established for the slavery trade, and well known by different European navigators, the first recommended strategy to develop colonial activities was the railway lines to link the coast and the interior.

The explorer Stanley (1841-1904), convinced Leopold II, King of Belgium, that the first step to govern his colony in Congo was to build a railway and the Katanga railway was created in 1902.

In different African colonies, the railway was a critical element to unify possessions, facilitate governance, and enable the military to move quickly to hot spots or conduct war, help settlement and foster trade. But the main interest of the railway in the different territories became quickly the raw materials traffic (gold, diamond, cobalt, manganese, copper, cotton, timber ...) from the big mines or industrial centres to the nearest port, as the rulers had control on the subordinates.

The railway infrastructure and operation in Africa was constructed and utilized to satisfy the needs of colonial powers. It was not intended to support a sustainable development of African countries and regions, as well as the continents economical and logistical integration.

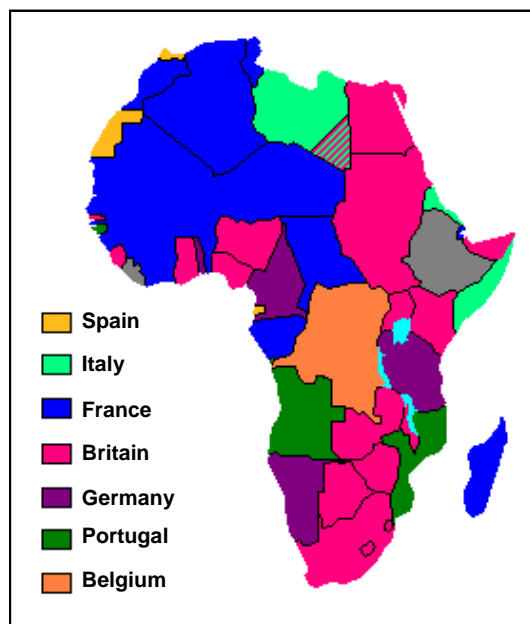
At the time when most infrastructure where built the focus was local and there where little concern related to effective logistical chains. The focus was usually one country and the specific commercial target for the railway investment (e.g. raw materials). Technical standardization, harmonization and issues like effective border-crossings where not on the agenda. Furthermore, there was no focus on commercial interoperability, broader market orientation and the railways as a tool for regional development in Africa.

This historical investment strategy has caused huge differences in standard and operational conditions for the railways in Africa and to some extent, separated countries more than contributed to integration.

Even if the big empires like Great Britain and France were very ambitious in their long connection plans, the railway map of Africa shows that the most African lines are turned to the exit ports. Neither Great Britain nor France has succeeded in their ambitions to join the Cape to Cairo and the West to East.

Interfering interests among the different powers was the main obstacle. The railway distribution respected the territory dividing on the continent (see Figure 8-1) and this explains easily the missing links between the different former colonies.

Another characteristic of the African railways is the archaic infrastructure and design, in accordance



with the old technology and the business need. In many cases the design has always been more for freight business with minimal passenger traffic. Only few countries, especially in the southern and northern Africa have been able to modernise their rail, like the luxury trains in South Africa and the light rail in Tunisia and Egypt. Indeed, the railway management, its maintenance and development have been compromised by some known facts like the economic problems between the world wars, the struggle for independence, the demise of colonialism and political turmoil in many African countries. Consequently and following the economic reforms recommended by donors and international financial institutions since 1980s, privatization and concession are initiated to reverse the decline. In addition to those efforts in restructuring railway, the Union of African Railways, an organisation under the auspices of the African Union, has been created for the sake of more effectiveness.

Figure 8-1: Map of colonial Africa as in 1913 (with present country borders)  
(Source: wikipedia ,chemin de fer Le Cap- Le Caire )

### 8.1.2 African Railways restructuring

In 1988, concrete attempts to modernise the African railways took place in Brazzaville (Congo). It was unanimously established that very few new railway lines have been constructed on the continent since independence (1960s), that there is also no interconnection between the different networks except in North and Southern Africa. In addition, experts were unanimous in recognizing that many African lines are outmoded due to age, lack maintenance and unsuitability of their design to the exigencies of modern efficient rail transport operation.

That initiative, known in Africa as "*Brazzaville Concept*" (Esprit de Brazzaville) conducted to the political consciousness. 18 years after the above mentioned historical meeting took place in the same city (Brazzaville) the "*First Conference of African Ministers responsible for railway transportation*" from 13 to 14 April 2006. The theme of the meeting was "For an Efficient Railway System for Development and African Integration".

Reassembling 27 African States of railway union and development partners like the World Bank, the UN Economic Commission for Africa, the European Union, The International Union of Railways (UIC), as well as different organizations involved in the development of transportation in Africa, the meeting aimed to define and adopt a shared vision of railway transport development in Africa, and to elaborate appropriate strategies.

At the end of the conference, a Brazzaville Declaration based on a 2006-2008 action plan has been formulated and the following points have been agreed:

- Set up the Conference of African Ministers responsible for transport, under the auspices of the African Union, to coordinate policies and strategies in the transport sector for then African continent.
- Encourage the States to carry out or pursue structural reforms in particular, in the context of a public-private venture.
- Enable projects included in the African union master plan to be developed and implemented.
- Establish an investment Fund for Infrastructure to fund railway development in Africa;

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- Enhance professionalism in the railway sector by setting up centres of excellence;
- Promote women's access to employment in the railway sector.

Those are appreciable measures and engagement aiming the restructuring process. But it is extremely important that any strategic plan defines the environment in which the railway will function and focuses on the crucial policy issues, including funding approach, that will guide or influence the railway's planning and actions.

See also chapter 9.1.6, regarding Liberalization and concession.

### 8.2 Railway map

The main map and descriptions (separate file)

Main map (separate file)

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The main map does not show the entire South African Railway network, only lines with high and medium density. Figure 8-2 shows the South African railway network (Source: Spoornet, 2007).

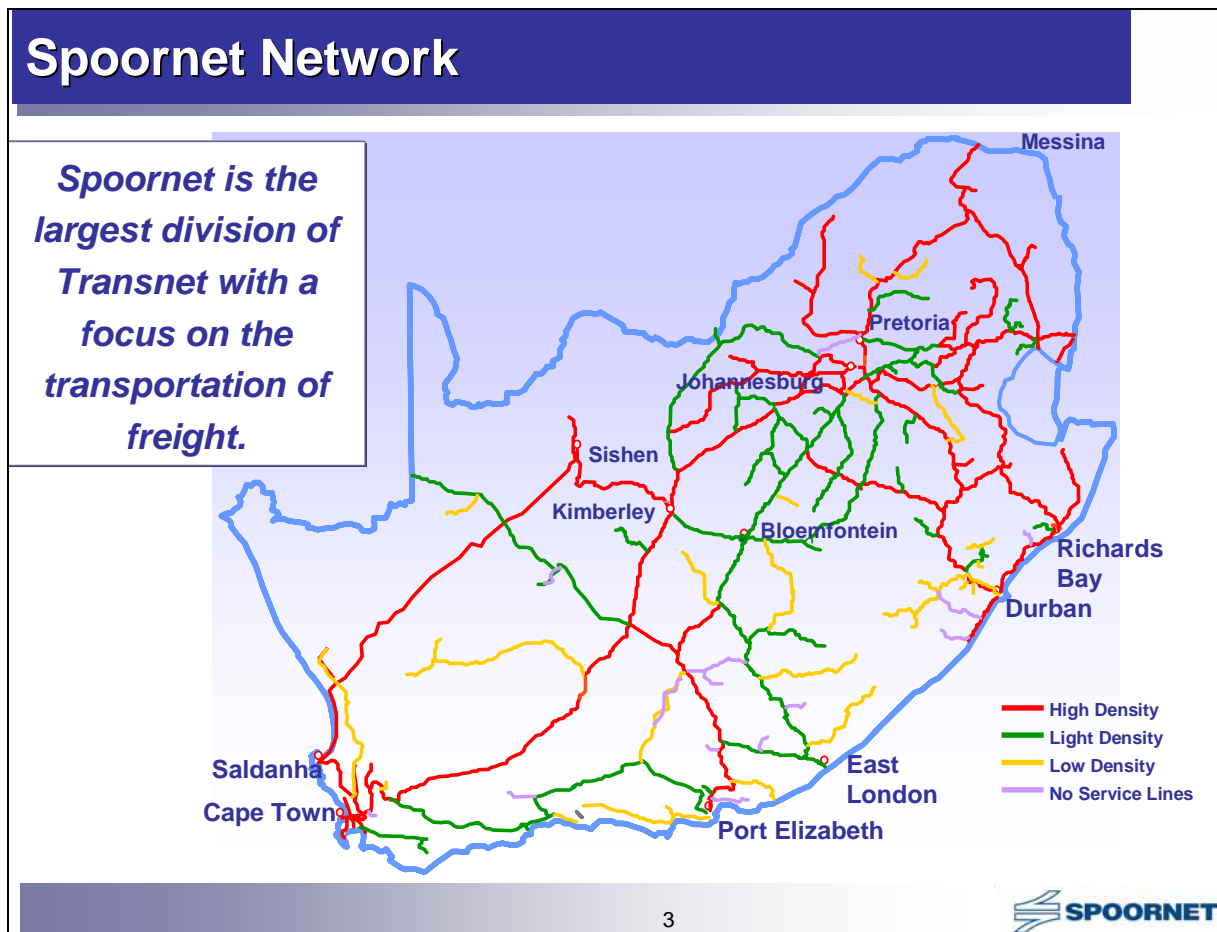


Figure 8-2 The South African railway Network



The figure (left) shows some details of the Egyptian railways system which not appears on the railways map.

The network is 1435 mm.

(Source: Railway Directory, 2007).

Figure 8-3: The railway Network in Northern Egypt

## 8.3 Overview

Two-third (35) of the countries (Africa definition, see enclosure I) has operational railways. The total route length of all 35 railway networks in the African region is estimated to 83.117 km (as per March 2007) **(THIS INFORMATION IS PRELIMINARY AND DEPENDS ON INFORMATION FROM THE RAILWAYS, WHICH IS NOT YET OBTAINED!!)**

The railways standard is quite heterogeneous and the majority of the countries have less than 1.000 km of railway network. Approximately 25% (20.872 km) of the network is located in South Africa, while only three countries have more than 5.000 km of railway network; Sudan (5.978 km), Democratic Republic of Congo (5.138 km) and Egypt (5.063 km).

The 35 countries, and the total length of their route network, are shown in the figure/table below.

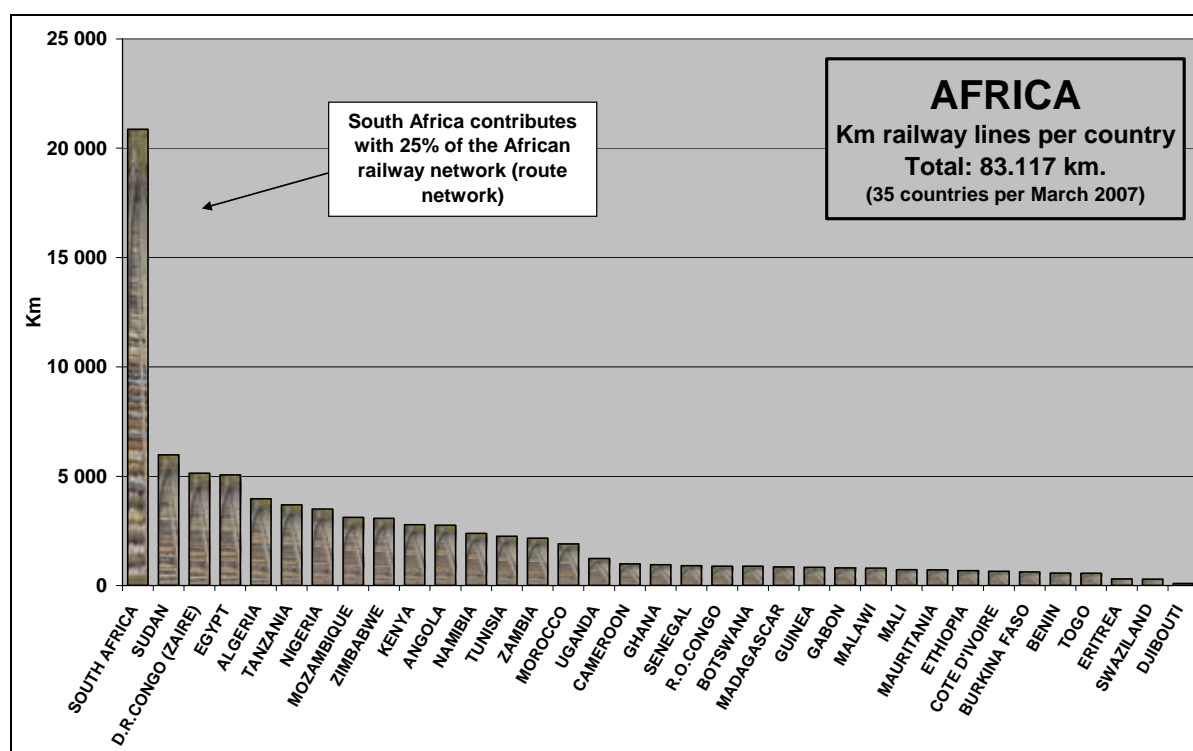


Figure 8-4: African railway network, per country

Comments will be made!

## 8.4 African railways and the world

The world railway network, according to World Fact Book estimates is 1 115 205 km (mostly 2005 updates). Based on this source on world figures, the African<sup>4</sup> network is 7.5% of the world total:

The African share of the world railway network is:

- 0% of broad gauge (more than 1435 m.m.)
- 38% of narrow gauge (less than 1435 m.m.)
- 2% of standard gauge (1435 m.m.)

<sup>4</sup> List of countries, see enclosure I

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Compared with EU, the African railway network (route km) is approximately 1/3 of the European network.

| Country           | Main gauge(m.m.) |
|-------------------|------------------|
| ALGERIA           | 1 435            |
| ANGOLA            | 1 067            |
| BENIN             | 1 000            |
| BOTSWANA          | 1 067            |
| BURKINA FASO      | 1 000            |
| CAMEROON          | 1 000            |
| R.O.CONGO         | 1 067            |
| COTE D'IVOIRE     | 1 000            |
| D.R.CONGO (ZAIRE) | 1 067            |
| DJIBOUTI          | 1 000            |
| EGYPT             | 1 435            |
| ERITREA           | <1000            |
| ETHIOPIA          | 1 000            |
| GABON             | 1 435            |
| GHANA             | 1 067            |
| GUINEA            | 1 000            |
| KENYA             | 1 000            |
| MADAGASCAR        | 1 000            |
| MALAWI            | 1 067            |
| MALI              | 1 000            |
| MAURITANIA        | 1 435            |
| MOROCCO           | 1 435            |
| MOZAMBIQUE        | 1 067            |
| NAMIBIA           | 1 067            |
| NIGERIA           | 1 067            |
| SENEGAL           | 1 000            |
| SOUTH AFRICA      | 1 065            |
| SUDAN             | 1 065            |
| SWAZILAND         | 1 067            |
| TANZANIA          | 1 000            |
| TOGO              | 1 000            |
| TUNISIA           | 1 000            |
| UGANDA            | 1 000            |
| ZAMBIA            | 1 067            |
| ZIMBABWE          | 1 067            |

Even though Africa are dominated by three main gauges, the African railways have 6 different gauges (less than 1.000 mm considered as one). Several countries have domestically more than one gauge-standard. The table (table 8-1) shows the gauge which is dominant in the respective country. Gauge changes represent discontinuity in logistical chains, where the costs only can be eliminated by building new tracks and reduced by various technical devices, transloading techniques and improved logistical operation.

The present (most usual) transloading operation has a cost connected to at least:

- The cost of moving physical units from one wagon to another (crane operation, forklifts etc),
- "Loss of time"
- Increased through transportation time, due to:
  - the mentioned physical operation
  - lack of logistical systems (e.g. no departing train waiting for the arriving train or lack of wagons),
  - Security, due to the fact that the risk is highest when the cargo (e.g. a container) is not moving

Table 8-1: African railway gauges

The figures below indicate that the gauge variations creates a potential lack of interoperability, which requires more effective operational procedures compared with a situation where the gauges are standardized. Gauge is only one issue when improving interoperability (see chapter 9.1.5). A future homogenous gauge in Africa is less probable, and other measures improving interoperability should be considered more important; like reduced time consumption, lower costs and better security and transparency.

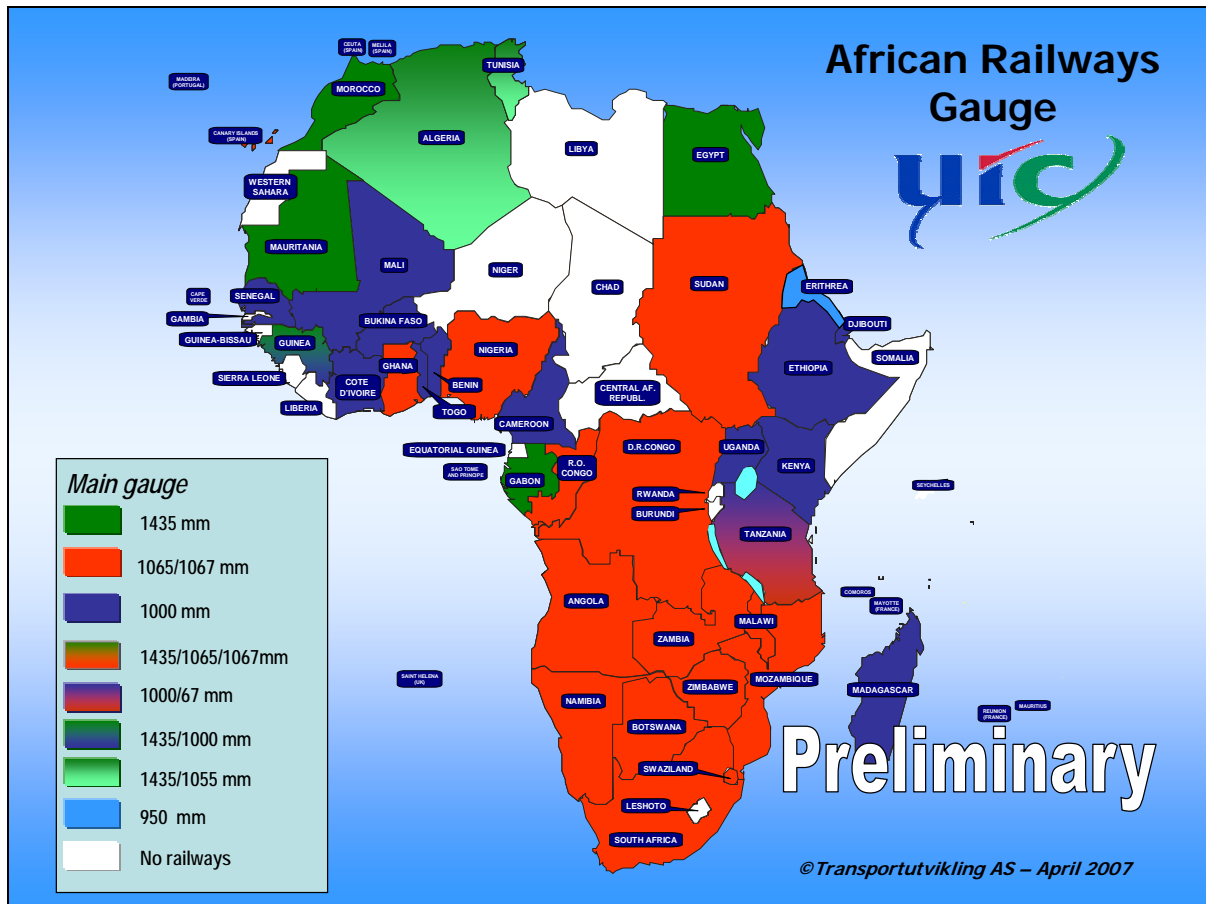


Figure 8-5: African Railway Gauge, 2007

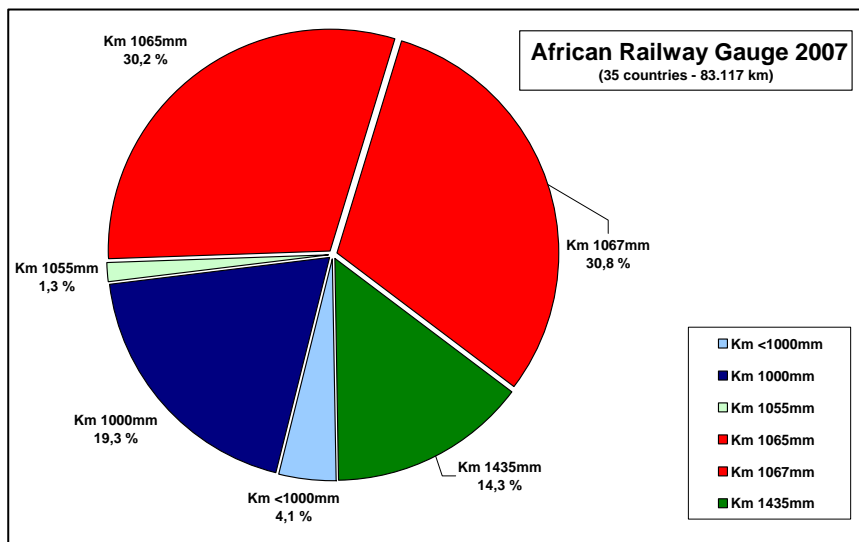


Figure 8-6: African railway gauge, share 2007

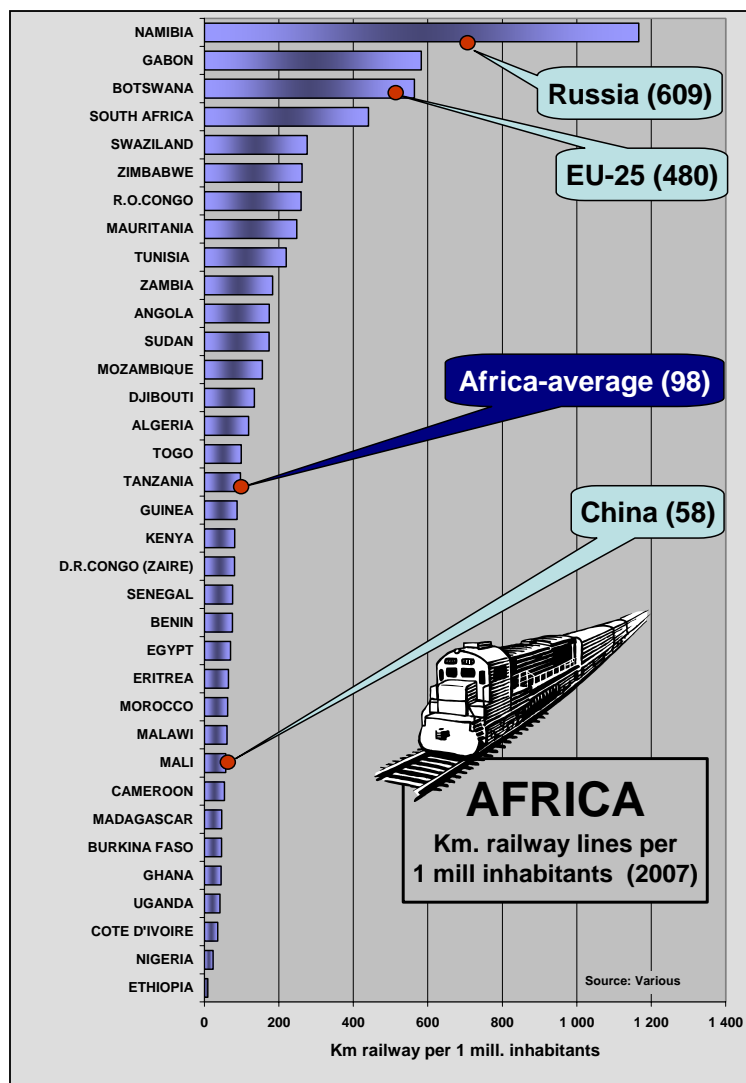
Figure 8-5 (map) is an illustration of the different railway gauges in Africa as per 2007 and figure 8-6 shows the share of the various gauges (km and %).

1.067/65 mm is the dominant gauges totaling 61% of the entire network in Africa. The second most dominant gauge is 1.000 mm (19%) while the standard gauge share is 14%.



## 8.5 Density of railway network

The network density (measured as per capita) varies greatly among the African countries.



### Density and population

A heavily populated country like Nigeria has approximately 23 km (2005) railway network per 1 million inhabitants. Egypt and DR Congo, which are among the largest countries have 70-80 km, while Ethiopia (same population as Egypt) has 9 km per 1 million inhabitants.

Namibia (small population) has more than 1.150 km, which is the highest density in Africa.

South Africa, the largest railway country in Africa, has 440 km railways tracks per 1 million inhabitants, which is almost like the EU. The top four countries are Namibia, Gabon, Botswana and South Africa.

Figure 8-7 shows the railway network (route km) per 1 million inhabitants (35 countries where the railway network is in operation).

The density in EU25, Russia and China is shown in the figure as a comparison.

Figure 8-7: Density of railway network (km per 1 mill inhabitants)

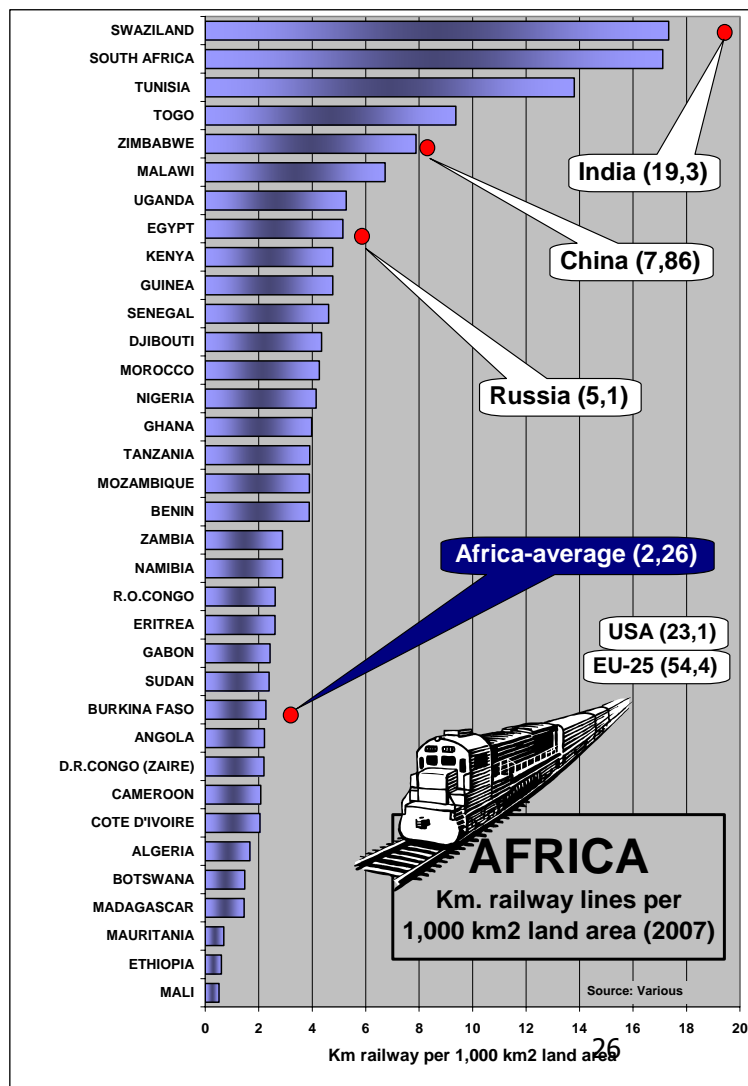
### Density and area

"Africa's railway density (tracks per km<sup>2</sup>) is approximately one tenth of the densities found in the United States". (UNCTAD, Review of Maritime Transports, 2006).

Figure 8-8 shows that the African average density, compared with Europe, is 4% (e.g. one to twenty-five).

The African average is 2,26 km per 1,000 square km of land area. There is a huge variation among the countries and the highest density is found in South Africa and Swaziland, while the lowest density is found in Mali, Ethiopia and Mauretania.

Compared with large countries like India and China, the density is 11% of the Indian and 29% of the Chinese. A very large country like Russia, have twice the density of the African average.



(Additional comments)

Figure 8-8: Density of railway network (km per 1,000 km<sup>2</sup> land area)

## 8.6 Main projects & international corridors

Transport corridors are an important international, as well as national, feature. Such corridors are of particular interest in the Sub-Saharan region where several landlocked countries requires connections to the ports. Transport corridors are also of importance when connecting the African regions (Intra-Africa) and stimulating to transit operations through the African continent.

There are a huge number of corridors and corridor projects in Africa, particularly in the Sub-Saharan region.

In **North Africa**, the main corridor is the Trans Maghreb, connecting Morocco and Tunisia through Algeria. The corridor is a fully operational standard gauge line, however not in continuous operation due to border crossing discussions among Morocco and Algeria. This line can be extended to Egypt when Libya completes their network and then further on to the Middle East.

Furthermore, the Gibraltar tunnel is a planned double-track railway tunnel under the Strait of Gibraltar, which will be a direct railway link between Europe and Africa. The idea of a link has existed since the 1980s.

In 2003 Morocco and Spain reached an agreement to build a double-track railway tunnel under the Strait of Gibraltar. The cost is unofficially projected to run over \$13 billion and engineers say the tunnel would take about 20 years to construct.

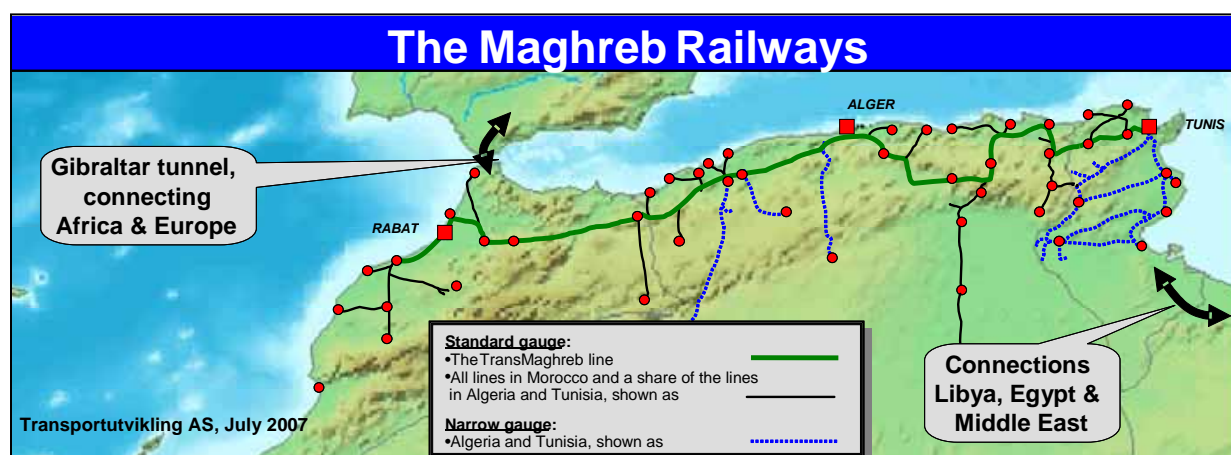


Figure 8-9: The Maghreb railways

The map below (Figure 8-10) shows transport corridors and port upgrades for **Southern Africa**. The map is produced by Spoornet. There are a huge number of projects and corridors. To some extent there are prospect for an integrated railway network, however mostly regional and not covering the wider African continent.

In their response to the Vision 2025 document, Botswana Railways (BR) commented upon a few opportunities. These are *Elisras Link*, which offers an opportunity for shorter distance to South African ports (e.g. coal to Durban) for Botswana, Zimbabwe and Zambia. *Trans Kgalagadi Corridor*, which gives alternative port access for South Africa facilitating coal exports to America and Europe. BR does also consider this corridor as an opportunity for establishing a regional trans-shipment hub and enhancement of regional competitiveness in global trade. Furthermore, *Mosetse-Kazungula* (link to Zambia) offers an opportunity for shorter leg between Botswana and Zambia, enhancing regional trade for bulk commodities.

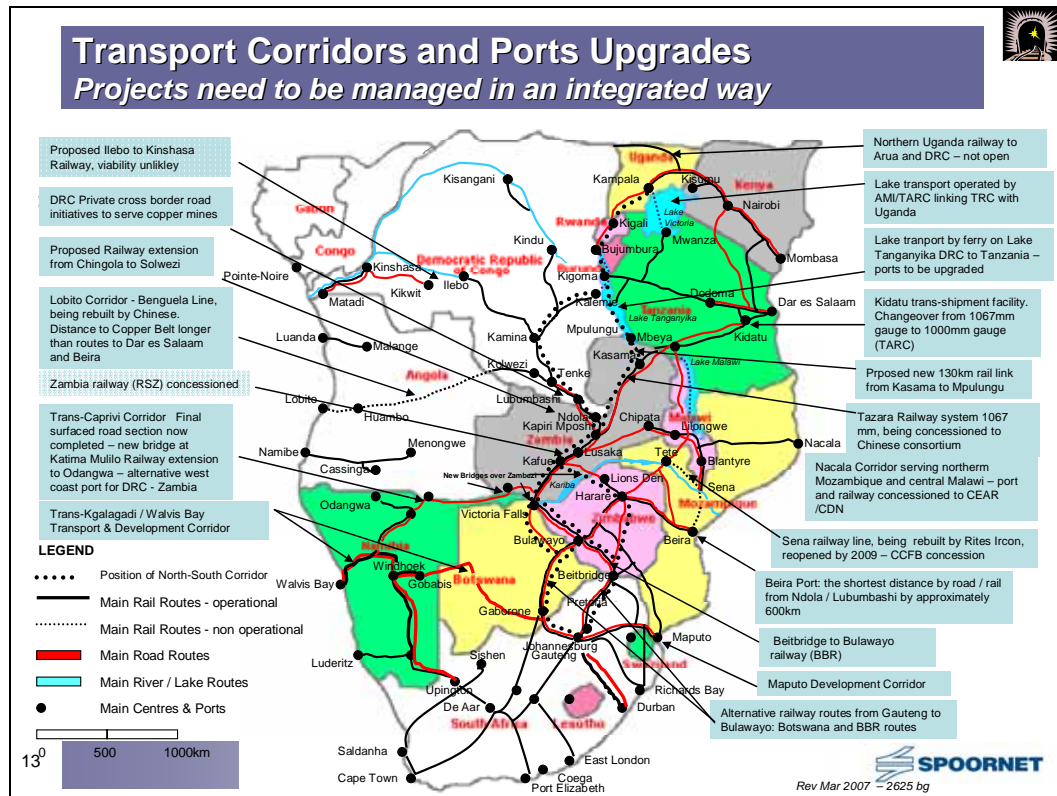


Figure 8-10 Transport corridors Southern Africa (Source: SpoorNet)

In **Western Africa** we find railway corridors between Dakar and Bamako (1250 km) and Abidjan-Ouagadougou (1249 km). The traffic flow has been fluctuating due to political turmoil and congestion at ports. There are plans/ideas for connections between Burkina Faso (Banfora) and Bamako (South West Mali) as well as connections from Ouagadougou/Kaya to Niger/Nigeria and the North Eastern parts of Mali.

In **Central Africa**, countries like The Central African Republic, have to rely on road transports since the railway infrastructure is missing. Further South substantial railway upgrading is ongoing and a 2 billion USD loan is made by China to Angola for the rebuilding of the Benguela railway. This railway aims to connect the port of Lobito (Angola) to the Congolese Copper belts. Zambia has also signed an MOU with private investors to build a connection between the mines in Kanshisi and Lumwana (North-West Zambia) to the Benguela line. Also in **Eastern Africa** the road transport are dominant and only 25% of the containerized cargo between the port of Mombasa (Kenya) and Uganda/Rwanda/Burundi goes by train. The corresponding corridor from Dar-Es-Salam (Tanzania) has higher railway utilization (43% in 2005). Other examples regarding corridors connection the inland is for instance the Nacala Corridor between the port of Nacala (Mozambique)-Central Malawi and Beira (Mozambique)-Zimbabwe. Furthermore, we mention the Maputo development corridor and various connections to/from South Africa and the neighboring countries. (NILA.....?)

The corridors and projects mentioned above, as well as many projects/corridors not mentioned, are all important for the development of the African railways. The corridors and projects which are truly international or Pan African is few. However, UAC has proposed various corridors and for the North/Western part of Africa some alternatives are shown figure 8-11.



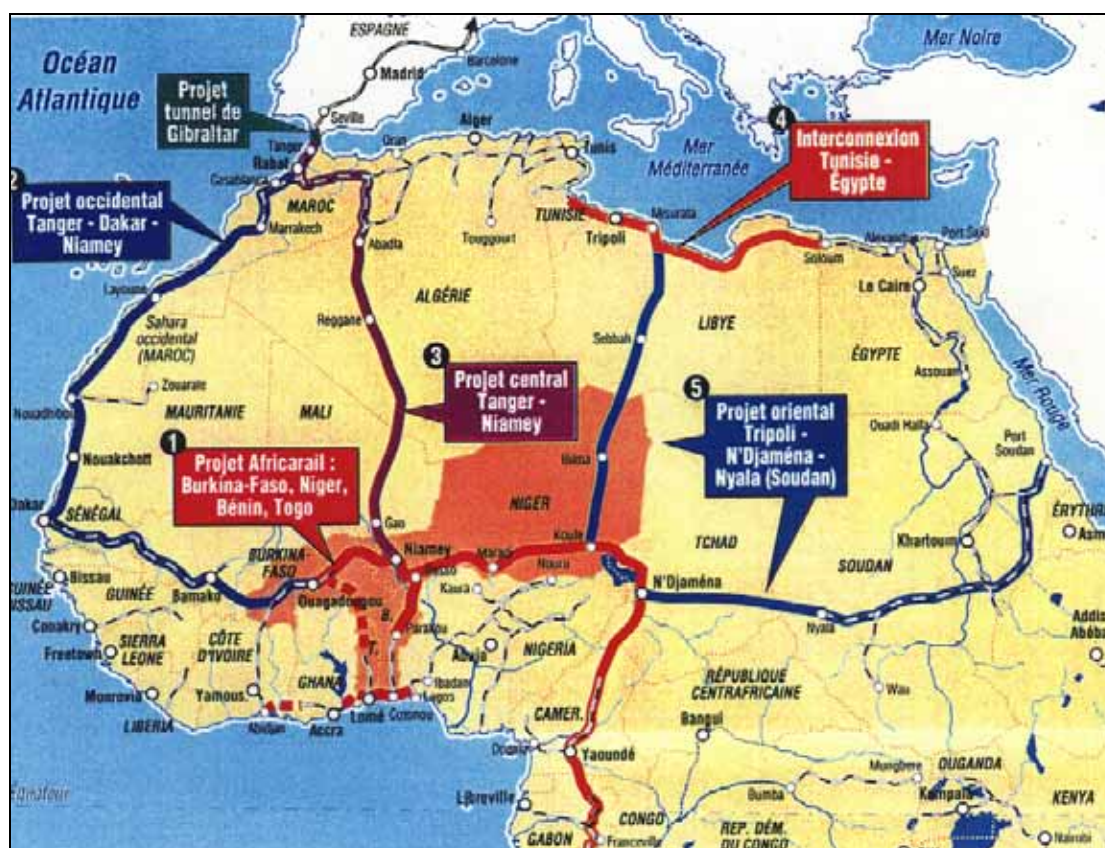


Figure 8-11: Potential UAC corridors in North, West and Central Africa

**LEGENDE :**

- Lignes de chemin de fer existantes
- Lignes de chemin de fer en projet
- Grands corridors de trafic
- ..... Extension du Projet AFRICARAIL

The purpose with this document is not to be detailed or launch plans for approval. The purpose is to make background information for UIC's work in Africa and the visions of African railways.

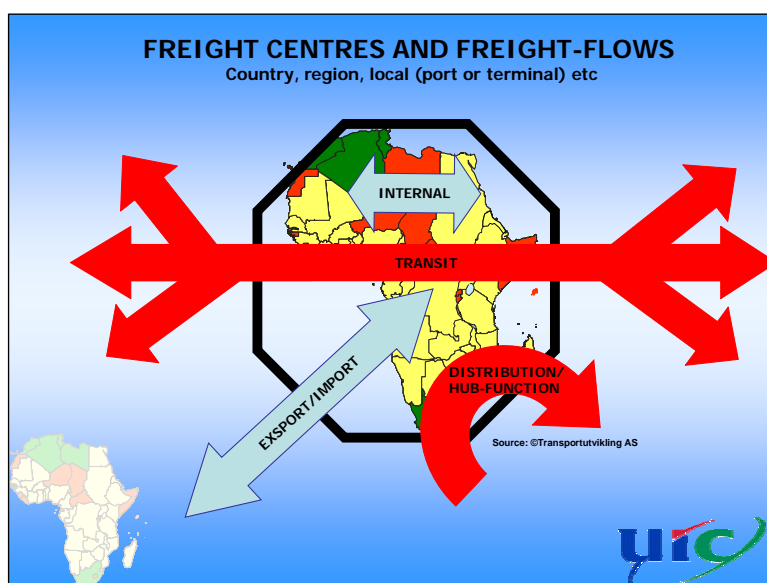


Figure 8-12: Potential trade flows

make background information for UIC's work in Africa and the visions of African railways.

Visions for transport corridors can be based on various criteria's. Development corridors are often mainly based on business spin-offs from the transportation work while the market perspective may be less emphasized.

When the market perspective is the main focus, it is possible to develop visions based on the flow structures by looking at the entire Africa as a region with international potential as well as regional opportunities.

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Figure 8-12 shows, in general terms, potential transportation flows which should be taken into consideration when developing corridors and transportation structures. The transportation flows are separated into:

- Internal
- Export/import
- Distribution/hub-functions
- Transit

Internal transports should be developed as a part of an Intra-Africa strategy and for the main purpose of integrating the African continent. Important corridors may be connections between major cities, production areas to consumption areas, light trains for populated regions, regional passenger/tourist trains etc.

Export/import corridors are the dominating corridors in today's Africa. They are important and could be further developed logistically as well as administratively. These corridors are important intermodal connections for the African industry and population.

Distribution/hub-functions can be considered as a separate activity. Maritime ports are often organized based on transshipment/distribution functions and in Africa there are several examples on the East Coast (Port Louis, Djibouti etc). The same principles can be used for inland terminals and railway hubs.

Transit corridors are Pan-African corridors crossing the continent. Such corridors in Africa are often considered as less relevant due to lack of infrastructure, maritime schedules and the perception of Africa as an island. However, this "island" is larger than USA, India, Western Europe, China, Great Britain and Argentina together (see chapter 7.1 and figure 7-1). There may be a transit potential, which also depends on the shipping lines' strategies and future rotations. It is also important to note that transit creates more activity than only the isolated through transport. Due to discontinuous points (ports, terminals, gauge breaks, markets etc) transit creates new port-hinterland connections and inland routes in both directions as well as synergies with other routes and modes. Transit corridors can truly be development corridors for the future.

Figure 8-13 shows a theoretical transport corridor from east to west in Africa. This port-to-port corridor creates at least two additional transport routes, serving the inland of Africa; one to the east and one to the west. By looking at the aggregate transport volume; transit (port-to-port) and the "inland-port", the combined volumes may be satisfactory for a new transport corridor.

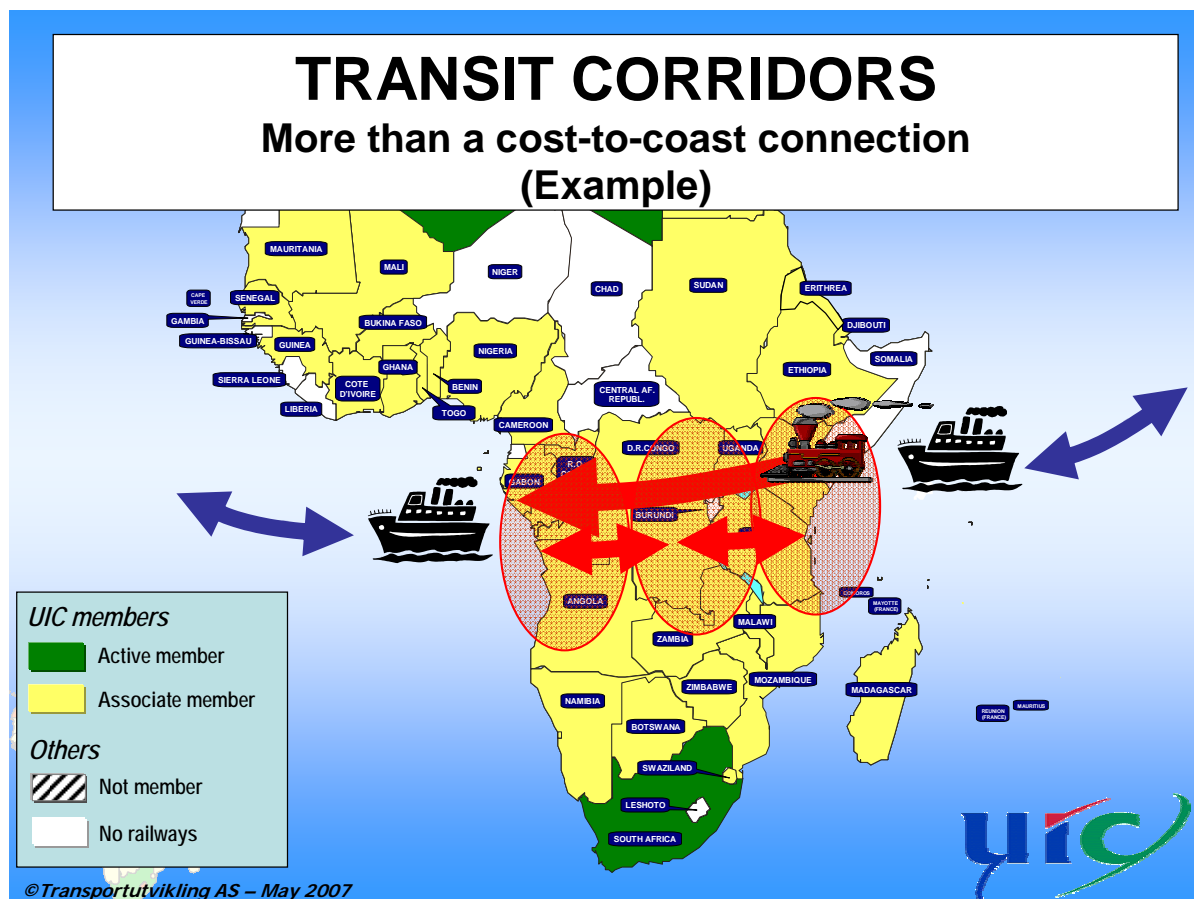


Figure 8-13: Transit corridors and new inland solutions

## 8.7 Production

The railways transportation work is measured by:

- Passenger-kilometers (pax-km), which is an indication of passenger transportation work based on the number of passenger transported and their average travel length measured in kilometers.
- Ton-kilometers (ton-km), which is an indication of net freight transportation work based on the net tons carried and average freight haul distances' measured in kilometers.

The production data's are of different quality. For some countries, accurate information is not available, and some countries have discontinued/broken time series or lack of data's. The main sources for the information are UIC, World Bank, the Railway Directory, national statistics and information from the separate railways.

The statistical data's from many countries in Africa are of poor quality and most countries have not contributed with information at all. The focus, below, is therefore put on the few countries where we believe data are reliable, - and available for the period 1990-2005

The main focus is put on the following countries:

- Algeria

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- Cameroon
- R.O.Congo
- D.R.Congo
- Morocco
- Senegal
- South Africa (Spoornet)
- Tanzania (Ex Tazara)
- Tunisia
- (Botswana will be included, information received as per July 2007 + others when possible)

### 8.7.1 Passenger transport

With a few exceptions, passenger transportation by rail in is at a low level and most countries (ex Egypt) are internationally to be considered as small producers. The total transportation work (passenger km) in Africa is not easy accessible and many countries shows a huge annual variation in their transportation work due to various reasons.

Based on available figures, total pax-km in Africa is estimated to be less than 70.000 millions. Populated countries like China and India alone have more than 600.000 million passenger kilometers, which is almost 10 times the entire African production.

The political and economical environment has strong influence on passenger transports. The figure below shows, as an example, passenger transportation in 4 countries, where two of them have quite stable macro conditions while the two others have a more turbulent history.

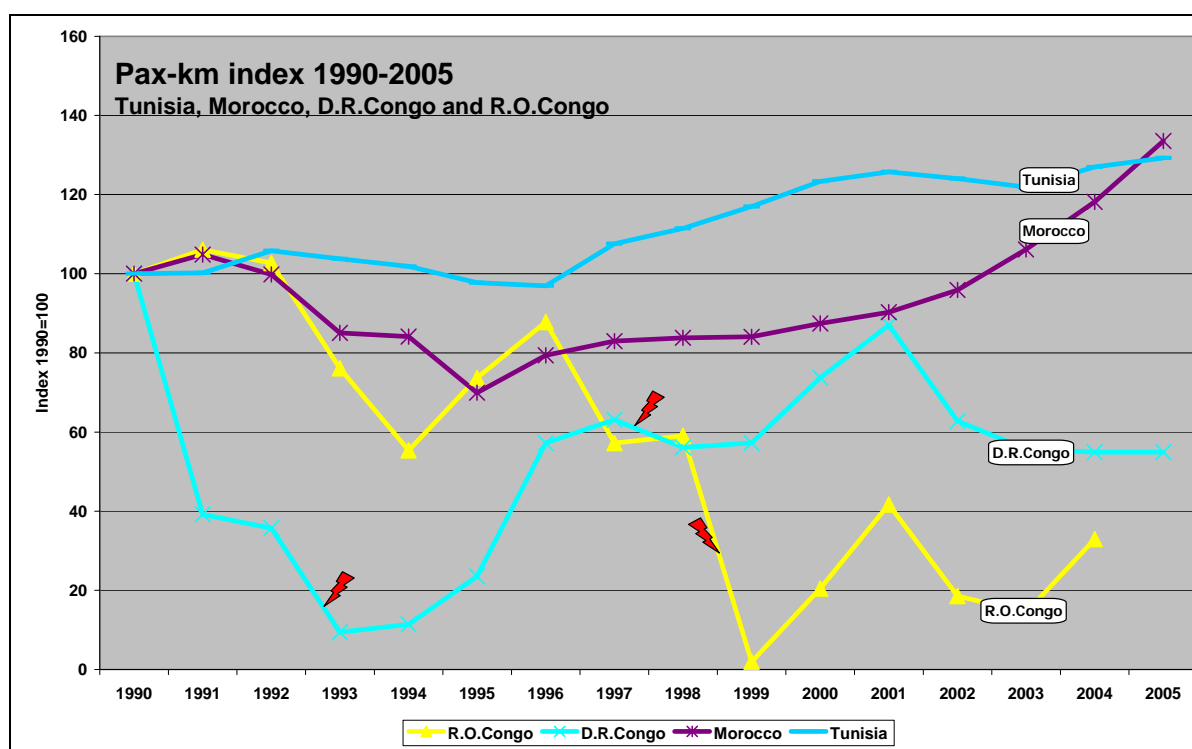


Figure 8-14 Stability and instability, passengers

Morocco and Tunisia shows relatively stable growth and there have been no major incidents, conflicts or negative circumstances which have huge impact on the transportation work since 1990.

The opposite situation is found in the two countries of Congo, where conflicts, economical- and political instability has been a part of the nearest history. Figure 8-16 shows that the variation in passenger transports by rail is strongly influenced by such circumstances.



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The main producer of passenger transport by rail in Africa is Egypt. In 2004 they produced 40,837 million passenger kilometers. The second largest producer is South Africa, however only one-fourth of the production in Egypt. Morocco (2,987 million passenger-km. In 2005) and Tunisia (1,317 mill. in 2005) is ranking 3 and 4, while the remaining countries have less than 1.000 mill passenger kilometers.

### Correlation

As mentioned, for many countries in Africa, we have found no clear co-variation between passenger transport by rail and macro conditions like population and economy. Figure 8-15 shows (as an index starting in 1990) the relationship between GDP per capita, population growth and total passenger kilometers by rail for the mentioned 9 countries.

The correlation between pax-km and GDP is slightly positive, while the correlation between pax-km and population in fact is negative. Negative correlation shows that passenger transports is declining while population is growing.

It is huge variations among the countries. By looking at the Maghreb region (Morocco and Tunisia) we find the same patters as in many developed countries, e.g. more transport when population grows. However, Algeria shows the opposite development and when population grows by 1% passenger transports declines by almost the same percentages.

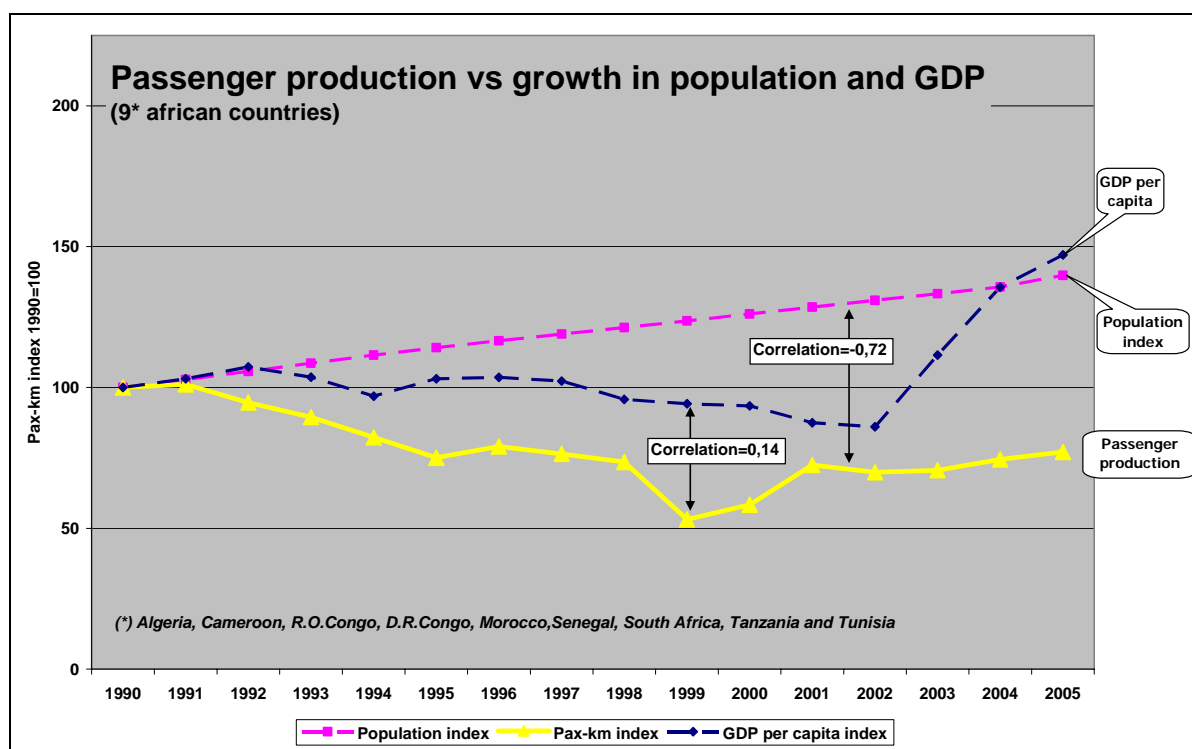


Figure 8-15 Passenger kilometers and correlation

### **8.7.2 Freight transport**

Freight transports by rail in Africa is also at a relatively low level (Ex South Africa) and the freight production in Africa is less than 1/14 of countries like Russia and China. As for passenger-figures, the total transportation work (ton-km) in Africa is not easy accessible and many countries shows a huge annual variation in their transportation work du to various reasons.

Based on available figures, total ton-km is estimated to be less than 150,000 millions. Countries like Russia and China alone have approximately 2,000 billion ton-kilometers.

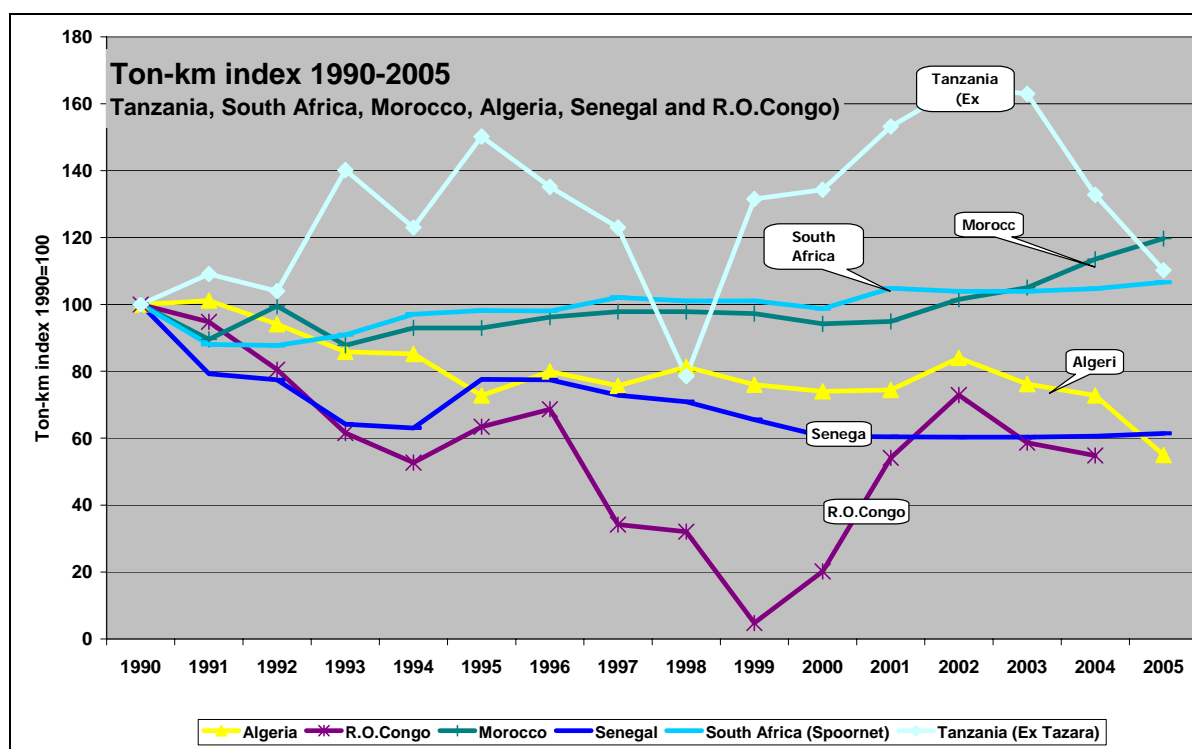


Figure 8-16 Stability and instability, freight

The political and economical environment do also have strong influence on freight transports. The figure above shows, as an example, freight transportation in 6 countries, where two of them shows stable growth (South Africa and Morocco), two are slightly declining (Senegal and Algeria) and two shows volatile figures (Tanzania and R.O.Congo).

## Correlation

For many countries in Africa, we have found no clear co-variation between freight by rail and economical. Figure 8-17 shows (as an index starting in 1990) the relationship between GDP, GDP per capita and total ton-kilometers by rail for the mentioned 9 countries.

The correlation between ton-km and GDP is positive which indicates some co-variation. Freight volumes have been stable through the entire period and the economic growth (starting 2002/2003) has not influence the freight transports in the same period.

As for passenger transports, there is a huge variations among the countries (See figure 8-16). South Africa (Spoornet) produced 108,513 million ton km, which is 70 % of the entire production. A few other producers are: Morocco 5,866 (2005), Zimbabwe 4,871 (1997), Egypt 3,917 (2004), Gabon 2,219 (2005), Tunisia 2,067 (2005) and Botswana 674 (2006). (TO BE UPDATED).

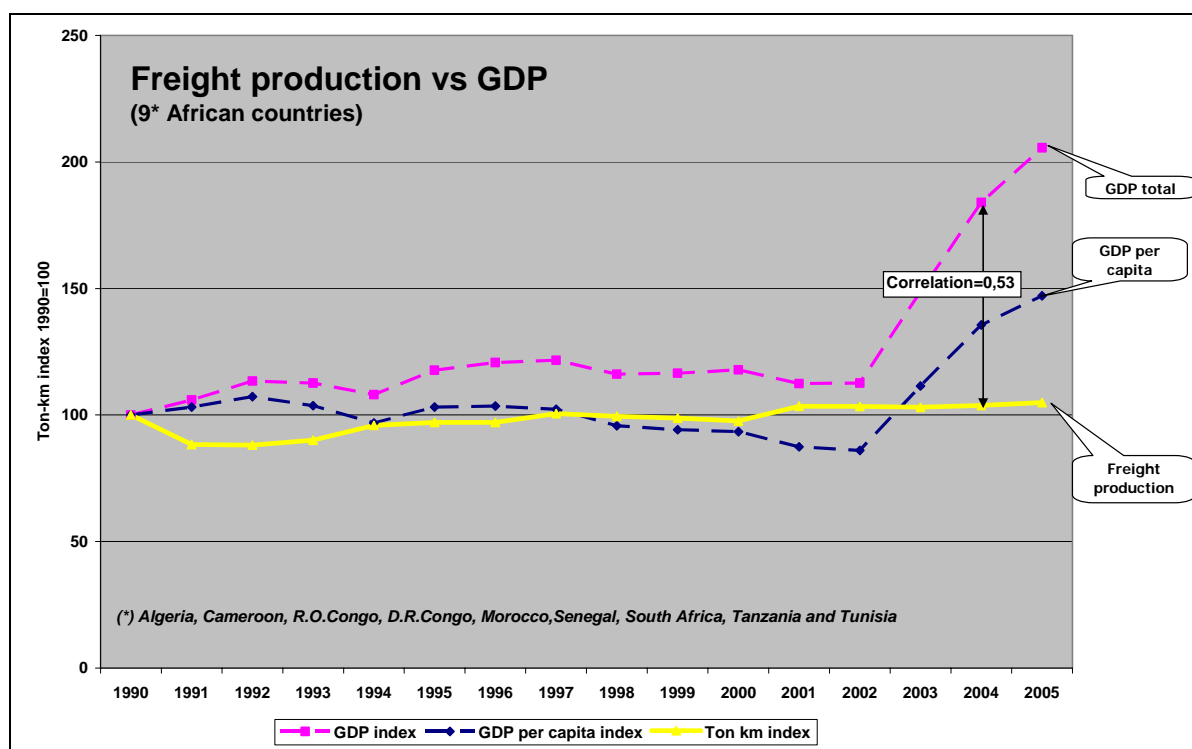


Figure 8-17 Ton -km and correlation

The figure above shows stable freight production from 1990 to 2005 for the above mentioned African countries (9 countries). The economic growth from 2002 has no visible influence on the freight production. The overall all share of the total production is represented by South Africa. The large South African production will dominate the picture and variations by smaller producers are less visible in the figure.

## 8.8 UIC and Africa

### 8.8.1 The new dimension of UIC

UIC is an international organization with members all over the world. UIC's strategic focus is the global level as well as to develop specific actions on the regional level, due to recognition of the regional railways importance and that they are the "building-blocks" of the global railway community.

The different regions of the world and the railways are on different development levels and they have different challenges and opportunities. It is therefore an important objective to develop targeted visions and strategies for the different regions of the world. These strategies may have different focus, depending on regional characteristics.

UIC's ambition is to identify relevant visions and develop procedures for the implementation of these visions for all "UIC-regions" of the world, including Africa.

Figure 8-18 shows the "UIC regions" as per 2007. Each region of the world is represented by their regional assembly.

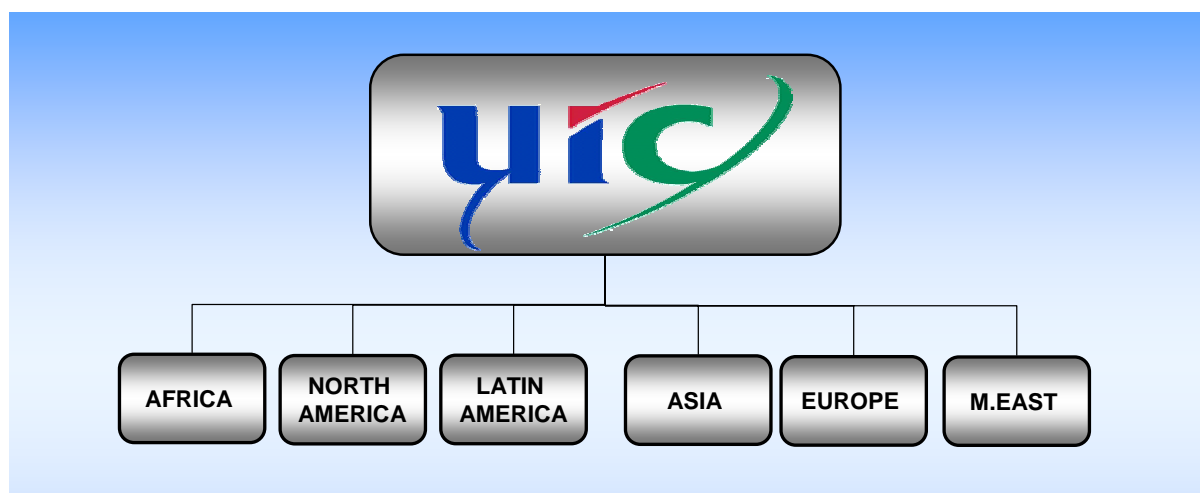


Figure 8-18 UIC's regional organization, 2007

### 8.8.2 UIC member status & strategy

The International Union of Railways intends to put a stronger focus on Africa and the development of the African railways.

35 countries have operational railways. Only 5 (including Libya where no railways are in operation) are active members. Other railway countries in Africa are associated members.

The 4 active members, where railways are in operation, cover 35% of the African railway network.

The following 5 countries are classified as active members:

- ALGERIA
- MOROCCO
- SOUTH AFRICA
- TUNISIA
- LIBYA (No operational railways as per August 2007)

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The UIC-members railway network is varying from approximately 1.900 km in Tunisia to close to 21.000 km in South Africa.

The following 31 countries have a relation to UIC (classified as "Associated"), without being classified as active members as per March 2007:

- ANGOLA
- BENIN
- BOTSWANA
- BURKINA FASO
- CAMEROON
- R.O.CONGO
- COTE D'IVOIRE
- D.R.CONGO (ZAIRE)
- DJIBOUTI
- EGYPT
- ERITREA
- ETHIOPIA
- GABON
- GHANA
- GUINEA
- KENYA
- MADAGASCAR
- MALAWI
- MALI
- MAURITANIA
- MOZAMBIQUE
- NAMIBIA
- NIGERIA
- SENEGAL
- SUDAN
- SWAZILAND
- TANZANIA
- TOGO
- UGANDA
- ZAMBIA
- ZIMBABWE

Most of the countries which are not active members of UIC are populated countries and many of them have more than 2.000 km of railway infrastructure. The figure below shows non-active members of UIC, the respective countries railway network and population.

According to the UIC's "Rapport d'Activité 2006", 16 countries are classified as associated. The fifteen missing countries are:

- ANGOLA
- BENIN
- BOTSWANA
- DJIBOUTI
- ERITREA
- ETHIOPIA
- GHANA
- GUINEA
- MALAWI
- MAURITANIA
- NAMIBIA
- SWAZILAND
- TOGO
- ZAMBIA
- ZIMBABWE

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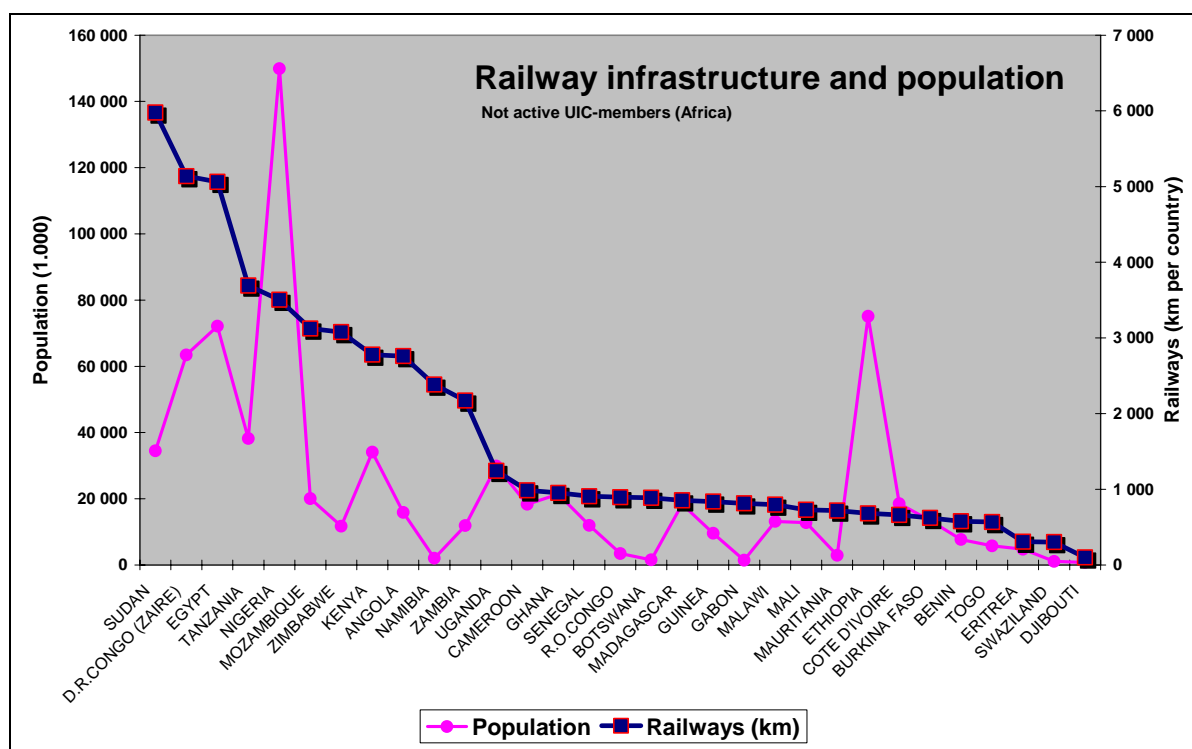


Figure 8-19: Not active UIC-members – population and railways infrastructure

11 of the non-active members have more than 2,000 km railways network (Table 8-2). These 11 countries have more than 450 million inhabitants and close to 50% of the African railway network.

| Country           | Population<br>(1.000) | Railways<br>(km) |
|-------------------|-----------------------|------------------|
| SUDAN             | 34 474                | 5 978            |
| D.R.CONGO (ZAIRE) | 63 450                | 5 138            |
| EGYPT             | 72 131                | 5 063            |
| TANZANIA          | 38 200                | 3 690            |
| NIGERIA           | 149 877               | 3 505            |
| MOZAMBIQUE        | 20 041                | 3 123            |
| ZIMBABWE          | 11 732                | 3 077            |
| KENYA             | 34 046                | 2 778            |
| ANGOLA            | 15 864                | 2 761            |
| NAMIBIA           | 2 042                 | 2 382            |
| ZAMBIA            | 11 873                | 2 173            |
| <b>TOTAL</b>      | <b>453 730</b>        | <b>39 668</b>    |

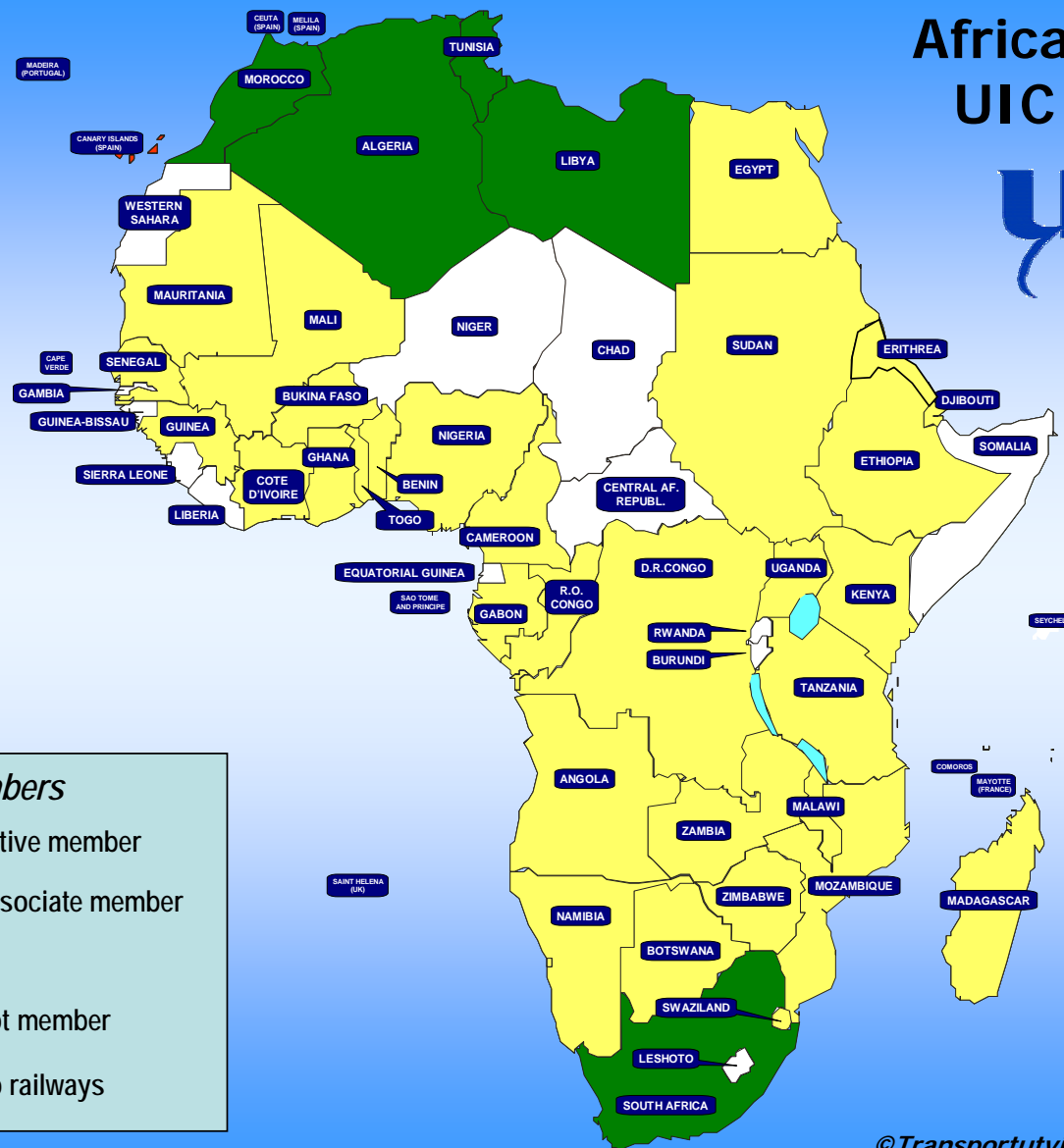
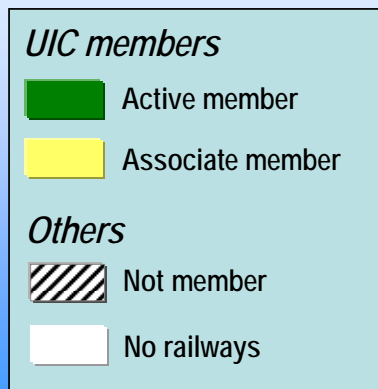
The railway countries of Africa should be encouraged to join UIC as active members, not only because of the benefits they can obtain, but also because of their importance as links in intermodal chains. Many of these countries (also smaller countries) can be important sections of international chains in Africa. Cooperation through UIC, when developing future strategies for Africa, should be of great importance.

Table 8-2: Not active UIC members with more than 2,000 km of railway tracks.

The map (next page) shows UIC members and associate members as per March 2007. Active UIC members are shown in green, yellow is associated members and white color indicates that there are no railways in the country. Libya is an active member with no current operational railways. However, railways are projected.

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# African Railways UIC members



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Figure 8-20: UIC map, Africa

## 9 Conditions having impact on railway transport

This chapter will further describe important drivers<sup>5</sup> behind the development of the African railways as well as economic conditions utilized in the basic estimates for further development (Chapter 11). The impact on railway transport towards 2025 by the various drivers is not easy to estimate and the uncertainty is underlined.

Economic development and population increase are important factors determining future transportation requirements as well as variables influencing transport, like the amount of energy and other resources necessary for industrial production and people's buying power. According to various observations and analyzes, GDP per capita may be a relevant indicator for describing the state of economic development of a country, however not necessarily the most valid indicator when it comes to international freight transports.

### 9.1 Transportation issues

The projections aim was to indicate a possible future development of the African railways. It is therefore sensible to include the transport sector itself as one of the main drivers. The transport sector includes a broad set of different factors, and some are more relevant than others. Many of them are also mutually interdependent.

Transport encompasses the demand for movement of passengers and freight, both influenced by various aspects. Due to market competition it is also important to consider the development within other modes of transport, such as road, sea and air. Furthermore, several issues within the railway sector need to be mentioned as a part of this chapter, like different gauge/discontinues points, technology development, efficiency/capacity etc.

#### *9.1.1 The African transportation sector*

The Transport sector is an important component of the economy impacting on development and the welfare of populations. When transport systems are efficient, they provide economic and social opportunities and benefit that impact throughout the economy. When transport systems are deficient, they can have an economic cost in terms of reduced or missed opportunities. Transport also carries an important social and environment load, which can not be neglected.

Recognizing the importance of transport in economic development, the African Export-Import Bank (AFREXIMBANK), attributed in 2003 the growth in value of intra-African trade (an increase in rate of growth in value from 4.7% in 2002 to about 13.5% in 2003, and in the share of intra-African trade in total African trade to 9.6% in 2003 compared to 9.1% in 2002 and 9.5% in 2001) to improvement in shipping and air-links between southern and west Africa.

Unfortunately, transportation sector in Africa is often characterized by inefficient transport operations. Indeed, inefficiency of transport services is manifested in several ways including high vehicles prices, poor market information, existence of transport cartels, poor knowledge of operating costs, poor operating practices and poor routine maintenance, all of which lead to high vehicle operating costs and low vehicle utilization. Transport-operators usually transfer the high vehicle operating costs to consumers by raising fares. Similarly, operators increase fares to offset low revenues to low vehicle utilization.

Rail freight rates in Sub-Saharan Africa are about twice, on average, those in Asia and 50% higher than Latin America. Air freight rates in Africa are in some cases four times those in Asia. (Source: Economic Commission for Africa, Report on regional integration trade and infrastructure, 2005)

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<sup>5</sup> The drivers are those variables which may an impact on the future of Asian Railways.



## 9.1.2 Alternative transport

Historically, the demand for transport has been increasing. There will be a demand in the future and this demand has to be covered by supply. Transport modes are competing on transport routes where competition is possible. This competition will probably continue to be intense. The competitive advantage differs between the means of transport, dependent on type of goods, geographical issues, time-aspects, comfort, economies of scale, reliability, political conditions etc. The development of alternative transportation influences future railway traffic. There might therefore be a direct connection between railway and alternative transports as competing modes, i.e. high price elasticity (Sæther, 2001).

### Air

Generally, air transportation is heavily dependent on oil prices. Oil, which is price-volatile commodity, has become a key determinant in the profitability of airlines. Flight charges/tickets are usually vulnerable for shift in oil prices and increasing oil prices are usually transferred to the customers if the company's intend to maintain their nominal profit contribution. However, this fundamental shift will also add further pressure to airframe and engine manufacturers to create more fuel-efficient designs, and cause airlines to move to larger capacity aircraft with lower fuel burn per seat. Moreover, high fuel prices will have an impact on the aircraft retirement cycle by pushing less fuel efficient types out of the market at a faster pace. (Bombardier, 2006).

Transportation time is an important issue. The speed of air transport, compared with other transport modes establishes air transport more preferable on longer passenger distances and for certain commodities. By utilizing the present airplane technology it is not very efficient to transport heavy goods by planes, due to the limited weight load capacity. Usually, airplanes are considered to compete with railways in terms of passenger transport.

Incidents like the terror attack on September 11<sup>th</sup> 2001 have an impact on air transport, particularly in a short term perspective. Stricter security and safety regulations did also lead to increased check in-delays, schedule reductions of 15% and higher costs (Stengel 2002). This altogether made alternative transport modes more attractive. On the other hand, the terror attacks in Madrid and London have proved that this is applicable for all types of transport.

Passenger transports by air has been growing at rate of 11% per annum the last 25 years, and it is expected that the growth will continue.

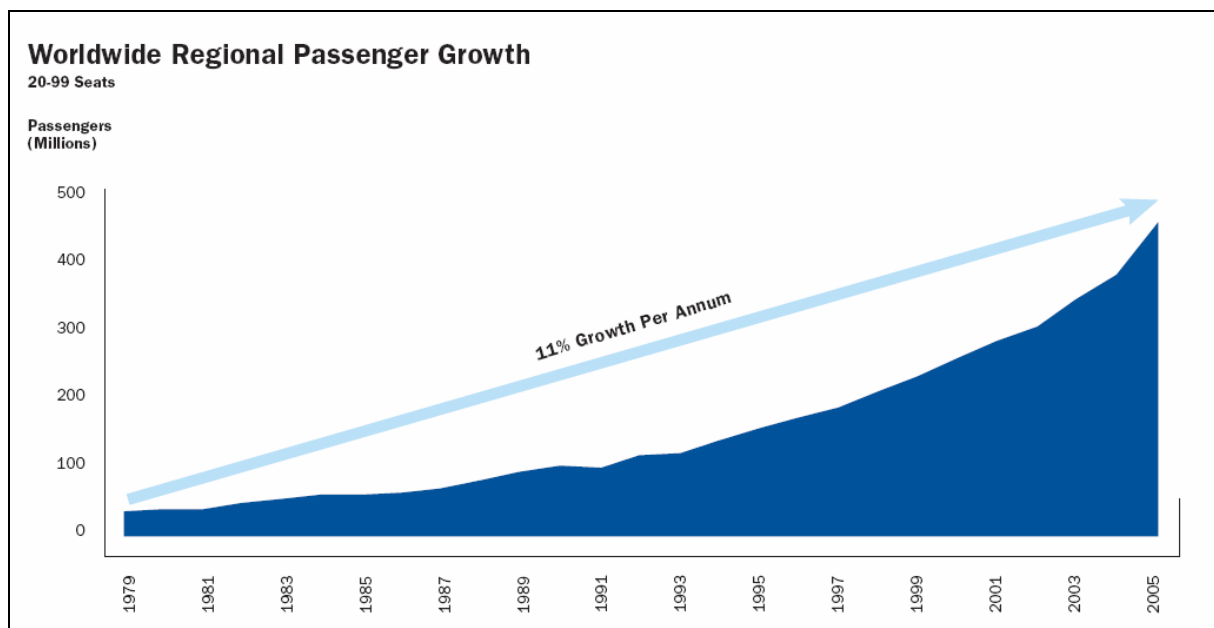


Figure 9-1: Worldwide regional passenger growth

Source: Bombardier Analysis, 2006

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Air freight does also play an important role in the competitiveness of African freight in world markets. In 2004, the 84 African cargo airports handled about 1.4 million tonnes of cargo, which is a 2% share of cargo handled by world airports (UNCTAD, 2006).

(Include some comments on low cost airlines in Africa)

### Road

Connected to the development of modern high speed road infrastructure, trailer trucks, express busses and personal vehicles, - road transport are becoming real competitors with trains regarding passenger and freight transportation. A major problem concerning road transport is congestion and various external costs (see environment, chapter 9.3). Congestion is a global problem in various regions of the world and there are serious problems on roads in many countries.

According to the United Nations (UN Population division, 2007), the urbanization process is to continue towards 2030. They predict 13.8% increase in urban population in Africa from 2005 to 2030 (see chapter 9.2). This means that more than half of the population living in Africa will be urbanized. As the figure below shows, motorization grows continuously in strong relation with the increasing per capita income (Schipper, Lilliu and Lewis-Davis 2001).

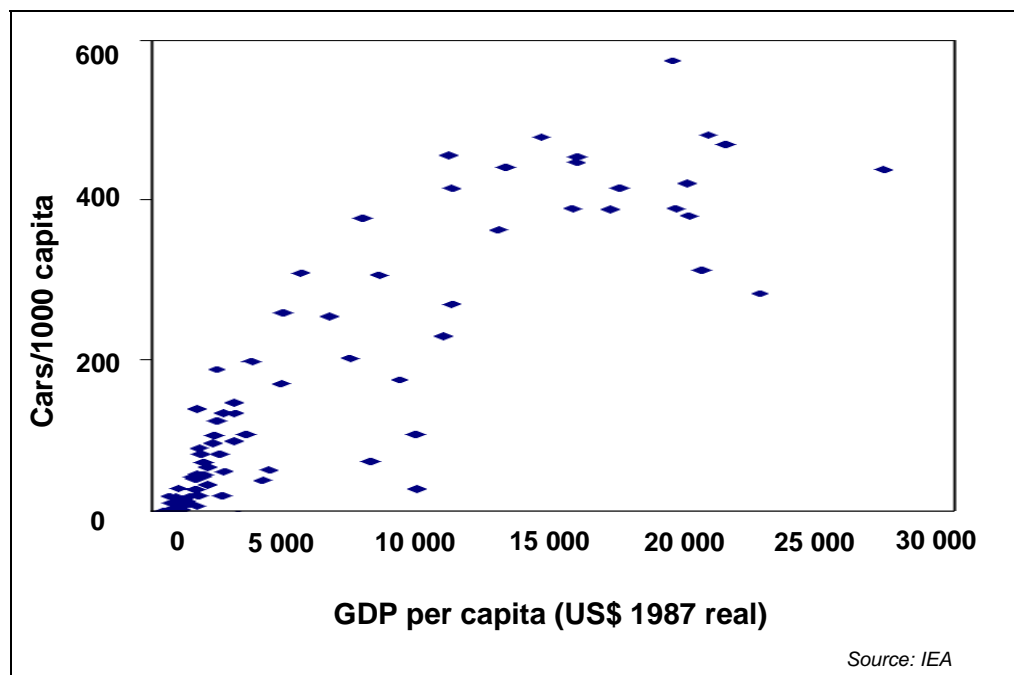


Figure 9-2: GDP growth and passenger cars

Since GDP per capita is expected to rise in Africa (IMF, World Bank etc), the numbers of cars are likely to increase considerably. This again may generate more severe congestion problems, -particularly in large cities.

As congestion to some extent can be relived by railway transport much of the future depends on whether public investments flows are canalized to road or rail.

In Africa and especially in Sub-Saharan Africa, road transport is the dominant form of transport which carries more than 80 percent (*source: World Bank, 2005*) of the region's passenger and freight transport. It is the almost only form of access to most rural communities and the interconnecting way between countries and regions.

But the major problem in Africa in general is related to the inadequate transport infrastructure both locally and regionally, and the missing of links especially at border areas. A study carried out by the United Nations Economic Commission for Africa (UNECA) in 2004 revealed for 103 cross-borders links,

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33% are unpaved roads in various conditions(good, fair and poor), 16 % are paved roads in poor condition and 38% are paved roads in good or fair condition. This clearly illustrates the poor state of physical integration between African countries. This is meaningful to intra-African trade because the physical condition of cross-border links affects traffic levels and the quality of transport services between countries.

The problem of missing links affects the Regional Economic Communities, yet designed for a regional integration, and apparently there is a disparity in the level of physical integration across the continent (*Table 9-1*).

| Regional Economic Community | Total Links(km) | Missing links(km) | Missing links as a share of total % |
|-----------------------------|-----------------|-------------------|-------------------------------------|
| COMESA                      | 15,723          | 2,695             | 17                                  |
| EAC                         | 3,841           | 523               | 14                                  |
| ECCAS                       | 10,650          | 4,953             | 47                                  |
| ECOWAS                      | 10,578          | 2,970             | 28                                  |
| IGAD                        | 8,716           | 2,423             | 28                                  |
| SADC                        | 11,454          | 2,136             | 19                                  |
| UMA                         | 9,923           | 1,110             | 21                                  |

*Table 9-1: Physical integration of Regional Economic Communities.  
Source: UNECA official site (2005).*

It emerges from the table that the Central and the Western regions are more affected by the interconnection problem.

Overall, the road sector in Africa is in a deplorable state. The total length of roads in the region is 2,064,613 kilometers out of which only 29,7 % is paved, the remaining portion being either earth or gravel roads. Clearly, the quality of road infrastructure affects transports costs, and charges change in wet and dry seasons on poor quality roads :in some countries( like Tanzania, Madagascar, Burundi...) passenger fares and freight charges increase doubly or more. Locally, maintenance and rehabilitation of roads is a major concern for many governments, while countries need more funds to build additional rural roads to open new areas for agriculture and development.

In our strategically vision 2025 for African railways, we set out our approach in respect of that fundamental situation of the African continent.

The phenomenon of roadblocks poses a serious challenge to transportation system in Africa. It results in excessive delays and substantial increase in transport costs. For example, it is reported that there are 47 roadblocks between Douala and Bertoua in Cameroon, on a distance of about 500kms. Nearly all West African States (**ECOWAS**) maintain numerous checkpoints, where drivers are sometimes subjected to administrative harassment and extortion (*Table 9-2: Checkpoints along major ECOWAS highways*)

| Highways            | Distance | Number Checkpoints | Checkpoints per 100 km |
|---------------------|----------|--------------------|------------------------|
| Lagos-Douala        | 992      | 69                 | 7                      |
| Cotonou-Niamey      | 1036     | 34                 | 3                      |
| Lome-Ouagadougou    | 989      | 34                 | 4                      |
| Accra-Ouagadougou   | 972      | 15                 | 2                      |
| Abidjan-Ouagadougou | 1122     | 37                 | 3                      |
| Niamey              | 529      | 20                 | 4                      |

*Table 9-2: Checkpoints along major ECOWAS highways  
Source: UNECA official site (2005).*

Payments at checkpoint include, among other things, various taxes and transit charges. Such payments also vary with the type of vehicle, type of goods transported and nationality of transporter;

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and they involve the police, customs officers and gendarmes. In addition, some of these checkpoints are illegal.

Checkpoints are not limited to Western African Countries. Road users in all regions suffer from the existence of numerous checkpoints. For example, between Mombassa (in Kenya) and the Uganda border, there are 27 police controls and within Uganda, there are 4 checkpoints and 5 obligatory stop zones for transit vehicles.

The problem of numerous checkpoints gets worse in some countries where security of goods is not safeguarded, and they can be diverted from their intended destination. In Kenya, Tanzania and Cameroon, a transit monitoring system in the form of police escorts has been introduced, and this contribute to delays and result in additional costs: the police usually escorts convoys of trucks and the journey only begins when several trucks are ready to depart, and operators have to pay the security provided by these police escorts.

The use of containers could be an efficient way of preventing the diversion of goods into the domestic market of transit countries. But containerization remains limited in Africa. However, according to a study conducted by the Development Bank of Southern Africa (DBSA) in 2005, containerized freight will grow by an average of 9, 8% a year in Sub-Saharan Africa between 2004 and 2010, and by an average of 8% a year between 2010 and 2015. This means that the growth in container traffic in Sub-Saharan Africa is set to outpace growth in most other regions of the world, except Asia, in the next ten years.

An other hindrance to international transportation of goods in Africa is the variation in technical standards for vehicles in different regions, and this blocks free competition between transport operators. For instance, if standards were applied, a 22 meters long truck operating in Nigeria, a member state of ECOWAS would not be allowed to operate in neighboring Cameroon, a member state of CEMAC whose maximum allowable vehicle length is 18 meters.

Table 9-3 shows different axle load and weight limits in three different Regional Economic Communities.

| RECs   | Axle load limit    |                    |                    | Max.load | Max length | Max.height | Max.width |
|--------|--------------------|--------------------|--------------------|----------|------------|------------|-----------|
|        | Single Axle(tonne) | Tandem axle(tonne) | Triple axle(tonne) | (tonne)  | (meters)   | (Meters)   | (meters)  |
| CEMAC  | 13                 | 21                 | 27                 | 50       | 18         | 4          | 2.5       |
| COMESA | 10                 | 16                 | 24                 | X        | 22         | X          | X         |
| ECOWAS | 12                 | 21                 | 25                 | 51       | 22         | 4          | 2.5       |

X= not available

*Table 9-3: Technical standards for vehicles in different Regional Economic Communities.*

*Source: UNECEA official site.*

Other obstacles for transport operators are divergences in transit costs among member states in different African regions, resulting in lack of transparency and high road user charges. However, let's appraise the recent progress made in COMESA (The Twelfth Summit of COMESA, Nairobi, Kenya 22<sup>nd</sup>-23<sup>rd</sup> May 2007) in the harmonization of transit charges (tariff barriers) at the regional level, and becoming operational in Burundi, Ethiopia, Kenya, Malawi, Rwanda, Sudan, Uganda, Tanzania, Zambia and Zimbabwe.

Nevertheless, many other problems still exist:

- Problems related to crew members confronted with administrative difficulties concerning their documents (driving licenses, residence permits, work permits, etc). While visas are not required for Commonwealth citizens moving in COMESA and SADC zones, crew members on vehicles in transit must pay for entry visas into countries (Burundi, Rwanda, and D.R.Congo for example) not belonging to that institution.

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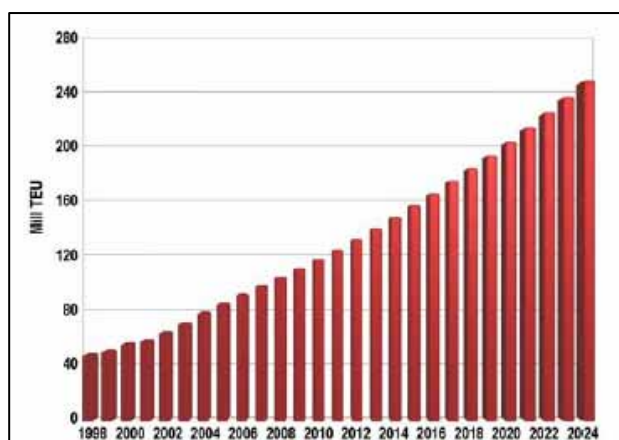
- Excessive documentary requirements and outdated official procedures.
- The lack of or insufficient use of automated processes and information technology.
- Safety and security: Security procedures, corollary of international terrorism and regional conflicts is becoming more and more important and poses a new and serious challenge to customs administration as well as to operators, especially in maritime and air transport sectors.
- Inefficient customs administration: delays at African customs are on average longer than the rest of the world: 12 days in countries South of Sahara, compared to 7 days in Latin America, 5.5 days in Central and East Asia, and slightly more than 4 days in Central and East Europe (UNECA, 2004). The situation in crossing borders in between African countries can be worse: delays at the main border between South Africa and Zimbabwe (Beit-Bridge) amounted to six days in February 2003, leading to an estimated loss in earnings per vehicle of US\$ 1,750, equivalent to the cost of a shipment from Durban in South Africa to US ( World Bank,2005). Border crossing delays are also linked to other trade costs, especially corruption in customs.

### Sea

Today, in terms of volume, approximately 90% of the world's trade is handled through sea ports (Major origins and destinations, China-Europe container trade, Transportutvikling AS, 2005). Ocean carriers have a competitive advantage with regards to international transports, large volume transports and various bulk/heavy transports. Although rail is suitable for transport of oil onshore, ships often offer more efficient transfer on long international distances and on trade lanes where sea and rail are competitors. This situation does also occur along the coast of Africa. Compared with rail, sea transports have several advantages when it comes to bottlenecks, discontinuous points, economies of scale, tariff barriers etc. Ocean carriers have also been operation in a competitive market, which have influenced the quality and standard offered to the customers.

The railways lack of competitiveness is also due to natural endowments on certain routes (such as geographical conditions, like transports to/from Africa, lack of railway connection inland Africa), but also caused by the various country specific obstacles (political situation, operational standard etc) in many of the countries linked to the African railways.

Container transport has been growing rapidly, and by 2005 the level is 8-9 times higher than in 1980. Historically world trade has been growing faster than world GDP and container transports has been growing faster than world trade. The basic assumption, economic growth, for increased container traffic is also valid for Africa. However, capturing this opportunity depends on the railways and the various governments ability & will to move together with the markets requirements.



Projections made for the shipping industry (ISL Market Analysis 2005), project world container trade to grow from less than 100 millions TEU's to day to more than 240 million TEU's in 2025. 50% of this container volume is expected to come from China. Figure 9-3 shows total projected global trade flow in millions of TEU's.

Figure 9-3: World growth projections, container traffic

Africa's total seaborne trade is heavily imbalanced. Loaded cargo is twice the unloaded, mainly due to crude and products. For Sub-Saharan countries the imbalance is even more dominant, and in 2005

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approximately 230.000 tons where loaded while unloaded cargo was less than a third of the total. When it comes to dry cargo (including containers and the 5 major bulks), the African balance is opposite. Unloaded (import) is almost twice the loaded (export).

The trade balance for total seaborne trade has been improving during the last 35 years, from a export/import factor of 5 in 1970 to less than 2 in 2005. Dry cargo has developed in a different direction. In 1970 the export was 2.5 times the import, while in 2005 (as mentioned) the export was less than 50% of the import cargo.

### 9.1.3 African ports

Africa, as an "island", has a huge number of ports. 32 of the 37 countries with coastline have operational ports. Most of them are linked to the African railways system. Depending on the trade structure in the respective countries, there are a wide variation among the ports. Large oil-exporters are dominated by wet-bulk ports while exporters of minerals have large dry bulk ports.

The intermodal containerized transport to/from Africa and Europe is the largest for the continent. In 2004 it reached 3.3 million TEU through all African ports. The flow between Africa and North America is only one tenth of this flow and Asia is expanding fast. The container traffic through the ports is heavily imbalanced and between the west coast ports of Africa and Europe, the south bound flow is twice the northbound flow. The estimate for 2005 was 556.000 TeU (south) and 286.000 TeU (north).

The 20 largest container ports in Africa handled 75% of the container throughput in 2004 (8.4 million TeU's). The largest ports are in the South and the North, Durban in South Africa (1.717 TeU's) and Damietta in Egypt (1.264 TeU's).

| Port                              | Country                     | TEUs   |       | Percentage change |
|-----------------------------------|-----------------------------|--------|-------|-------------------|
|                                   |                             | 2004   | 2003  |                   |
| Durban                            | South Africa                | 1 717  | 1 511 | 13.6              |
| Damietta                          | Egypt                       | 1 263  | 955   | 32.2              |
| Abidjan                           | Côte d'Ivoire               | 670    | 613   | 9.4               |
| Cape Town                         | South Africa                | 570    | 533   | 6.9               |
| Casablanca                        | Morocco                     | 492    | 448   | 9.8               |
| Lagos                             | Nigeria                     | 444    | 486   | -8.7              |
| Mombasa                           | Kenya                       | 404    | 331   | 22.3              |
| Tema                              | Ghana                       | 340    | 350   | -2.9              |
| Dakar                             | Senegal                     | 331    | 281   | 17.7              |
| Port Elizabeth                    | South Africa                | 323    | 274   | 17.6              |
| Port Louis                        | Mauritius                   | 290    | 381   | -23.9             |
| Dar-Es-Salaam                     | United Republic of Tanzania | 260    | 204   | 27.5              |
| Luanda                            | Angola                      | 235    | 210   | 12.1              |
| Port Sudan                        | Sudan                       | 206    | 157   | 31.2              |
| Port Reunion                      | Reunion                     | 193    | 170   | 13.5              |
| Lome                              | Togo                        | 185    | 166   | 11.1              |
| Djibouti                          | Djibouti                    | 159    | 244   | -34.8             |
| Sokhna                            | Egypt                       | 155    | 122   | 27.2              |
| Toamasina                         | Madagascar                  | 105    | 95    | 10.8              |
| East London                       | South Africa                | 60     | 56    | 7.3               |
| Total top 20                      |                             | 8 402  | 7 587 | 10.7              |
| Total all African ports           |                             | 11 239 | 9 661 | 16.3              |
| Top twenty share in African ports |                             | 74.8   | 78.5  |                   |

From 2003 to 2004, 85% of the top twenty ports showed increase in the port throughput. The top-twenty ports are shown in

to be updated!

figure 9-4.

TO BE UPDATED!

Figure 9-4 Top twenty African Container ports (ranked by 2004 figures)<sup>6</sup>  
(Source: Containerization International Yearbook, 2006)

The major share of the African ports is operated by ports/terminals controlled by their respective public authorities. In 2004 the share was 84%. However, and like the rest of the world, the share of global terminal owners/operators is increasing. In 2004 11% of the throughput was handled by global operators while the percentage in 2003 was 5-6%. Many countries are searching for improved operational efficiency through a landlord model, which usually means that the infrastructure is owned by the government while the operation and superstructure is controlled by private operators (through concessions).

Along the East Coast ports of Africa transshipment has been growing during the last few years, often based on a strategy to avoid the congestion at main ports in Africa. Particularly a Port like Port Louis (Mauritius) has been growing fast since several lines have made agreements to use it as a transshipment hub.

Congestion is major challenge at many ports in Africa. Severe congestion continues in harbors like Mombassa (Kenya) and Dar-Es-Salam (Tanzania). Recently (February 2007) the waiting time at the port in Mombasa was 4 days, while the waiting time in Dar-Es-Salam was 8 days. This situation caused that ships were diverted to Kenya, which is worsening the situation there (Railways Africa, February 14 2007).

### ***9.1.4 Railway technology***

Rail transportation has been the product of industrial era, and it represented a major improvement in land transport technology and has obviously introduced important changes in the movement of freight and passengers. This was not necessarily because of heavy loads, since maritime transportation excelled at doing so, but because of the time element. Rail transport systems dramatically improved travel time as well as the possibility to offer reliable schedules that could be included in the planning of economic activities such as production and distribution. The coherence of economic activities and social interactions was thus substantially improved. Rail transport has been affected by continuous innovations, technical and commercial changes. Increasing electrification and automation will also improve the efficiency of rail transportation, passenger and freight alike. New rail lines have been built recently but mainly in developed countries. Railway speed records have constantly improved (for instance the French high speed rail system-TGV). Variable wheel –base axles permit rail transport between different gauges.

The global trend involves the closure of unprofitable lines as well as the elimination of several stops. The process of rationalization (deregulation) of rail network is now completed in a number of countries: over the last 50 years, rail companies abandoned lines (or sold them to local rail companies), removed excess terminals and warehousing capacity and sold off property.

In addition to energy efficient (the fuel efficiency of locomotives has increased by 68% between 1980 and 2000) and lighter equipment, the usage of double-stack cars has revolutionized rail transportation

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<sup>6</sup> In 2005, Durban is still the largest port (1.899.000 TEU), followed by two Egyptian ports; Port Said (1.340.000 TEU) and Damietta (1.129.595 TEU)

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with additional fuel efficiency of 40%. Double-stack rail technology is major challenge for the rail transport system as it effective for long distances where additional terminal costs are compensated by lower transport costs.

Whereas railway transport elsewhere is experiencing a period of prosperity, African railways, in general, are currently facing a very difficult situation: almost all the networks are faced with numerous challenges, which are mainly linked to the absence of a political and economic environment capable to guarantee their growth. Very few new railway lines have been constructed on the continent since independence. There is also no interconnection between the different networks, except in North and Southern Africa. We take three examples to illustrate the situation of the railway technology in Africa:

1. The West African example.
2. The Egyptian example.
3. The South African example

### 1. The West African example.

All the lines in West Africa, built in early 20th century, are now outmoded due to age, lack maintenance and unsuitability of their design to exigencies of modern efficient rail transport operation: ballasting generally inadequate; too many sharp curves on some sections and similarly inadequate tracking and rail weight, as the lines date back to an era when the average axle load hardly exceeded 14 tones. The rolling stock is highly diversified with often advanced average age. Spare parts supply has been extremely difficult by shortage of funds and the multiplicity of origin of the parts. Only a few modern wagons have been mounted in the sub-region with knocked-down parts sourced from European manufactures. With regard to the characteristics of the infrastructure, the structures constructed in 1836 had been designed for light axle load (generally 14 tones). The dilapidation state of the structures constitutes a constraint which must be eliminated if modern rail system is to be put in place. The lines generally have old rails made of quite hard materials; but these rails have been weathered by time. 13.30% of the lines on record have between 20 and 26 kg/ml rails. Most of those currently in use are equipped with 30 to 54 kg/ml rails, and are fairly well ballasted. The sleepers are similarly very old, and tracking are generally few on the lines. Nearly 70 % of the rail lines in the sub-region are welded. Three different gauge systems exist on the 10,475 km lines in West Africa:

- Metric gauge (1000mm) for 4,737 km.
- 3'6" gauge (1067mm) for 4,785 km.
- Standard gauge (1435mm) for 953 km.

The signaling and telecommunication systems are characterized by modest installation, low running and maintenance costs, and the performance is poor: several methods are used like request for passage, telephone receptors on specific locations or pilot baton system.

The rolling stock (coupling system, breaking system, wheel profile and bogies system) are mutually compatible in French-speaking West African countries, but not so with those in Ghana and Nigeria (coupling and breaking systems). The wheels and axle systems of the public railway networks are practically the same, and so, compatibility is ensured.

In general, the operations methods in the sub-region's rail networks are practically identical, and therefore compatible.

### 2. The Egyptian example.

Due to its exceptional geographical location as one of the main international trade passages between east and west, Egypt has a performed transport sector, compared to the whole African situation. In addition, Egypt offers an ideal field for exploitation, from a railway point of view: Construction was easy and economical, almost the only major works being the Nile bridges. Gradients are practically non-existent and curves are easy. The planning of a railway between Suez and Cairo to facilitate transit between Europe and India is dated in 1833. The first railroad in Africa and even in the Middle East was completed in 1856 in Egypt, between Alexandria and Kafer Eassa. In order to redraw the history and development of the Egyptian National Railway, the Egyptian Railway Museum had been founded already in 1933. In 2005, 5063 km of rail were operated using standard gauge of 1435 mm.



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Nowadays around 35% of Egypt's commuter traffic travels on 28 rail lines running over a length of about 9525 km through 760 passenger stations and operate 1800 trains on round trips at length of 135 km. Until recently, the Egyptian railway technology was characterized by an old equipment and poor maintenance. For long years, Egypt did not invest railway in regard to maintaining their facilities or equipment. And following a series of major train accidents( Recent cases :in 2002, 373 people killed and in 2006, 58 people died and 128 injured), The Egyptian National Railway started a whole rehabilitation program . In the Egyptian system, signalmen and their ability to communicate with train drivers are keys to security because many of the collisions of the past have been blamed on human error such as an absent signalman. At present, developing and reforming the railway system is one of Egypt's priorities, and there is significant local demand for railway parts in the Egyptian market: new locomotives, electrical and mechanical spare parts, signaling equipment, increasing networks, and upgrading of railway stations, diesel engines, traction motors, alternators, radiator and fans, train station management/upgrade, electrification and maintenance, Safety and security equipment.

While the Egyptian National Railway purchases engines and rail abroad, passenger wagons are built and refurbished in Egypt by the "Société Générale Egyptienne de Matériel de Chemins de fer (SEMAF)".

Despite those measures to bring to date, it will take more than new hardware to solve the many problems of the railways: the staff has to be retrained and the system of rewarding drivers according to distances travelled is to be reviewed because it encourages speeding and disregard for safety.

Rail service is a critical part of the transportation infrastructure of Egypt but of limited service for transit. The vast majority of engines are diesel-driven. Sixty-three km are electrified, namely commuter lines between Cairo-Helwan and Cairo –Heliopolis. Egyptian National Railway's current locomotive fleet consists of 671 diesel-electric locomotives and several Turbine-Powered bi-directional train sets operating in 12 regions.

Egypt has mastered a head start comparatively to the African continent: the Egyptian passenger trains offer a noticeable service both for tourists and local population: Air-conditioned passenger trains usually have 1st and 2nd class service, while no-air-conditioned trains will have 2nd and 3rd class. Air-conditioned sleeper trains are appropriate to tourists who can spend a night on trains. Egypt is also the first country in Africa and the Middle East to implement the underground metro which transports 3 millions passengers / day and its lines extend to a length of 64, 6 km. Egypt has the largest railway swig bridge in the world, El Ferdan Railway Bridge erected in 1924 and rebuilt in 2001, crossing the Suez Canal and linking Africa to Asia.

### 3. The South African example:

Dating to the 1860s, South Africa's railway system is probably the largest and the most sophisticated on the African continent. The few coastal lines opened since 26th June 1860 along the Bluff in Durban rapidly began to penetrate the interior during the two following decades, as an immediate consequence of the discovery of the world's richest diamond and gold and the accompanying industrialization and accelerated movement and urbanization of people.

Like elsewhere in Africa, railway development in South Africa was essential part of European colonization. The railway development in many African countries experienced stagnation after independences, but in South Africa, progress was unregistered after 1910(Date of independence). Economic performances are factors to explain the expansion of the railway system: the discovery of more minerals, rapid industrialization after 1910, followed by agricultural development after 1945, the influx of new settlers, urbanization, the creation of the Africa's largest energy-generating infrastructure (coal-based), tourism development and others.

The impressive railway system in South Africa is characterized by 20872 km of railway network, owned by spoornet (In charge of freight, containers and main line passengers) and other three small companies providing city and intercity passenger service (Metrorail, Blue Train and Shosholoz Meyl); more than 1000 station complexes with station buildings; sheds; workshops, houses and villages for railway staff (including recreational facilities); 10000 bridges and viaducts; 150 tunnels

(Many lines are engineering monuments in their own right); some of the world's largest and most powerful steam engines, as well as many electric and diesel –electric engines specially designed for local conditions, and finally, some of the world's longest goods trains and most luxurious passenger trains.

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Most lines are built according to the 1065mm 'cape gauge' (3 feet 6 inches) track width, which was accepted as a standard in 1873 and has been adopted in most African countries. There is also a narrow gauge, 610mm (2 feet), covering a distance of about 314km, and the 80 km route of "Gautrain" under construction since September 2006 by a Canadian-French and South African consortium has a standard gauge of 1435mm (4 feet 8,5 inches). An estimated distance of 10436 km route is electrified.

Railway transport in South Africa has been through different transformations, starting in the late 1980s when the then South African Railways was put on the road to privatization and became the South African Transport Services (SATS). A vast transportation network public company, Transnet, replaced SATS in the 1990s. The major divisions composing the Transnet are those focused on rail transportation, including Spoornet (main line transport in charge of freight, containers and main line passengers), metrorail (a commuter rail transport business operating suburban trains in the metropolitan center of South Africa), and Transwerk.

Transwerk is a division involved in engineering activities and operates as a portfolio of eight national product-focused businesses being Locomotives, Coaches, Wagon Build, Rail Freight Refurbishing, Rolling Stock Equipment, Rotating Machines, Wheels and Tarpaulins. Transwerk markets worldwide and its products are now operating both in Europe (in some 7 countries), in Africa (in 11 countries) and in Australia. Transwerk meets the demands of the rail freight industry especially in the heavy haul market.

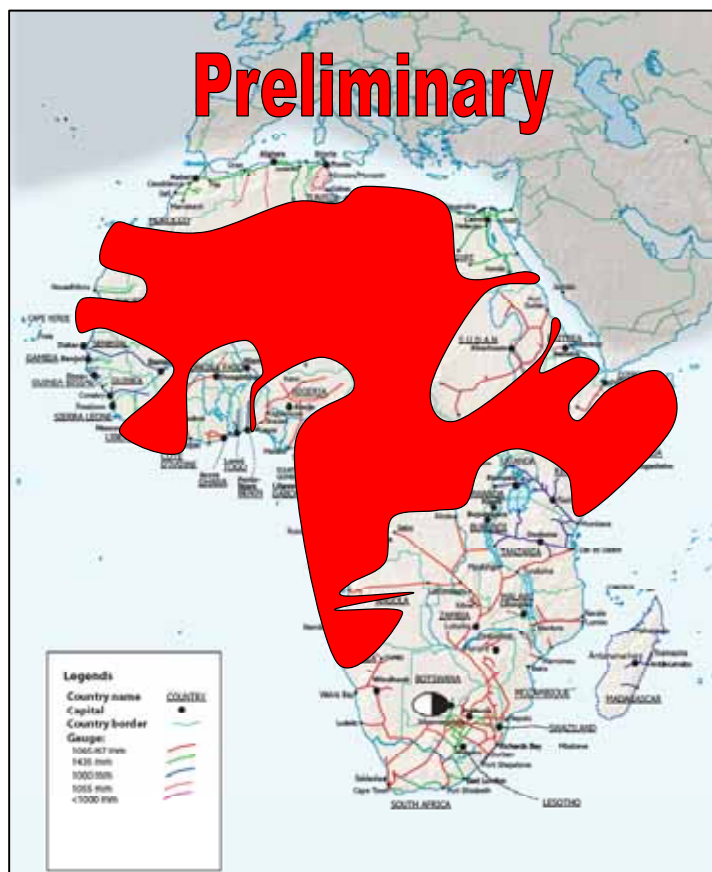
On chapter of railway heritage conservation, mention must be made of an existence of the Transnet Heritage Foundation that has managed to save the entire holdings of former railway publicity department (including hundreds of films, videos, slides, negatives and photographs), and the official Transnet conservation agency that operates the official Transnet Museum (composed of engines, rolling stock and other objects).

A significant progress on railway technology has been accomplished by Spoornet in developing an acoustic broken rail detector. This is a suitable solution for unpredictable rail breaks. Rail breaks are common phenomena in all railways over the world, causing very costly derailments if not detected before the passage of a train. Ultrasonic Broken Rail Detector has the capability of detecting a broken rail almost continuously without human intervention. The technical evaluation of the system on the Spoornet lines was completed in November 2002 and the development was supported by the UIC. Other railway technical ameliorations are expected by June 2010 (when the country will host the FIFA World Cup), to meet the transportation requirements of the event. The transportation system is expected to serve approximately 140,000 passengers daily. The Gautrain will take commuters from Johannesburg to Pretoria, traveling at speeds of up to 160 to 180 kilometers an hour. A leading provider of IP-based video surveillance solutions announced that 96 new Electrostar cars for the Gautrain Rapid Rail Link in Gauteng Province will be equipped with the Bombardier SEKURFLO transit security solution. The video surveillance component of the SEKURFLO solution is jointly designed and developed by Bombardier Transportation and March Networks. The SEKURFLO solution will enable Gautrain personnel to monitor driver and passenger safety and deter theft and vandalism. It will also alert staff to potential emergencies and provide visual information to accelerate response.

## 9.1.5 Infrastructure and operational conditions

### Missing links and cross border issues

Africa represents more than 20% of the world land area, constitutes of at least 53 countries, where 7 (13%) are islands and 15 (28%) are landlocked. 35 (66%) of the countries have some kind railway infrastructure in operation.



Africa has no continuous railway infrastructure which can be accommodated to bring freight or passengers across the entire continent, east-west nor north-south. Technically it is only possible to perform relatively short east-west railway transports in the North along the Mediterranean Sea (Maghreb), in the south (South Africa and bordering countries) and a few north-south sections (like between South-Africa and Tanzania).

Missing links are obvious challenges when it comes to the development of railway transports. A transport through a missing link can only be organized as a multimodal transport where at least two trans-loadings are required. The trans-loading operation is costly and time consuming. For many countries this operation also involves higher level of risk, since the potential risk level is higher when freight is not moving.

Figure 9-5: Lack of intra-Africa railway connections

Figure 9-5 is a simplified illustration of the geographical area in Africa where no railway connection do exist (red area). These missing links is an effective barrier for intra-African railway transports as well as international transit corridors.

However, construction of railway infrastructure is only a necessary, not a satisfactory, condition for the development of competitive railway corridors and routes. The physical missing links are only a part of the challenges since the operational systems have to improve when getting the full effect out of infrastructure investments. If the operational system is not functioning, quality is low or the commercial conditions are not accepted by the market, -the return on investments will be low.

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Regulations, infrastructure, rolling stock and procedures in Africa are not generally homogenous, -all contributing to more complex border crossings in regions where the infrastructure exists. This discontinuity has severe impact on effective logistical chains, -time consumption as well as costs. Efficient border crossing by railway is particularly important in Africa where 15 of the worlds' 30 landlocked countries are located (12 are in Asia).

The most "promoted" obstacle is the lack of a common railway gauge. Africa has 3 main gauges and in reality 6 different gauges<sup>7</sup> (less than 1.000 mm considered as one). The dominating gauges are 1067 m.m. (xx%) and 1000 m.m. (xx%). 1065 and 1067 m.m. counts for xx% of the African network.

Several gauge-breaks appear in Africa (Ref. figure 8-5 in Chapter 8.4, "African railways and the world").

The trans-loading operation can be made with several different techniques. Manual or mechanical transshipment, boogie exchange and the use of variable gauge boogies are some examples. Dual or composite gauge operations are also alternatives. The most favorable solution has so far been transfer of containers between two set of wagons (using fork-lifts or cranes), due to less investments and easy operation.

Furthermore, there might be missing links due to geographical conditions, national conflicts, damage or economical reasons (not considered commercial viable to build the link). Whether the missing links are to be completed depends mainly on the importance of relevant trade opportunities compared with investment costs completing the links.

In addition to these physical discontinuities, there are political and administrative barriers like tariffs, border permissions, change of crew, safety inspections, bureaucratic administration procedures and various other impediments. These non-physical challenges can be considered as more important than the physical. Saving 5 hours by introducing a more efficient trans-loading procedure may not have considerable impact on the through time if administrative procedures are unchanged.

All these physical and non-physical barriers interrupt movement of goods and passengers, which again cause additional costs and thus affecting the future African Railway as well as these railways connections to intermodal freight centers (like ports) and the international market.

### Capacity constraints

Railway capacity is influenced by several variables. Static capacity, measured as the capacity that the infrastructure can handle, is commonly used. Infrastructure capacity is a necessary, however not a satisfactory, condition for smooth operation. The intention with this study is not to calculate capacity, - but state that in case of increased demand for railway traffic towards 2025, capacity problems may appear and increase for some countries.

Constraints in infrastructure are by many identified as a major limitation to economic growth. Take ports as an example. Several ports are located to Africa. Many of these are operating at full capacity. Possible solutions to constraint problems usually involve moving non-maritime activities further inland where acreage is plentiful, and connecting this to the ports by rail (Krumm, 2003; 165).

Some railway-services face constraints at present.

As long as the infrastructure is not separated between passenger and freight transports, growing freight transports will influence the passenger capacity and vice-versa.

A recent study indicated that 30% of Africa's huge resource requirements are related to infrastructure investments. These investments are not only related to transport infrastructure. They do also take into consideration that only 30% of Africa's population have access to electricity, 65% to water/sanitation

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<sup>7</sup> Rail gauge is the distance between the inner sides of the rails which make up a railway track, measured in millimeters. The most common gauge world wide is 1435 mm.

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and that the penetration rate for telecommunication is only 13%. However, the figures do also take into consideration that only 34% of Africa's population have acceptable road access (Source: African Development Group, paper November 2005, ref. Commission fro Africa report).

Transport capacity is a comprehensive concept, including several different issues. Infrastructure capacity is only one of many variables influencing capacity. Some African countries face challenges which may be considered as more important than the plain infrastructure capacity. Availability of rolling stock/traction, bureaucracy, poverty, political conditions, poor logistical systems and operational standard as well as lack of transparency and market orientation is important elements influencing capacity and quality.

Lack of intermodal solutions and economies of scale are examples which influence capacity.

Capacity limitations are often related to the ports inland connectors and terminal choke points. An American study identified 10 major factors of importance when evaluating a terminal's ability to handle its export and import cargo.

### **Terminal effectiveness influenced by:**

- 1.Length of Yard tracks
  - May be necessary to split the train
- 2.Number of inbound and outbound tracks
  - Frequency of arrivals and departures in conjunction with cycle times.
- 3.Yard design
  - Where logistical elements are located and organized
- 4.Number of non-port trains
  - Trains which do not enter the intermodal port facilities may cause conflicts
- 5.Number of switch engines on-duty
- 6.Jurisdictional Restrictions
  - Restrict the railroads ability to perform due to pre-existing agreements between carries that
- 7.Yard limits/restricted speed
  - Speed limits within yards can be reduced in e.g. foggy conditions.
- 8.Remote controlled locomotives
- 9.Near port surge capacity potential
  - Limited storage and holding capacity near the port facilities.
- 10.Performance measurements
  - Identify when and where the congestion occurs.

*Source: Washington Public ports association 2004*

There are several factors influencing terminal capacity. Space conditions in general, management systems and cargo-mix are determinants of crucial importance.

Some countries in Africa are planning to develop their terminal systems, and some countries have more exhaustive plans than others.

(Some examples from African countries to be included)

Figure 9-6 Terminal effectiveness

### **Intermodality**

In recent years there has been an increased demand for intermodal transport practices that promote seamless transport by integrating different transport modes of railways, roads and maritime shipping to facilitate trade flows.

The world's economies are becoming increasingly interconnected. As a result, advanced logistic systems can have a significant effect on the competitiveness of enterprises and trading economies.

Countries in Africa have varying levels of intermodal infrastructure. They face differing challenges (both physical and institutional) in upgrading existing or creating new intermodal infrastructure, or in promoting the use of these systems. Furthermore, countries are at different stages in devising strategies to remedy existing deficiencies and planning for future needs.

Issues which impede the development and use of intermodal systems in Africa include inadequate existing infrastructure (e.g., poor rail and road access to ports); poor coordination of loading and unloading activity; differing rail gauges (resulting in costly methods of moving freight from one country

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to another); lack of land availability in close proximity to major ports, highways and rail access routes; conflicting customs and immigration procedures, resulting in delays and prevention of freight movement from one country to another; institutional blockages of the free flow of transit vehicles and cargo in the hinterlands; and lack of coordination between different levels of governments.

Effective intermodal transport operations must also be supported in by investment in intermodal transport infrastructure. Positive initiatives are found in countries like Morocco, Namibia, South-Africa, Kenya, Tanzania?, Djibouti, Mozambique and others.

An intermodal chain is not stronger than its weakest points and the development of inland container terminals are important to develop the African intermodal systems (as well as the railways systems).

### ***9.1.6 Liberalization and concessioning***

Liberalization of international trade and the globalization that has accompanied it, have accelerated the growth of international trade. At the same time, the change in the composition of international trade, with a shift away from basic commodities towards processed primary products and manufactured goods, also favored growth in container volumes.

Organizational issues have strong influence on the efficiency and effectiveness of transports. Whether a railway company should be privatized/concessioned or not, separated into infrastructure and operational sections etc. are subjects currently addressed. Some European countries have been pioneers concerning this matter, although different experiences have been gained and the processes have been relatively slow. Several studies (e.g. Transportrådet 2002, Denmark) conclude that the total benefits subsequent to privatization of public transport have been positive. These benefits include various parameters like reduction in rates and governmental subsidies as well as increased customer satisfaction. These conclusions are not generally accepted and there are research findings concluding less optimistic.

Countries in Africa are not homogenous. It may therefore be a simplification to advise a single solution.

However, liberalization is usually considered to be one condition leading to enhanced activity and efficiency. How far the liberalization process will go in Africa depends mainly on political decisions. African governments, like other governments, will probably adapt some experience from other regions of the world and public pressure may push the development further.

Most of the railways in Africa are owned by the governments and operated by national owned companies. Several countries have established privately owned railways through concession systems. Most of the railways that have been presented for concessioning are badly run-down, requiring substantial rehabilitation of both infrastructure and rolling stock. They generally carry volumes that are very low by world standards (World Bank, September 2005).

Since 1993 (and as per September 2005), thirteen concessions have been awarded in Africa , with further seven in the process of being occasioned.

The table and figure (below) shows the African concessions as per September 2005

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| Country                  | Year Awarded | Concessionaire | Year Commenced |
|--------------------------|--------------|----------------|----------------|
| Ivory Coast/Burkina Faso | 1995         | Sitarail       | 1995           |
| Cameroon                 | 1998         | Camrail        | 1999           |
| Gabon                    | 1999         | Transgabonais  | 1999           |
| Malawi                   | 1999         | CEAR           | 1999           |
| DRC                      | 1995         | Sizarail       | 1995           |
| Zimbabwe                 | 1997         | BBR            | 1997           |
| Togo                     | N.A.         | WACEM          | 2002           |
| Maputo Corridor          | 2002         | NLPI/Spoornet  |                |
| Senegal/Mali             | 2003         | Transrail      | 2003           |
| Zambia                   | 2003         | RSZ            | 2003           |
| Madagascar (north)       | 2003         | Madarail       | 2003           |
| Mozambique (Beira)       | 2004         | Beira Rail     | 2004           |
| Mozambique (Nacala)      | 1999         | CDN            | 2005           |
| <b>In Progress</b>       |              |                |                |
| Ghana                    | 2005         | United Rail    |                |
| Kenya                    |              |                |                |
| Uganda                   |              |                |                |
| Tanzania (TRC)           |              |                |                |
| Tanzania (Tazara)        |              |                |                |
| Ethiopia                 |              |                |                |
| Congo Brazzaville        |              |                |                |

Table 9-4: Concessions of African Railways since 1993 (Source: World Bank, 2005)

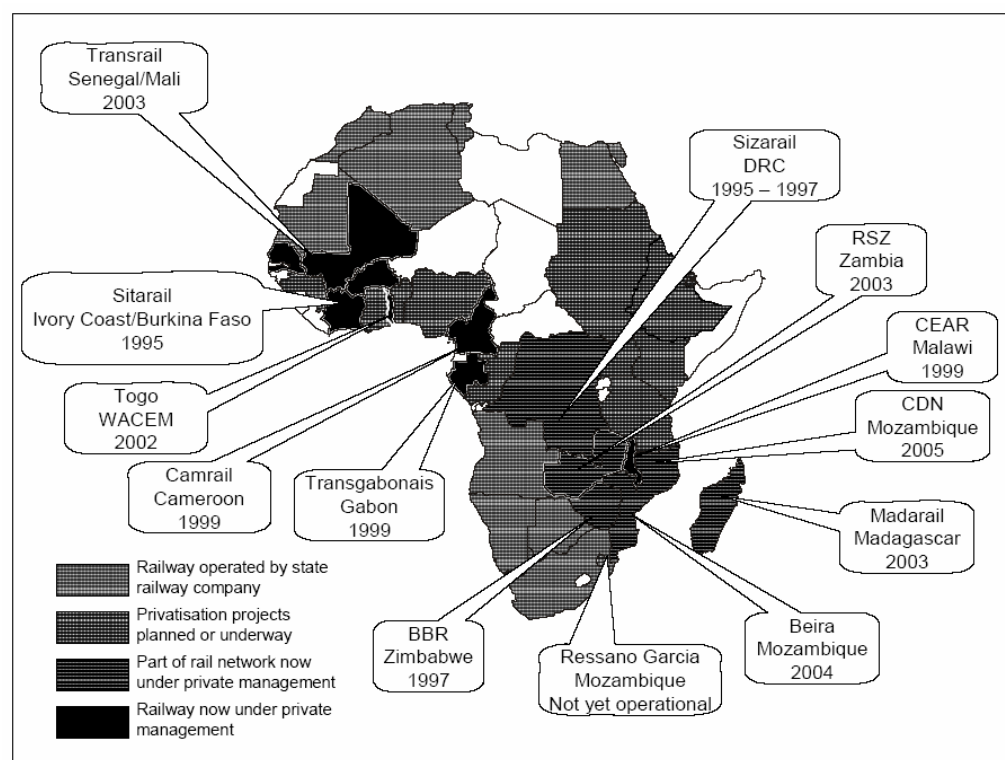


Figure 9-7: Railway Concessions Awarded in Africa since 1990 (Source: World Bank, 2005)

According to the World Bank (September 2005), the railways in Africa that have been concessioned are operating more efficiently and are more competitive. Investment has largely been funded by

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multilateral and bilateral loans at concessional rates (and often after substantial delays); there has been only been comparatively minor investment from other sources. Overall, concessioning in Africa has revitalized many systems but it is doubtful whether it can ensure their long-term survival without further injections of public investments.

**(Information will be updated as per 2007)**



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## 9.2 Demographical issues

Population, urbanization, geographical and environmental issues have impact on transport in general and passenger transport in particular. Africa's cultural diversity and geographical conditions contribute

| World Rank | Country                  | Population (est. July 2006) | Share of Africa |
|------------|--------------------------|-----------------------------|-----------------|
| 11         | Nigeria                  | 131 859 731                 | 14,5 %          |
| 17         | Egypt                    | 78 887 007                  | 8,7 %           |
| 18         | Ethiopia                 | 74 777 981                  | 8,2 %           |
| 23         | DR Congo                 | 62 660 551                  | 6,9 %           |
| 29         | South Africa             | 44 187 637                  | 4,9 %           |
| 31         | Sudan                    | 41 236 378                  | 4,5 %           |
| 35         | Tanzania                 | 37 445 392                  | 4,1 %           |
| 36         | Kenya                    | 34 707 817                  | 3,8 %           |
| 37         | Morocco                  | 33 241 259                  | 3,6 %           |
| 39         | Algeria                  | 32 930 091                  | 3,6 %           |
| 43         | Uganda                   | 28 195 754                  | 3,1 %           |
| 51         | Ghana                    | 22 409 572                  | 2,5 %           |
| 56         | Mozambique               | 19 686 505                  | 2,2 %           |
| 58         | Madagascar               | 18 595 469                  | 2,0 %           |
| 59         | Cote d'Ivoire            | 17 654 843                  | 1,9 %           |
| 60         | Cameroon                 | 17 340 702                  | 1,9 %           |
| 64         | Burkina Faso             | 13 902 972                  | 1,5 %           |
| 67         | Malawi                   | 13 013 926                  | 1,4 %           |
| 68         | Niger                    | 12 525 094                  | 1,4 %           |
| 70         | Zimbabwe                 | 12 236 805                  | 1,3 %           |
| 71         | Angola                   | 12 127 071                  | 1,3 %           |
| 72         | Senegal                  | 11 987 121                  | 1,3 %           |
| 73         | Mali                     | 11 716 829                  | 1,3 %           |
| 74         | Zambia                   | 11 502 010                  | 1,3 %           |
| 81         | Tunisia                  | 10 175 014                  | 1,1 %           |
| 83         | Chad                     | 9 944 201                   | 1,1 %           |
| 84         | Guinea                   | 9 690 222                   | 1,1 %           |
| 89         | Somalia                  | 8 863 338                   | 1,0 %           |
| 90         | Rwanda                   | 8 648 248                   | 0,9 %           |
| 93         | Burundi                  | 8 090 068                   | 0,9 %           |
| 95         | Benin                    | 7 862 944                   | 0,9 %           |
| 105        | Sierra Leone             | 6 005 250                   | 0,7 %           |
| 107        | Libya                    | 5 900 754                   | 0,6 %           |
| 110        | Togo                     | 5 548 702                   | 0,6 %           |
| 116        | Eritrea                  | 4 786 994                   | 0,5 %           |
| 123        | Central African Republic | 4 303 356                   | 0,5 %           |
| 129        | RO Congo                 | 3 702 314                   | 0,4 %           |
| 134        | Mauritania               | 3 177 388                   | 0,3 %           |
| 136        | Liberia                  | 3 042 004                   | 0,3 %           |
| 146        | Namibia                  | 2 044 147                   | 0,2 %           |
| 147        | Lesotho                  | 2 022 331                   | 0,2 %           |
| 149        | Gambia The               | 1 641 564                   | 0,2 %           |
| 150        | Botswana                 | 1 639 833                   | 0,2 %           |
| 151        | Guinea-Bissau            | 1 442 029                   | 0,2 %           |
| 153        | Gabon                    | 1 424 906                   | 0,2 %           |
| 155        | Mauritius                | 1 240 827                   | 0,1 %           |
| 156        | Swaziland                | 1 136 334                   | 0,1 %           |
| 162        | Guyana                   | 767 245                     | 0,1 %           |
| 164        | Comoros                  | 690 948                     | 0,1 %           |
| 167        | Equatorial Guinea        | 540 109                     | 0,1 %           |
| 172        | Cape Verde               | 420 979                     | 0,0 %           |
| 175        | Maldives                 | 359 008                     | 0,0 %           |
| 181        | Western Sahara           | 273 008                     | 0,0 %           |
| 185        | Mayotte                  | 201 234                     | 0,0 %           |
| 186        | Sao Tome and Principe    | 193 413                     | 0,0 %           |
| 198        | Seychelles               | 81 541                      | 0,0 %           |
| 168        | Djibouti                 | 48 653                      | 0,0 %           |
| 225        | Saint Helena             | 7 502                       | 0,0 %           |
|            | <b>TOTAL</b>             | <b>910 744 925</b>          | <b>100,0 %</b>  |

to the complexity. A broad, and complex, set of social, demographical and environmental factors influence future rail traffic.

### Population growth

The definition of Africa in this document is 53 countries whereof 35 have operational railways. Table 9-5 shows the population of 61 countries/provinces located to Africa. A few of them are still under foreign control, however shown to make a complete picture of the population (Source: World Fact book, 2006).

As per July 2006 approximately 14% of the world population is estimated to be living in Africa and more than 80% of the of Africa's population is located to the 20 most populated countries. Nigeria alone counts for 14.5% of Africa's population.

Africa's population has been growing fast and from 1995 to 2005 the population increase has been more than 42%, almost twice the rate of world growth for the same period (22%). The growth is expected to continue above world average.

Predictions from United Nations Population Division (2006) indicate 41%-56% (Medium scenario=48%) increase in the population of Africa from 2005 to 2025. Compared with another growing region of the world, Asia, the medium scenario showed 21% growth.

From 2005 to 2050 the increase is expected to be between 84%-146% (Medium scenario=114%). UN's three different growth scenarios are shown in figure 9-8.

Table 9-5: African population as per July 2006.

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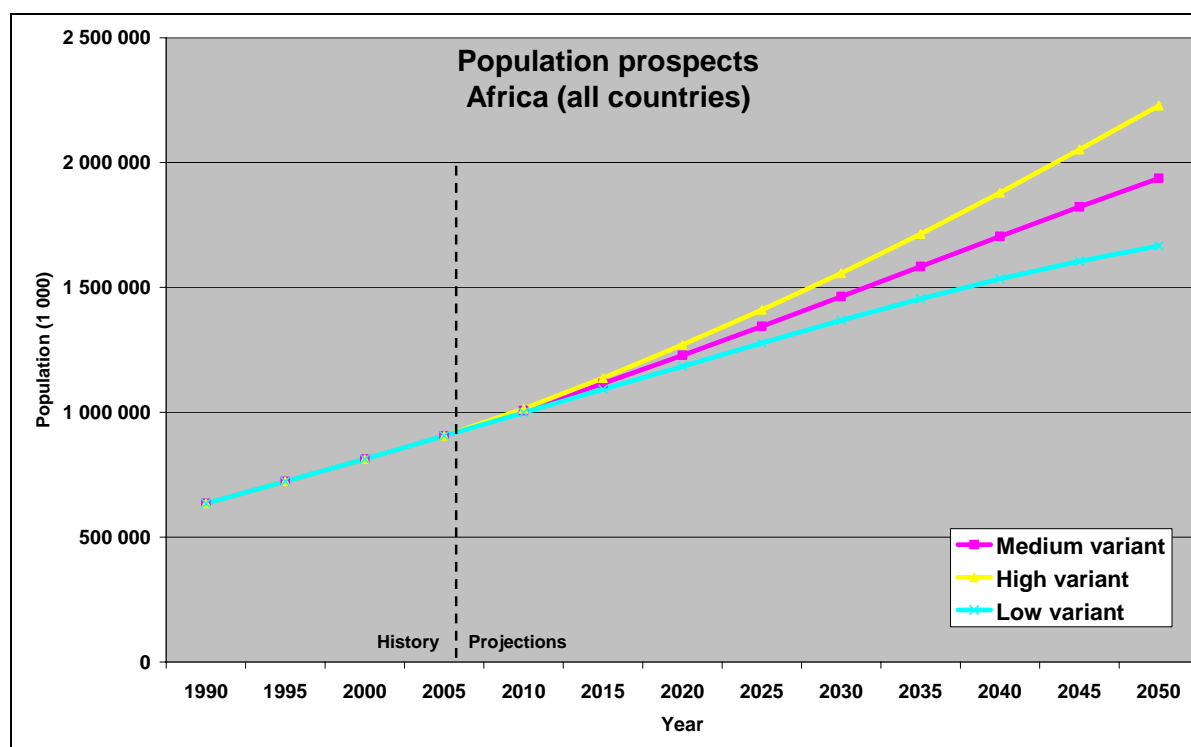


Figure 9-8: Population prospects 2050

Source: UN Population Division, April 2007

Figure 9-8 and table 9-6, show the 3 different scenarios used by the UN Population Division (figures in 1 000).

| Population projections Africa |                |              |             |
|-------------------------------|----------------|--------------|-------------|
| Year                          | Medium variant | High variant | Low variant |
| 1990                          | 635 685        | 635 685      | 635 685     |
| 1995                          | 722 669        | 722 669      | 722 669     |
| 2000                          | 812 466        | 812 466      | 812 466     |
| 2005                          | 905 936        | 905 936      | 905 936     |
| 2010                          | 1 006 905      | 1 014 194    | 998 659     |
| 2015                          | 1 115 358      | 1 136 732    | 1 092 313   |
| 2020                          | 1 228 276      | 1 270 382    | 1 184 495   |
| 2025                          | 1 344 491      | 1 410 045    | 1 277 247   |
| 2030                          | 1 463 493      | 1 557 193    | 1 368 390   |
| 2035                          | 1 584 258      | 1 713 638    | 1 454 977   |
| 2040                          | 1 704 870      | 1 879 362    | 1 534 382   |
| 2045                          | 1 823 062      | 2 051 804    | 1 605 112   |
| 2050                          | 1 936 952      | 2 227 675    | 1 666 475   |
| 2005-2025                     | 48 %           | 56 %         | 41 %        |
| 2005-2050                     | 114 %          | 146 %        | 84 %        |

Table 9-6: UN Population growth scenarios for Africa

The table shows that the total African population in 2005 was more than 905 millions. By 2025 it will increase by approximately 0,505 billion (medium scenario) and by 2050 additional 0,8 billion.

The total population in Africa is expected to be approximately 1,4 billion by 2025 (medium scenario).

The significant increase is applicable for almost all African nations.

However, this aggregate figure does not show that there are significant differences in growth rates between the countries.

By looking at the "Top-12" populated countries (more than 20 million inhabitants as per 2006) some of these variations can be illustrated. 67,6% of Africa's population (2006) is located in these 12 countries. By 2025 the share is expected to be 66,6% and by 2050 approximately 65,1% (medium scenario).

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| Year      | Algeria | D.R.Congo | Egypt   | Etiopia | Ghana  | Kenya  | Morocco | Nigeria | S.Africa | Sudan  | Tanzania | Uganda  |
|-----------|---------|-----------|---------|---------|--------|--------|---------|---------|----------|--------|----------|---------|
| 1990      | 25 291  | 37 764    | 55 673  | 51 040  | 15 479 | 23 430 | 24 696  | 90 557  | 36 877   | 26 066 | 26 231   | 17 758  |
| 1995      | 28 271  | 44 999    | 61 225  | 60 007  | 17 725 | 27 226 | 27 004  | 103 914 | 41 894   | 29 352 | 30 930   | 20 892  |
| 2000      | 30 463  | 50 052    | 67 285  | 68 525  | 19 867 | 30 689 | 29 231  | 117 608 | 45 610   | 32 902 | 34 763   | 24 309  |
| 2005      | 32 854  | 57 549    | 74 033  | 77 431  | 22 113 | 34 256 | 31 478  | 131 530 | 47 432   | 36 233 | 38 329   | 28 816  |
| 2010      | 35 420  | 67 129    | 81 133  | 86 998  | 24 312 | 38 956 | 33 832  | 145 991 | 47 819   | 40 254 | 41 838   | 34 569  |
| 2015      | 38 085  | 78 016    | 88 175  | 97 155  | 26 562 | 44 194 | 36 152  | 160 931 | 47 902   | 44 035 | 45 598   | 41 918  |
| 2020      | 40 624  | 90 022    | 94 834  | 107 681 | 28 789 | 49 563 | 38 327  | 175 798 | 48 100   | 47 536 | 49 265   | 50 572  |
| 2025      | 42 871  | 103 224   | 101 092 | 118 354 | 30 964 | 54 997 | 40 280  | 190 287 | 48 297   | 51 031 | 52 807   | 60 601  |
| 2030      | 44 706  | 117 494   | 107 056 | 128 979 | 33 075 | 60 606 | 42 016  | 204 465 | 48 405   | 54 511 | 56 178   | 72 078  |
| 2035      | 46 217  | 132 437   | 112 689 | 139 490 | 35 115 | 66 393 | 43 538  | 218 436 | 48 430   | 57 890 | 59 314   | 84 875  |
| 2040      | 47 508  | 147 586   | 117 803 | 149 904 | 37 065 | 72 188 | 44 801  | 232 180 | 48 445   | 61 076 | 62 170   | 98 555  |
| 2045      | 48 635  | 162 598   | 122 234 | 160 195 | 38 896 | 77 783 | 45 746  | 245 493 | 48 507   | 64 020 | 64 695   | 112 674 |
| 2050      | 49 500  | 177 271   | 125 916 | 170 190 | 40 573 | 83 073 | 46 397  | 258 108 | 48 660   | 66 705 | 66 845   | 126 950 |
| 2005-2025 | 30 %    | 79 %      | 37 %    | 53 %    | 40 %   | 61 %   | 28 %    | 45 %    | 2 %      | 41 %   | 38 %     | 110 %   |
| 2005-2050 | 51 %    | 208 %     | 70 %    | 120 %   | 83 %   | 143 %  | 47 %    | 96 %    | 3 %      | 84 %   | 74 %     | 341 %   |

Table 9-7: Most populated countries in Africa

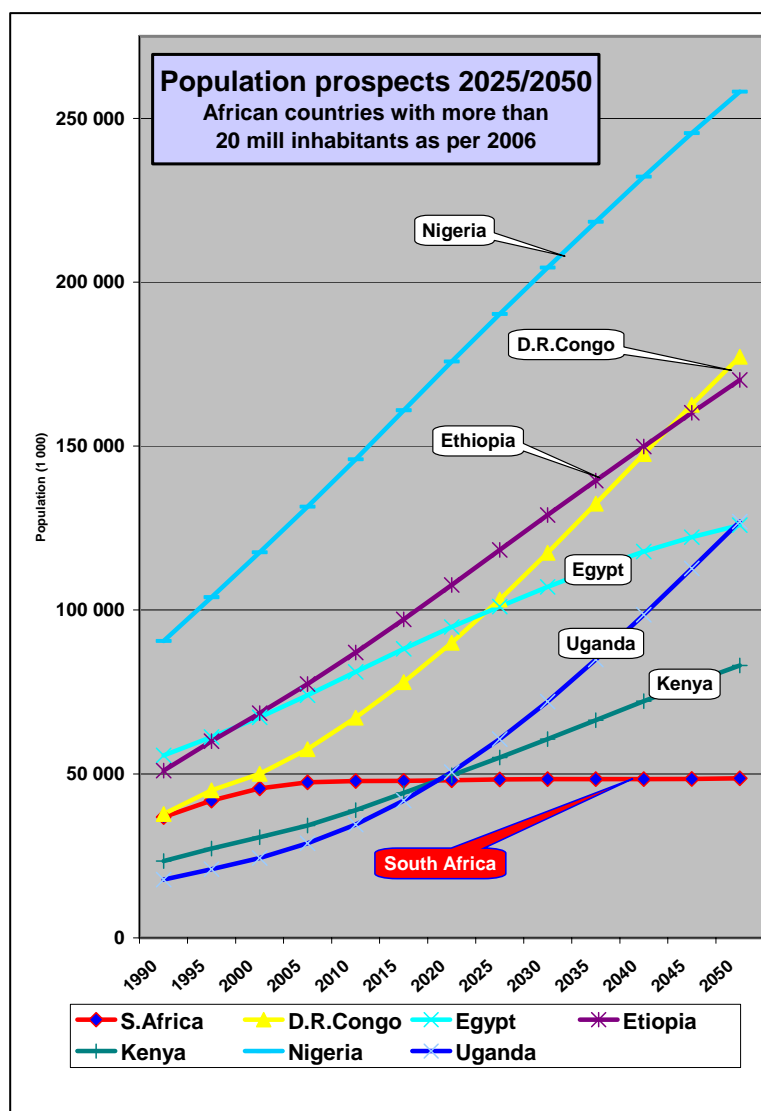


Figure 9-9: Population prospects, large countries

## Countries with railways

The major part of Africa's population is located to the countries where railways are in operation (35 countries). 33 of these 35 countries are expected to have an increase in population by 2025 and 29 countries are expected to have a significant growth by more 25%.

The expected population increase in these "railway countries" is illustrated in the figure below. The total population growth for these countries is 51% between 2005 and 2025 and 119% between 2005 and 2050. By 2025, 390 million new Africans will require transport services and by 2050 more than 900 millions compared with 2006.

Figure 9-9 (left) shows population prospects for the 6 largest countries and South Africa.

Nigeria continues its strong population growth and by 2025 the population will increase by almost 60 million people (+45%).

The figure does also show that the Democratic Republic of Congo is expected to outpace Ethiopia as Africa's second most populated country by 2040.

The strongest growth is represented by Uganda, by 110% between 2005 and 2025 and 341% between 2005 and 2050. Uganda's share of Africa's population is expected to increase from 3.2% in 2005 to 6.6% in 2050.

South-Africa shows an atypical development and the population is expected to be stable for the next 40 years.

In Africa, only three countries is expected to show a reduction in population (Swaziland, Botswana and Lesotho). The total population of these 3 countries is not more than 4.5 millions inhabitants

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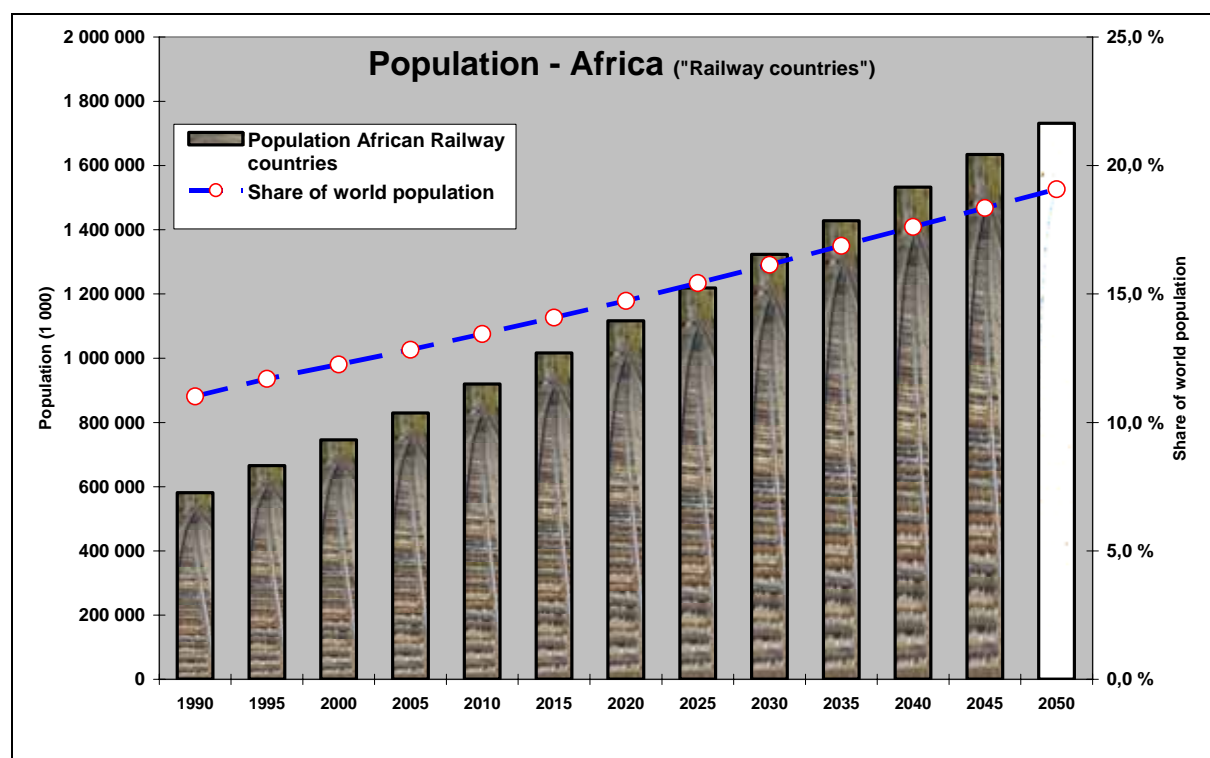


Figure 9-10: African population and share of world population 1990-2050 (railway countries)

The fastest growing railway countries (29), representing more than 750 million people (2006) is shown in the table below. By 2025 the population is these 29 countries expected to be 1.14 billions (+51% compared with 2005) and by 2050 1.65 billions (+119%).

### Countries where population expected to grow by more than 25% by 2025

| Country      | Population (1.000) |                  |                  | Growth (%)  |              |
|--------------|--------------------|------------------|------------------|-------------|--------------|
|              | 2005               | 2025             | 2050             | 2005-2025   | 2005-2050    |
| Uganda       | 28 816             | 60 601           | 126 950          | 110 %       | 341 %        |
| R.O.Congo    | 3 999              | 7 404            | 13 721           | 85 %        | 243 %        |
| D.R.Congo    | 57 549             | 103 224          | 177 271          | 79 %        | 208 %        |
| Mali         | 13 518             | 24 031           | 41 976           | 78 %        | 211 %        |
| Burkina faso | 13 228             | 23 162           | 39 093           | 75 %        | 196 %        |
| Benin        | 8 439              | 14 254           | 22 123           | 69 %        | 162 %        |
| Angola       | 15 941             | 26 829           | 43 501           | 68 %        | 173 %        |
| Eritrea      | 4 401              | 7 352            | 11 229           | 67 %        | 155 %        |
| Mauritania   | 3 069              | 4 973            | 7 497            | 62 %        | 144 %        |
| Kenya        | 34 256             | 54 997           | 83 073           | 61 %        | 143 %        |
| Guinea       | 9 402              | 14 911           | 22 987           | 59 %        | 144 %        |
| Madagascar   | 18 606             | 29 434           | 43 508           | 58 %        | 134 %        |
| Togo         | 6 145              | 9 613            | 13 544           | 56 %        | 120 %        |
| Malawi       | 12 884             | 19 737           | 29 452           | 53 %        | 129 %        |
| Etiopia      | 77 431             | 118 354          | 170 190          | 53 %        | 120 %        |
| Senegal      | 11658              | 17348            | 23108            | 49 %        | 98 %         |
| Nigeria      | 131530             | 190287           | 258108           | 45 %        | 96 %         |
| Sudan        | 36233              | 51031            | 66705            | 41 %        | 84 %         |
| Zambia       | 11668              | 16419            | 22781            | 41 %        | 95 %         |
| Ghana        | 22113              | 30964            | 40573            | 40 %        | 83 %         |
| Djibouti     | 793                | 1107             | 1547             | 40 %        | 95 %         |
| Mozambique   | 19792              | 27556            | 37604            | 39 %        | 90 %         |
| Côted'Ivoire | 18154              | 25114            | 33959            | 38 %        | 87 %         |
| Tanzania     | 38329              | 52807            | 66845            | 38 %        | 74 %         |
| Egypt        | 74033              | 101092           | 125916           | 37 %        | 70 %         |
| Cameroon     | 16322              | 21620            | 26891            | 32 %        | 65 %         |
| Gabon        | 1384               | 1809             | 2279             | 31 %        | 65 %         |
| Algeria      | 32854              | 42871            | 49500            | 30 %        | 51 %         |
| Morocco      | 31478              | 40280            | 46397            | 28 %        | 47 %         |
| <b>TOTAL</b> | <b>754 025</b>     | <b>1 139 181</b> | <b>1 648 328</b> | <b>51 %</b> | <b>119 %</b> |

Table 9-8: Fastest growing countries in Africa

Source: UN Population Division, March 2007

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Only two of the railway countries are expected to reduce their population by 2025 and 2050. Swaziland and Botswana is expected to decline by 6% until 2025.

| Population expected to decline by 2025 |                    |              |              |             |             |
|--|--------------------|--------------|--------------|-------------|-------------|
| Country                                | Population (1.000) |              |              | Growth (%)  |             |
|  | 2005               | 2025         | 2050         | 2005-2025   | 2005-2050   |
| Swaziland                              | 1032               | 975          | 1026         | -6 %        | -1 %        |
| Botswana                               | 1765               | 1655         | 1658         | -6 %        | -6 %        |
| <b>TOTAL</b>                           | <b>2 797</b>       | <b>2 630</b> | <b>2 684</b> | <b>-6 %</b> | <b>-4 %</b> |

Table 9-9: Countries where population is expected to decline

Source: UN Population Division, March 2007

Historical data's from other regions of the world ("The Railways of Asia, visions 2025", UIC 2006) seem to support a correlation between passenger-km by train and population changes. For China and India, which are the most populated countries in the world and where information is quite reliable, the correlation is approximately 0.95 for the period 1980-2004, -for both countries.

Even though the picture is mixed, we can not verify the same for Africa. Statistical measures like correlation do not indicate a causal connection, however a co-variation.

### 9.2.1 Urbanization

Figure 9-11 shows the urban population in Africa for the period 1990 to 2030. The urban population is expected to grow from less than 40% in 2005 to more than 50% in 2030. Together with the increased percentage of urban population in Africa, several implications for transport and railway traffic in particular are expected.

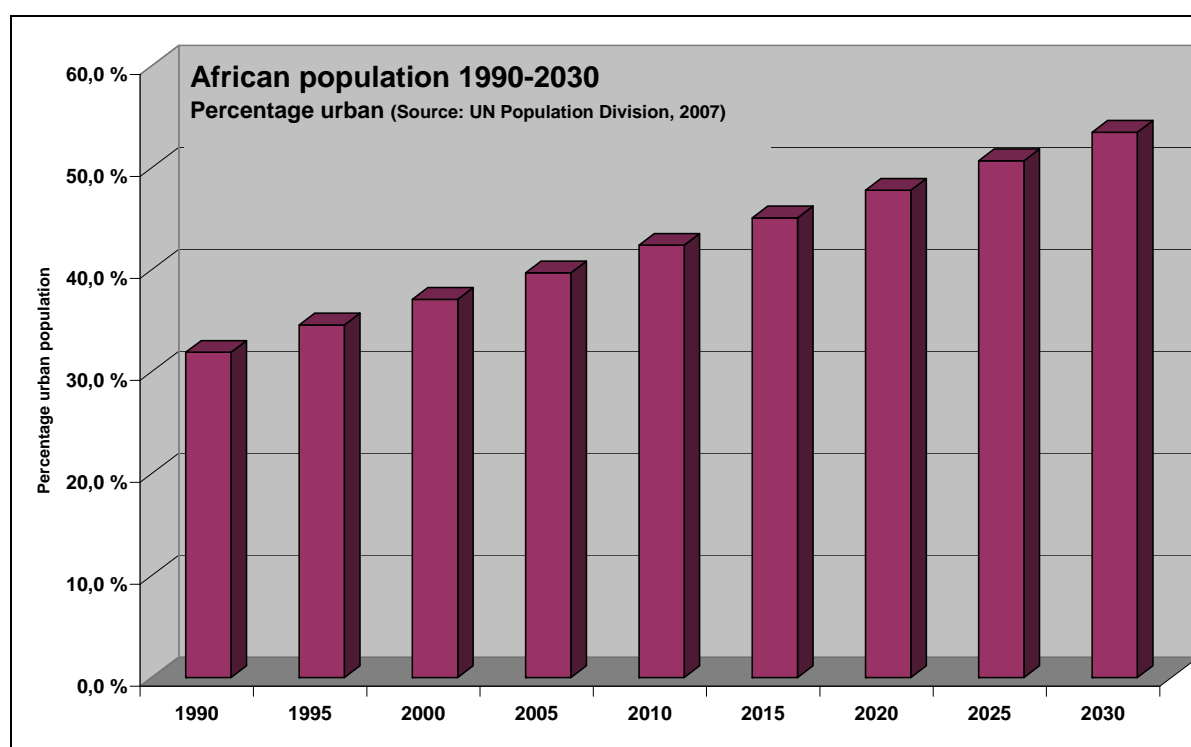


Figure 9-11: African urban population, 1990-2030

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According to United Nations<sup>8</sup> there were 20 mega-cities<sup>9</sup> in the world in 2005 (5 in 1980). Two cities are located to Africa (Lagos and Kairo, ref. table 9-10). Lagos is among the fastest growing cities in the world.

| Actual and expected population and growth rate of urban agglomerations with more than 10 million inhabitants in 2005, 1980-2015 |  |                       |      |      |                          |           |           |
|---|--|-----------------------|------|------|--------------------------|-----------|-----------|
|   |  | Population (millions) |      |      | Growth Rate (percentage) |           |           |
|   |  | 1980                  | 2005 | 2015 | 1980-1995                | 1995-2005 | 2005-2015 |
| Tokyo   |  | 28.5                  | 35.3 | 36.2 | 1.1                      | 0.51      | 0.24      |
| Mexico City   |  | 13.0                  | 19.0 | 20.6 | 1.7                      | 1.25      | 0.80      |
| New York  |  | 15.6                  | 18.5 | 18.3 | 0.5                      | 0.94      | -0.11     |
| Mumbai  |  | 8.7                   | 18.3 | 22.6 | 3.3                      | 2.65      | 2.11      |
| São Paulo   |  | 12.1                  | 18.3 | 20.0 | 1.9                      | 1.40      | 0.87      |
| Delhi   |  | 5.6                   | 15.3 | 20.9 | 4.1                      | 4.27      | 3.15      |
| Calcutta  |  | 9.0                   | 14.3 | 16.8 | 1.9                      | 1.83      | 1.62      |
| Buenos Aires  |  | 9.9                   | 13.3 | 14.6 | 1.2                      | 1.19      | 0.90      |
| Jakarta   |  | 6.0                   | 13.2 | 17.5 | 2.9                      | 3.72      | 2.86      |
| Shanghai  |  | 11.7                  | 12.7 | 12.7 | 0.7                      | -0.35     | 0.03      |
| Dhaka   |  | 3.3                   | 12.6 | 17.9 | 9.2                      | 4.33      | 3.61      |
| Los Angeles   |  | 9.5                   | 12.1 | 12.9 | 1.2                      | 0.69      | 0.60      |
| Karachi   |  | 5.0                   | 11.8 | 16.2 | 3.5                      | 3.39      | 3.20      |
| Rio de Janeiro  |  | 8.6                   | 11.5 | 12.4 | 1.1                      | 1.21      | 0.78      |
| Osaka-Kobe  |  | 10.0                  | 11.3 | 11.4 | 0.7                      | 0.21      | 0.10      |
| Cairo   |  | 7.3                   | 11.1 | 13.1 | 1.9                      | 1.39      | 1.63      |
| Lagos   |  | -                     | 11.1 | 17.0 | 6.1                      | 5.64      | 4.32      |
| Beijing   |  | 9.0                   | 10.8 | 11.1 | 1.2                      | 0.02      | 0.23      |
| Metro Manila  |  | 6.0                   | 10.7 | 12.6 | 3.1                      | 1.28      | 1.67      |
| Moscow  |  | 8.1                   | 10.7 | 10.9 | 1.1                      | 1.10      | 0.21      |

*Source:* United Nations, 2002. *World Urbanization Prospects: The 2003 Revision* (United Nations publication, Sales No. E.04.XIII.6).

Table 9-10: Mega-cities of the world

In 2007, for the first time, half the world's population lives in cities. Nearly all population growth will be in the cities of developing countries. Even though the urban share (%) of Africans population is expected to increase (see figure 9-11), the rural population is expected to grow. Africa, with approximately 550 million rural inhabitants in 2006, is expected to see its rural population rise to 650 million by 2030. Except for Africa (and Oceania), all major regions of the world are expected to experience a reduction of the rural population between 2000 and 2030.

Even though the major share of Africa's population (until 2030) will be living in rural areas, the predicted urbanization requires enhanced focus on passenger transport in several regions and cities. The main focus concerning the population increase and urbanization is thus how to provide satisfactory transportation for people as well as to cope with growing urban freight transport demands, like transportation of garbage. Governments of many countries have begun studying or implementing projects to develop rail-based mass transit systems in response to the shortcomings of road-based transport systems to meet growing demand in very large cities.

The focus should of course not only be put on the "mega-cities". Africa has several large cities which, to some extent, have the similar challenges as the mega-cities. Table 9-11 shows the 11 largest cities in Africa figuring on the top-100 cities of the world (Source: City Mayors, 2007). Large cities are found in countries like Nigeria, Egypt, Congo, Sudan, Morocco, Cote d'Ivoire, South Africa and Algeria. They

<sup>8</sup> UNESCAP, Review of developments in transport in Asia and the Pacific, 2005

<sup>9</sup> A mega-city is defined as being a city with a population of more than 10 million

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are all expected to grow, -some very fast. Cities like Lagos and Kinshasa is expected to almost double their population.

| City                   | Country       | Population (mill) |       |        |
|------------------------|---------------|-------------------|-------|--------|
|                        |               | 2006              | 2020  | Change |
| Lagos                  | Nigeria       | 11,70             | 21,51 | 84 %   |
| Cairo                  | Egypt         | 11,29             | 14,02 | 24 %   |
| Kinshasa               | Congo         | 5,89              | 10,04 | 70 %   |
| Khartoum               | Sudan         | 4,63              | 6,46  | 40 %   |
| Casablanca             | Morocco       | 3,83              | 5,09  | 33 %   |
| Alexandria             | Egypt         | 3,81              | 4,77  | 25 %   |
| Abidjan                | Côte d'Ivoire | 3,62              | 5,11  | 41 %   |
| Johannesburg           | South Africa  | 3,44              | 4,67  | 36 %   |
| Algiers                | Algeria       | 3,37              | 4,93  | 46 %   |
| East Rand (Ekurhuleni) | South Africa  | 3,23              | 4,82  | 49 %   |
| Cape Town              | South Africa  | 3,21              | 3,92  | 22 %   |

Table 9-11: Largest African cities (urban areas)

In 2020 Africa is expected to have 3 mega-cities (two in 2006). In addition to Lagos and Cairo, Kinshasa is expected to have approximately 10 million inhabitants, which is an increase by 70% from 2006.

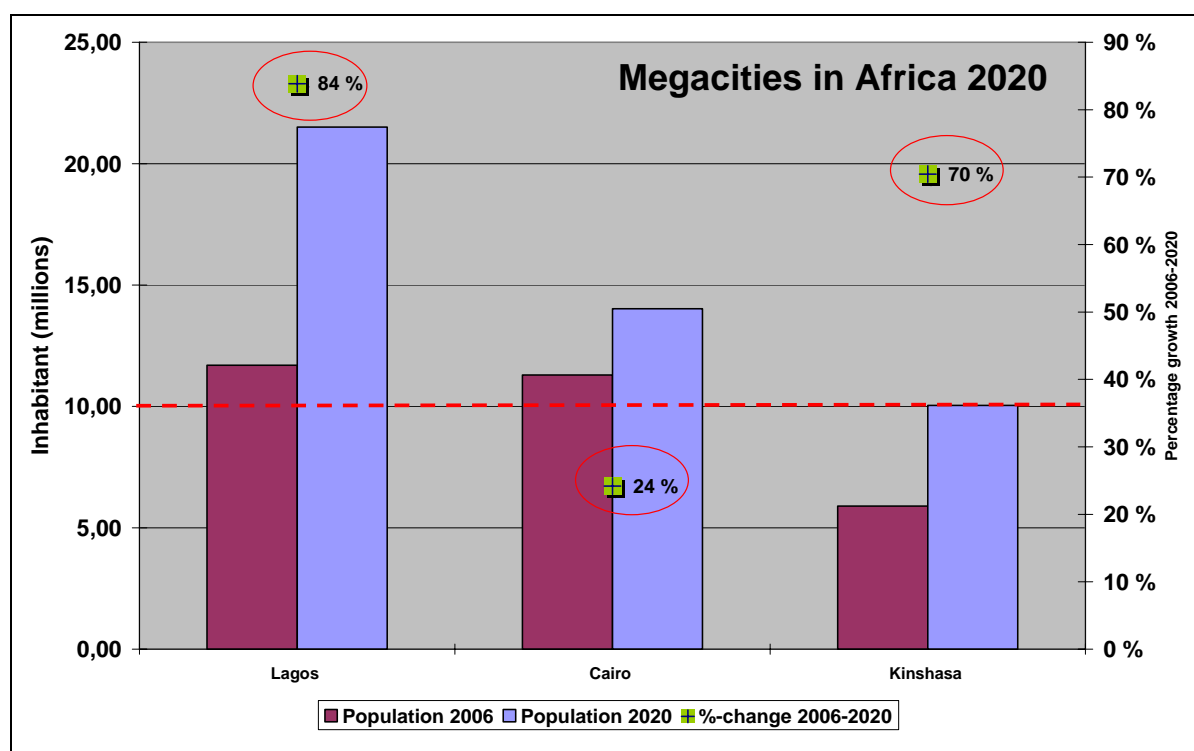


Figure 9-12: African mega-cities 2020

Africa's growing urbanization will seriously strain existing transport systems and contributing to air pollution and global greenhouse gas emissions. Railway systems are known to be among the most cost-effective, energy- and space-efficient, and environmentally-friendly forms of urban transport. Building such systems is the most relevant way Africa's mega-cities and large cities can serve their burgeoning populations in a sustainable, equitable manner.

## 9.3 Environmental development

It's agreed that the promotion of the railway transport in any region must meet many goals. Such goals may include healthy living and working environments for the inhabitants, but also a sustainable relationship between the use of the new transport infrastructures and the natural resources and the ecosystem on which they draw.

The new vision of the railway transport in Africa grants a particular attention to the environmental issues on that continent characterised by an important population growth, an urban expansion, an extremely pressure on natural resources, and so on

We break into this point with some information on the environmental challenges the African cities are facing.

Even if the contribution of African countries in general to the global environmental problems remains small relative to the share in the world's urban population, urban environmental problems in terms of their impact on human health and damage to local resources and ecosystems are far more serious in African cities. If we take an example of the most discussed environmental problem "emissions of carbon dioxide", the greenhouse gas contributing to the global climate change, statistics confirm that the share of the developing countries ( most of them in Africa ) is lower.

The following table illustrates the world carbon dioxide emissions by region, and it appears that the African share both for history and projections is lower compared to the rest the world.

| Region                           | History       |               | Projections   |               |               |               |               | Average Percent | Annual change |
|----------------------------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|-----------------|---------------|
|                                  | 1990          | 2003          | 2010          | 2015          | 2020          | 2025          | 2030          | 1990-2003       | 2003-2030     |
| <b>OECD</b>                      | <b>11,378</b> | <b>13,150</b> | <b>14,249</b> | <b>15,020</b> | <b>15,709</b> | <b>16,545</b> | <b>17,496</b> | <b>1.1</b>      | <b>1.1</b>    |
| <b>North America</b>             | 5,753         | 6,797         | 7,505         | 7,997         | 8,513         | 9,096         | 9,735         | 1.3             | 1.3           |
| <b>Europe</b>                    | 4,089         | 4,264         | 4,474         | 4,632         | 4,741         | 4,909         | 5,123         | 0,3             | 0,7           |
| <b>Asia</b>                      | 1,536         | 2,090         | 2,269         | 2,390         | 2,455         | 2,540         | 2,638         | 2.4             | 0,9           |
| <b>Non-OECD</b>                  | <b>9,846</b>  | <b>11,878</b> | <b>16,113</b> | <b>18,643</b> | <b>21,039</b> | <b>23,500</b> | <b>26,180</b> | <b>1.5</b>      | <b>3.0</b>    |
| <b>Europe and Eurasia</b>        | 4,193         | 2,725         | 3,113         | 3,444         | 3,758         | 4,047         | 4,352         | -3.3            | 1.7           |
| <b>Asia</b>                      | 3,626         | 6,072         | 9,079         | 10,753        | 12,407        | 14,113        | 15,984        | 4.0             | 3.6           |
| <b>Middle East</b>               | 704           | 1,182         | 1,463         | 1,647         | 1,811         | 1,987         | 2,177         | 4.1             | 2.3           |
| <b>Africa</b>                    | <b>649</b>    | <b>893</b>    | <b>1,188</b>  | <b>1,363</b>  | <b>1,477</b>  | <b>1,593</b>  | <b>1,733</b>  | <b>2.5</b>      | <b>2.5</b>    |
| <b>Central and South America</b> | 673           | 1,006         | 1,270         | 1,436         | 1,586         | 1,758         | 1,933         | 3.1             | 2.4           |
| <b>Total World</b>               | <b>21,223</b> | <b>25,028</b> | <b>30,362</b> | <b>33,663</b> | <b>36,748</b> | <b>40,045</b> | <b>43,676</b> | <b>1.3</b>      | <b>2.1</b>    |

Table 9-12: World Carbon Dioxide Emissions by Region, 1990-2030 (Million Metric Tons)

Source:UN Source:UNEP(2005)

Even if the high-income economies remain the largest emitters of carbon dioxide, it is important to note that those emissions have increased in Africa and the trend is not reassuring.

A close analyse for single nations in Africa proves that a small number of countries are largely responsible for the African emissions: South Africa accounts for 40% of the continental total, and another 44% of the CO<sub>2</sub> comes from Egypt, Algeria, Nigeria, Libya and Morocco combined. These are the only four countries on the continent with annual CO<sub>2</sub> emissions in excess of 10 million metric tons



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of carbon. Only three African countries have per capita CO<sub>2</sub> emissions higher than the global average (1.12 metric ton of carbon per year): Libya (2.51), South Africa (2.07), and the Seychelles (1.80).

It may be erroneous to conceive the Africa nations (as all least developed nations) pollute less. The problem is to be considered locally and not globally. In fact, the air quality in Africa is deteriorating, as rates of urbanization, motorization and economic activities are increasing. In addition, most studies on global warming confirm Africa, as well as Asia, to be the worst affected by the rise in CO<sub>2</sub> emissions in terms of drastic climatic changes, droughts and floods, causing food insecurity, higher death rates, higher amount of diseases and finally income loss. On the other hand, air pollution is emerging as a key threat to human health, the environment and quality of life of millions of Africans.

As an efficacious medical treatment results from a correct diagnostic, this tragic situation requires a good diagnostic of its causes: In general, the share of transport sector in emissions of CO<sub>2</sub> is higher and this is related to gasoline and gas oil consumption. Transport causes approximately 30 % of global CO<sub>2</sub> emissions, and it is at the same time one of the sectors where CO<sub>2</sub> emissions increase the most. Mobility and economical growth are walking hand and hand. In Africa, urban traffic, essential to social and economic development, is regrettably a serious problem since it is known that vehicle emissions are major contributors in atmospheric pollution. The motorized transport (vehicles, two or three wheelers) carries social and economic costs through its adverse impacts on urban air quality. According to the World Bank Organization, poor air quality has been shown to seriously affect public health and contributes to the premature deaths of over 500,000 people a year in developing countries. There are also costs in terms of loss of time and slowing down of economic activities.

In large cities of Africa, two pollutants merit particular attention:

### Lead (Pb):

While modern refining technology and changes in engine design have reduced the need for lead additives in developed countries, there is still more to do in African nations where usage of leaded gasoline is concentrated.

### Particles (PM):

Particles (or particulate matter), especially fine particles, cause serious health problems (respiratory illnesses) and environmental damages. Particles can be carried over long distances by wind and then settle on ground or water. The effects of this settling include: depleting the nutrients in soil, affecting the diversity of ecosystems, damaging sensitive forests and farm crops, changing balance in coastal waters and large river basins.

The problem is aggravated by the quality of motorized vehicles: Importation of used or second-hand vehicles, trucks, buses, taxis, coaches, engine etc. has become a lucrative business in Africa during the last decade and economical considerations prevail over environmental advantages. Many of those vehicles don't comply with environmental norms; above all, non use of clean fuels; bad operational and maintenance practice intensify pollutant emissions on the road.

Underlining the value of the catalytic converters in vehicles, a comparison has been made (table below) between vehicles without and those with catalytic converters, and there is a high disparity in regarding with the density of pollutant substances per kilometer. For the majority of vehicle purchases in Africa, cheaper second-hand vehicles surpass environmentally sound vehicles. We deduct then that those most damaging air pollutants participate in atmospheric pollution in Africa, since imported vehicles are not equipped with catalytic converters.

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| <i>Emissions</i>   | <i>Vehicles without Catalytic Converters</i> | <i>Vehicles with Catalytic Converters.</i> |
|--------------------|--|--|
| <b>CO (gm/km)</b>  | 42,67  | 6,86                                       |
| <b>VOCs(gm/km)</b> | 5,62   | 0,67                                       |
| <b>CH4 (gm/km)</b> | 0,19   | 0,04                                       |
| <b>NOx(gm/km)</b>  | 2,70   | 0,52                                       |

Table 9-13: Vehicles emissions

Source: World Bank report, regional conference, Dakar (Senegal), 2001

We regret the scarcity of reliable statistics on the increased use of individual means of transport or the volume of traffic by vehicle in general, to be more explicit on another serious problem named congestion. But available data in the Department of Transport, Transport Statistics in Pretoria (South Africa) give an example on how the number of motor vehicles increases. The statistics may be relevant to the rest of the continent.

| <b>Year</b> | <b>Cars</b> | <b>Minibuses</b> | <b>Comm. Vehicles *</b> | <b>Buses</b> | <b>Total</b> |
|-------------|-------------|------------------|-------------------------|--------------|--------------|
| <b>1985</b> | 2 971 451   | 125 125          | 1 122 812               | 28 168       | 4,247,556    |
| <b>1986</b> | 3 101 860   | 135 321          | 1 164 400               | 28 209       | 4,429,790    |
| <b>1987</b> | 3 142 906   | 143 867          | 1 186 549               | 29 910       | 4,503,232    |
| <b>1988</b> | 3 170 552   | 151 845          | 1 190 525               | 29 095       | 4,542,017    |
| <b>1989</b> | 3 316 706   | 181 466          | 1 252 104               | 28 000       | 4,778,276    |
| <b>1990</b> | 3 403 605   | 196 243          | 1 273 257               | 28 107       | 4,901,212    |
| <b>1991</b> | 3 489 947   | 208 256          | 1 303 995               | 28 545       | 5,030,743    |
| <b>1992</b> | 3 522 129   | 217 037          | 1 338 737               | 28 354       | 5,106,257    |
| <b>2000</b> | 4 234 132   | 250 000          | 1 568 089               | 29 900       | 6,082,121    |
| <b>2020</b> | 6 371 100   | 302 800          | 3 070 300               | 39 400       | 9,783,600    |

Table 9-14: Motor Vehicles in South Africa

Source: Jolanda Pretorius Prozzi and Co, Cambridge Systematic: "Transportation in Developing Countries: Greenhouse Gas Scenarios for South Africa

Extrapolation based on those statistics and corresponding demographical data shows that as of 2000, South Africa had an estimated 141 vehicles per 1000 population, of which 98 per thousand were cars for personal use.

The physical concentration of people in African cities results to transportation difficulties. Some towns in Africa give an image of "cities for automobiles". In September 2002, during his official trip in New York, Abdoulaye Wade, President of Senegal said: "Sustainable transport is something we must develop in Senegal". Let's mention that President Wade is responsible for implementation of Transports, Energy and Environment sectors for the New Partnership for African Development, a coalition of African Heads of State. And the Mayor of Accra, Solomon Darko, said in February 2003: "Accra's worsening traffic congestion is an issue of great concern to the Ghanaian government".

Indeed, in African cities, traffic congestion, unsafe street conditions and inadequate public transportation are big defiance to the public transport services and to the creation of "cities for people". Increasing congestion within small, medium or large sized towns in Africa causes excessive levels of exhaust fumes and noises, reducing resident's quality of life.

Considering the below forecast on increase in motor vehicles in less developed countries and the faintness of suitable measures to address the issue, it appears that the equation "Transport-Environment" will be more awkward in the future.

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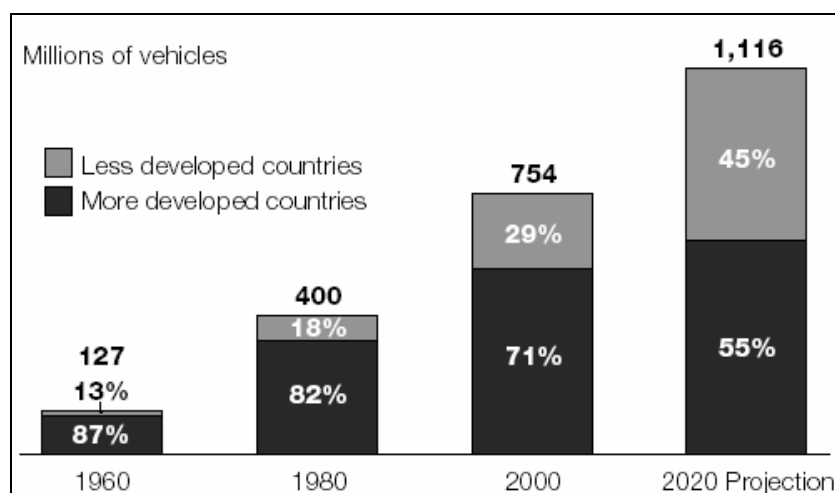


Figure 9-13: World Vehicle Forecasts and Strategies to 2020 increase in motor vehicles 1960-2020  
Source: M. Pamberton, *Managing the Future*, 2000

According to the projections, the number of vehicles in less developed countries in general, and in Africa particularly, will increase by 2020. The car fleet will grow even faster than all vehicles as the number of two-car families and imported and locally available second-hand cars will also increase. Trucks and buses will play a significant role by 2020 in transporting freight and for mass transit, because of the poor quality of railway systems and increased demand for public transport.

In the rural area, the problem may be expressed in terms of environmental impact assessment on roads construction and other transportation infrastructures. The impact of current roads in Africa is a consequence of displaced species, deteriorating ecosystem, pollution, hydrological and erosions effects. It has been difficult for low-income countries and inefficient technology to adequately afford strict environmental control during road construction.

This analyse is enough to show that the most predominant existing mode of freight and passenger transport in Africa, named transport by road, has harmful effects on environment. The problem is expected to increase since projections of urban population and vehicles growth are high. In a such situation where the growth of road haulage was seen as particularly problematic in terms of congestion and environmental pollution, rail should have a competitive advantage, as a challenged transport mode to offer a service that is clean, convenient, affordable and efficient.



| Mode   | Air  | Water resources  | Land resources  | Solid waste   | Noise  | Accident risk   | Other impact.   |
|--|--|--|---|---|--|---|---|
| <br><b>Rail</b> |  |  | Land taken for rights of way and terminals; dereliction of obsolete facilities. | Abandoned lines, equipment and rolling stock  | Noise and vibration around terminals and along lines                               | Derailment or collision of freight carrying hazardous substances  | Partition or destruction of neighbourhoods, farmland and wildlife habitats.             |
| <br><b>Road</b> | Local(CO,CH,NO fuel additives such as lead and particulates) Global (CO <sub>2</sub> ,CFC) | Pollution of surface water and groundwater by surface run-off; modification of water systems by road building. | Land taken for infrastructure: extraction of road building materials            | Abandoned spoil tips and rubble from road works; road vehicles withdrawn from service; waste oil. | Noise and vibration from cars, motorcycles and lorries in cities along main roads. | Deaths, injuries and property damage from accidents; risk from transport of hazardous substances; risk of structural failure in old or worn road facilities | Partition or destruction of neighbourhoods, farmland and wildlife habitats; congestion. |

Table 9-15: The main environmental effects of rail and road transport  
(Source: Jean Manirakiza, Transportutvikling AS)

It appears from this comparative table on environmental effects that transport in general is an important source of external effects such as air pollution, noise, casualties and congestion. For certain categories such as NO, CH, CO, the contribution of road traffic are dominant and a major source of specific pollutants such as lead.

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Considering the significant share of the inadequate transportation system in climate change, the Kyoto protocol (an international and legally binding agreement to reduce greenhouse gases emissions world wide) has recommended integrating transport policies and sustainable mobility into the climate change framework. In regarding with the railway transport, it is expressed that the CO<sub>2</sub> advantage of the railways provides the means of achieving the aims of the Kyoto Protocol and making a key contribution to sustainable mobility. The European Environment Agency for example is continuously working to improve the rail sector and its environmental performance. Indeed, railways are crucial to reducing greenhouse gas emissions and creating sustainable transport systems. They offer the most energy efficient performance both according to passenger/km and tonne/km. A shift of 3 % from road to rail transport corresponds to 10% decrease in greenhouse gas emissions. There is no doubt that moving from road to rail is a key to achieving the Kyoto Protocol targets and at the same time, a sustainable global transport policy for the future.

Those strategies are strongly recommended in Africa where environmental effects of road transport are major environmental health hazard. This results in broad range of serious and often irreversible health consequences. Furthermore, recognising the increasing costs of congestion, the rail appears to be the safer transport mode; the promotion of rail transport can contribute to relieve the traffic congestion on big cities and consequently can reduce the population crowding of urban zones and its environmental health effects.

Let's admit that the most important environmental issue of railways is noise. Basically rolling noise in railways is created by rough wheels and tracks. In the European Union for example, noise concern has led to the Environmental Noise Directive (END), and railway noise emissions of new and upgraded vehicles have recently been limited by EU legislation. If rough wheels and tracks can be kept smooth, noise can be reduced significantly. Smooth wheels can be achieved by replacing cast-iron brake – blocks with composite brake blocks. Once again, this railway technology already improved in European Union makes railways the most sustainable means of transportation.

Those evident advantages of the rail transport should be improved through complex modernisation interactions implemented according to sound environmental principles. This means that the designing of new railway projects, rehabilitation and maintenance operations must be inflicted to a prior environmental impact assessment. This will include the impact of the rail transport on: Human being, flora and fauna, soil, water, air, climatic factors, landscape, material assets, including architectural, archaeological and cultural heritage.

Let's mention that despite the capital cost of the electrification equipment, electric trains have environmental advantages including the lack of exhaust fume at point of use and less noise. In countries where electricity comes from non-fossil sources, such as Austria and France, electric trains also produce fewer carbon emissions than diesel trains.

The Gautrain under construction in South Africa and expected to operate by 2010 will help easing traffic congestion and related air pollution in Gauteng Province.

To meet those environmental objectives (air and noise pollution, climate change, accidents and congestion...) and at the same to respond to the current population growth and urban area expansion, a robust rail system is crucial in Africa.

As it has been recognized for the other regions (in developed countries), this is the same for the African continent: railways are an answer to the problem of climate change and offer an efficient transport built on social equity, low environmental impact and positive economic growth, resulting in more sustainable mobility and an improved quality of life.

Railway is considered as an environmentally sound carrier, especially when compared to road. The figure below is a comparison of total external costs (not including congestion) by transport means and cost category. The figure illustrates that railway transport (both passenger and freight) produce significant lower external costs than modes like road and aviation transport. These benefits may further be developed by additional electrification of the railway network. As per 2007, only a small share of the African railway network is electrified.

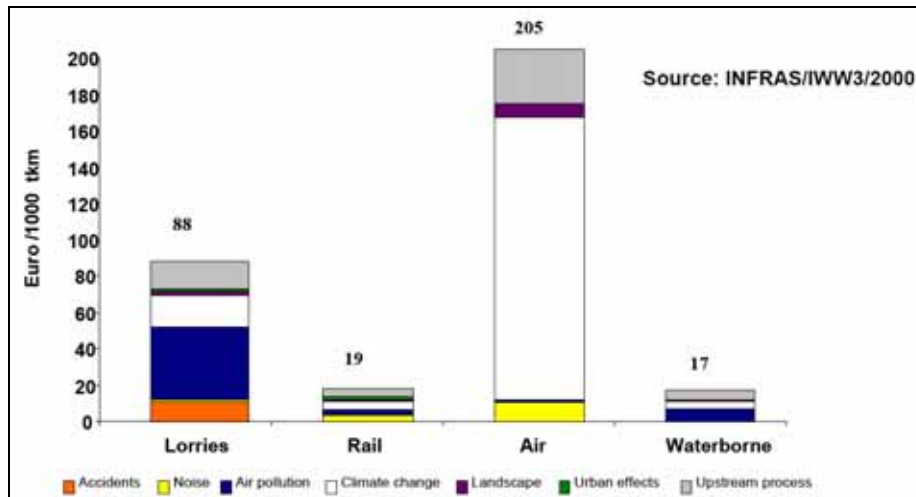


Figure 9-14 External costs, different transport modes

## 9.4 Energy

The energy situation (demand, supply, price level, security etc) is considered to have a major impact on both economic growth and logistical operations. Transportation sector energy use includes fuels consumed for the purpose of moving people and goods by road, rail, and air. Economic growth and population growth are key factors. Petroleum products continue to dominate energy use in the transportation sector; barring any widespread increase in the penetration of new technologies. The use of alternative fuels is expected to remain relatively modest through 2030 (EIA, International Energy Outlook 2006). In the context of this study, -energy is mainly related to price and supply of oil, and the availability of electricity as an alternative to oil. The price of oil has an impact on most nations' gross domestic product. Africa constituted 3,4% of the worlds total oil consumption in 2003. African oil consumption is expected to grow by 2,3% annually from 2003 to 2030. (EIA 2006, International Energy Outlook 2006) Total primary energy consumption for Africa is expected to grow from 13,2 Quadrillion BTU in 2003 to 26,8 Quadrillion BTU<sup>10</sup> in 2030, with an annual growth rate of 2,6%. In 2003 Africa consumed 3,2% of the worlds total primary energy consumption. Even with an annual growth of 2,6% from 2003 to 2030, primary energy consumption for Africa is relatively low with 3,7% of the worlds total primary energy consumption. (EIA 2006, World Energy Outlook to 2030).

Many oil-analysts do also project the price of oil to reach a USD 100 per barrel on a medium term perspective. The current level as per August 2006 is USD 70-75 per barrel. EIA projects a 1.4-percent average annual growth rate for transport related petroleum demand from 2003 to 2030. Much of the projected growth in demand for petroleum products in the transportation sector comes from the non-OECD economies (2.3 percent per year) as compared with the OECD countries (0.8 percent per year). Energy demand in the non-OECD transportation sector as a whole is expected to grow at an average annual rate of 2.3 percent until 2030.

Africa account for 11,7% of world oil production and is the fourth largest oil producing region in the world with a daily production of 9.435,2 thousand barrels per day, shown in the figure below. The oil production in the different African countries varies considerably where 17 African countries had oil production in 2004 (EIA 2007).

<sup>10</sup> Explain BTU

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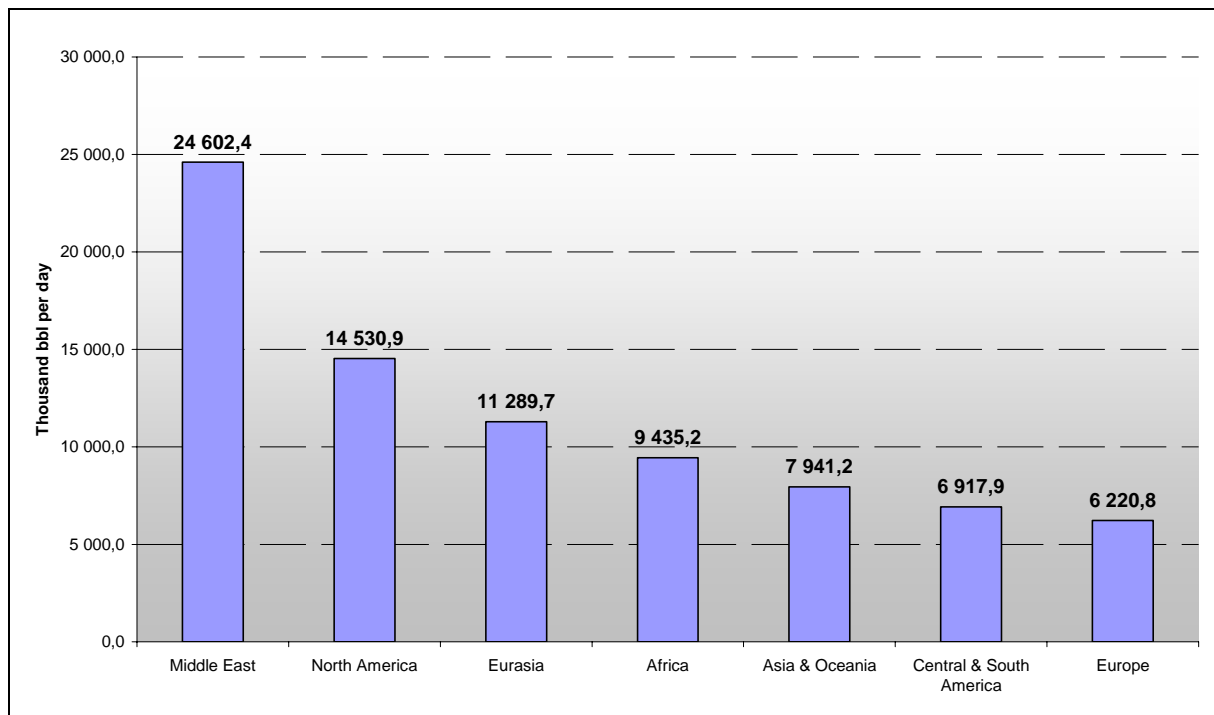


Figure 9-15 World oil production

Source: EIA 2006, <http://www.eia.doe.gov/emeu/international/oilproduction.html>

The largest producer in Africa is Nigeria accounting for 24,7% of African oil production. The smallest oil producer is Morocco and Ghana accounting for 0,1% each.

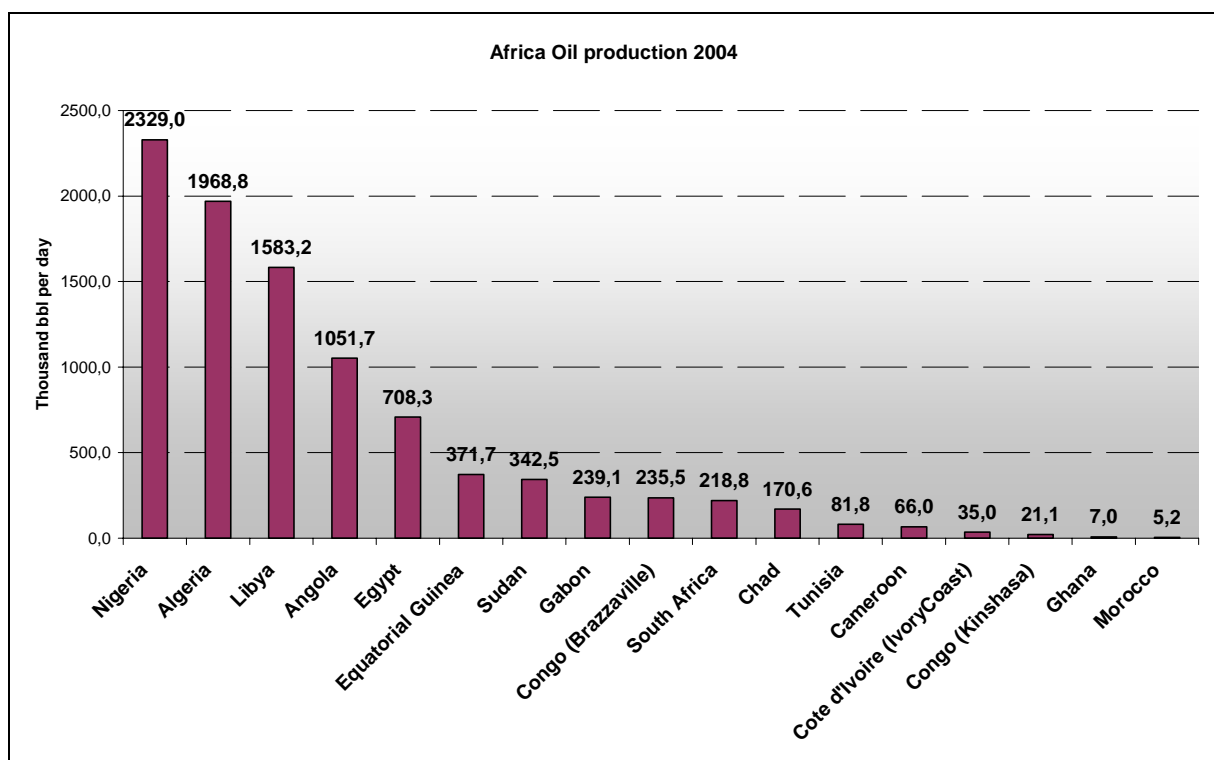


Figure 9-16 African oil production I

Nigeria is by far the largest oil producer in west Africa followed by Algeria (20,9%), Libya (16,8%), Angola (11,1%) and Egypt (7,5%). These countries constitute 81% of total African oil production.

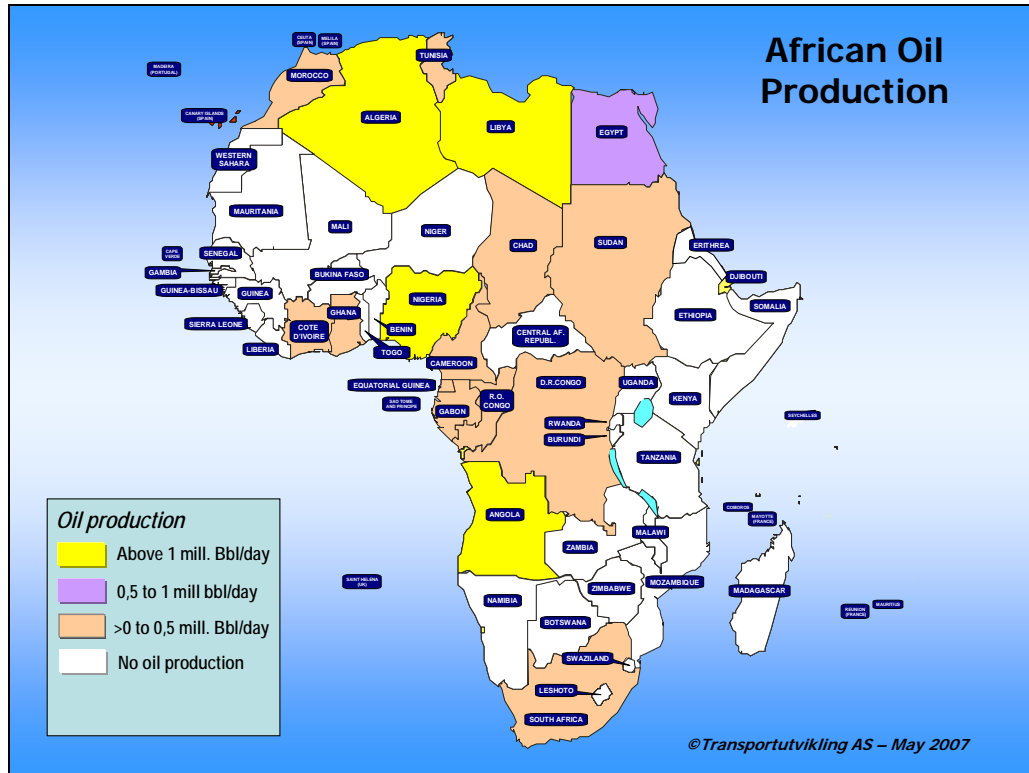
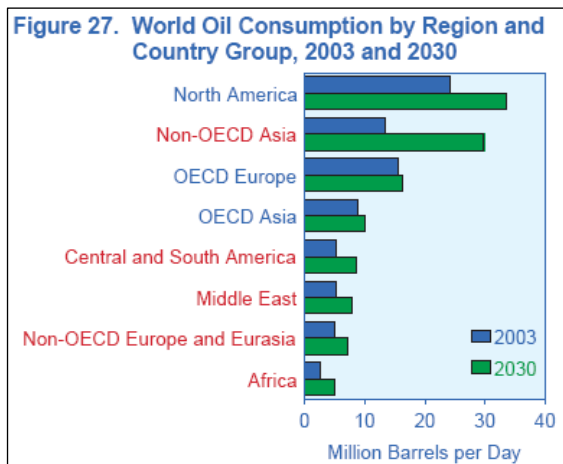


Figure 9-17 African oil production II



Africa counts for 3,4% of the worlds oil consumption in 2003 with a consumption of 2,73 mill bbl/day. In comparison North America had a consumption of 24,2 mill bbl/day in 2003 and Europe had a consumption of 16,1 mill. bbl/day (EIA 2006, International Energy Outlook 2006) Africa is expected to have a growth in oil consumption of 2,3% per year from 2003 to 2030. (EIA 2006, International Energy Outlook 2006)

Figure 9-18 World Oil consumption by region, 2030 (Source EIA)

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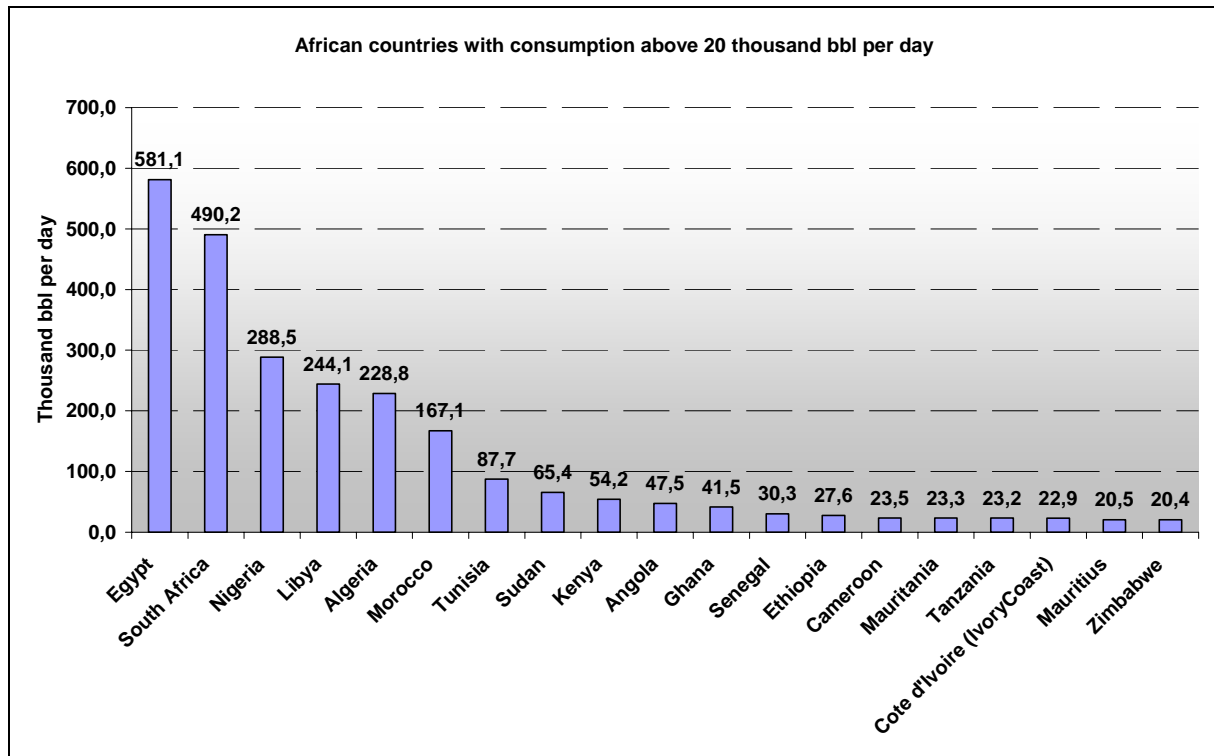


Figure 9-19 African countries with oil consumption above 20 000 bbl per day

Countries consuming more than 20 thousand barrels per day are shown in the above figure. These countries constitute 91% of Africa's total oil consumption. The figure below illustrates the variation in oil consumption among the different African nations.

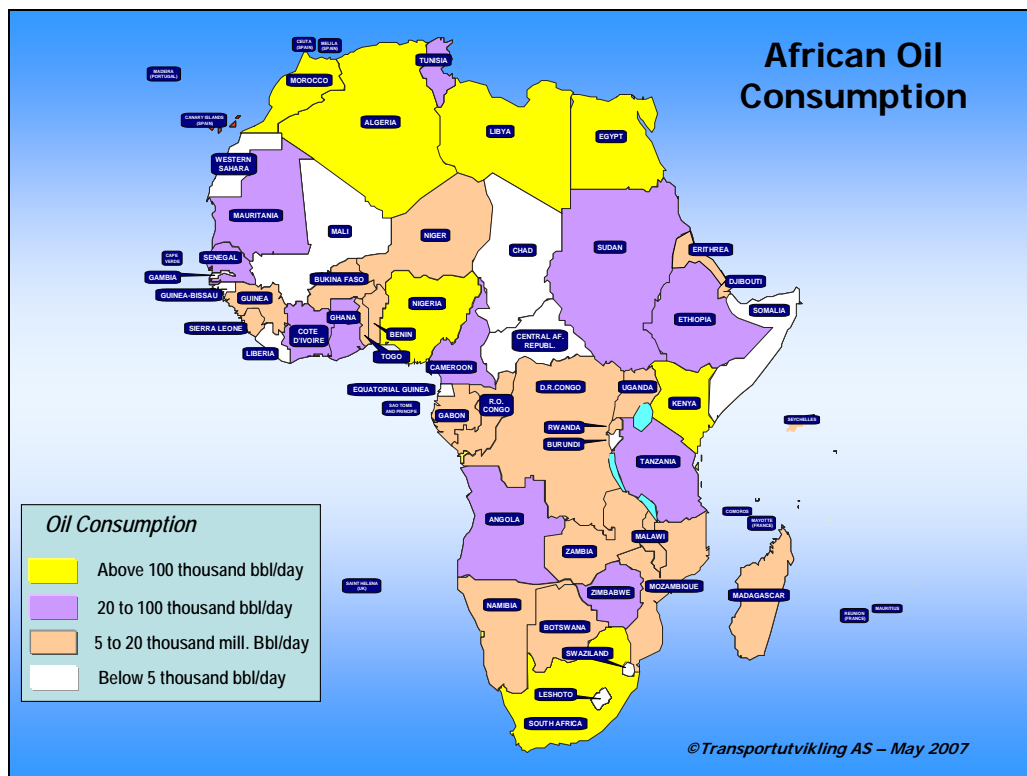


Figure 9-20 African oil consumption



## 9.4.1 Electricity

Total electricity production in Africa was 505,4 TWh in 2004 (EIA 2006, International Energy Outlook). This is 3% of the worlds total electricity production. As the below figure shows, 13 countries have a production above 5 TWh. South Africa and Egypt has a combined generation of 319 TWh which is 63,1% of the total African production.

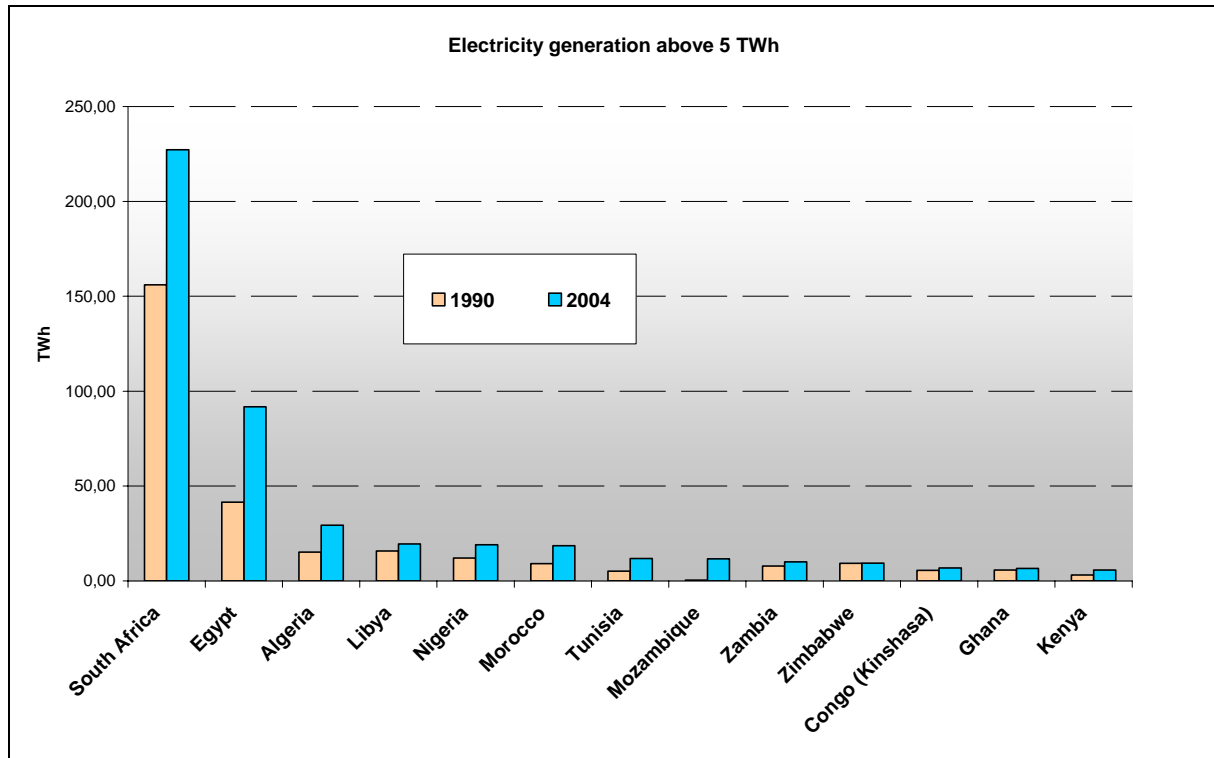


Figure 9-21: African electricity generation (Source: EIA 2006)

The only African country with Nuclear electricity production is South Africa. Electricity production started in 1984 with a net production of 3.93 TWh. In 2004 South Africa had a Nuclear electricity production of 14,28 TWh. South Africa's net electricity generation in 2004 amounts to 227,24 TWh of which Nuclear electricity generation constituted 6,3% of total net electricity generation. (EIA, International Energy Annual 2004)

## 9.4.2 Energy per capita

Per capita total primary energy consumption (TPEC) for Africa is on average 4.605 kWh per capita, with Seychelles (43.284 kWh per capita), Libya (38.979 kWh per capita) and South Africa (33.741 kWh per capita) having the highest per capita TPEC and Burundi (306 kWh per capita), Mali (295 kWh per capita) and Chad (94 kWh per capita) having the lowest per capita TPEC. (EIA 2006, <http://www.eia.doe.gov/emeu/international/energyconsumption.html>, 2004 numbers)

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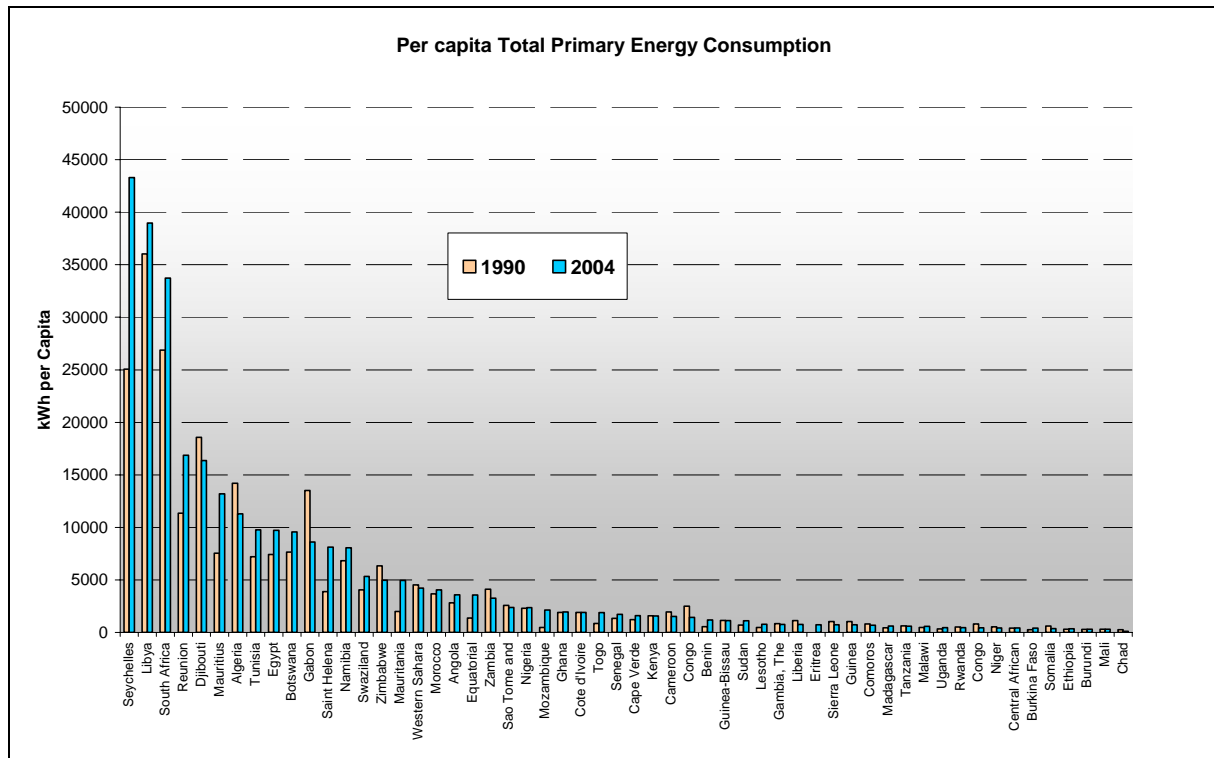


Figure 9-22 Per capita Energy consumption (Source EIA 2006)

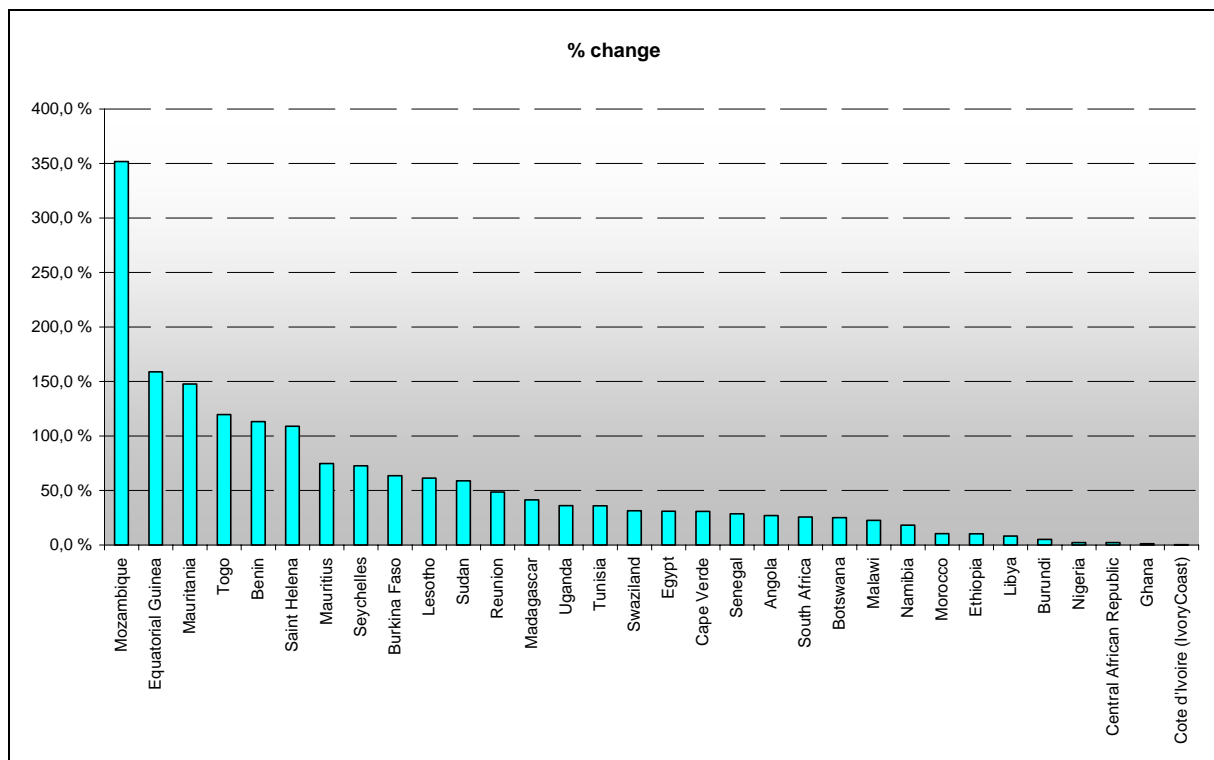


Figure 9-23 Change in energy consumption 1990-2004 (Source: EIA 2006)

32 countries showed positive growth in primary energy consumption per capita from 1990 to 2004, as illustrated in the above figure. Mozambique, Equatorial Guinea, Mauritania, Togo, Benin and Saint Helena have a growth rate above 100% with Mozambique with the highest change of growth in primary energy consumption per capita of 351,8% change from 471 kWh TPEC per capita in 1990 to 2126 kWh TPEC per capita in 2004.

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23 countries have had a negative growth of TPEC per capita from 1990 to 2004. Ranging from Kenya with the lowest reduction from 1572 kWh TPEC per capita in 1990 to 1553 kWh TPEC per capita in 2004, a change of -1,2%. The highest reduction is in Chad with a change from 239 kWh TPEC per capita in 1990 to 94 kWh TPEC per capita in 2004, a change of -60,6%. There are now available data for Eritrea from 1990.

### **Coal**

Coal is an important energy source as well as an important commodity for railways transport in Africa. Of the three fossil fuels coal has the most widely distributed reserves, and coal is mined in over 100 countries, and on all continents except Antarctica. The largest reserves are found in the USA, Russia, Australia, China, India and South Africa.

South Africa has 10 times larger coal reserves than Botswana, which ranks number two in Africa. There are also large coal reserves in Zimbabwe, Swaziland, Mozambique, Nigeria, D.R. Congo and Niger.

Emissions from coal-fired power plants represent the largest source of carbon dioxide emissions, which have been implicated as the primary cause of global warming. Future environmental concerns and development of alternative energy sources may put some restrictions on the use of coal. Such restrictions may have an impact on railways transports in many African countries.

## 9.5 Economy

Economic growth is a feature on virtually all regions of the world, albeit at different pace (Review of Maritime Transport, 2006, UNCTAD). This is shown by various economic indicators. Seaborne trade is perhaps one of the best indicators, where all major trade segments have shown growth during the last years.

Economic growth has impact on transportation and vice-versa. Furthermore, a broad set of drivers have impact on economic growth, as well as there are uncertainties connected to economic growth. Drivers which have impact on economic growth and transportation may be several and analysts have different views. These drivers may also be interrelating and circular, and even though analysts use different models, as well as emphasizing different driver, they may draw similar conclusions. Drivers like population growth, investment ratio, human capital and trade openness are considered to be important drivers by serious research institutions (Global Growth Centres 2020, Deutsche Bank Research, 2005).

Although the debate remains about the exact nature of the links between trade and growth, rapid expansion of trade, particularly merchandise trade in manufactured goods, has usually occurred in parallel with investments in capital, technological upgrading and the acquisition of new skills and knowledge—all of which have improved productivity.

It is reasonable to believe that similar statements can be made for Africa; however the challenges in Africa may come out more strongly than many other regions of the world. Political conditions, risk, business climate, stability and transparency are variables which have major impact on economic development as well as transportation. Such conditions are of importance for the development of the

railways in Africa and influences factors which more easily can be seen as necessary conditions for improved railway transports (e.g. investments in infrastructure and improved operational conditions).

Africa has several challenges and one of those is related to the funding of the continent's future development in general and a huge "backlog" when it comes to infrastructure investments. There is a large infrastructure gap to be filled in almost all sectors of the African continent. The investments are partly related to transportation infrastructure, however to an even more exhaustive extent to energy-supply/-systems, information and communication technology, water-supply and water quality, environment, health care, education and poverty reductions in general.

The annual inflation rate in Africa is for many countries generally high and for some countries a symptom of economic turbulence. During the period 2000-2007 60% of the railway countries have experienced an average yearly inflation of more than 5% and 3 countries more than 90% average annual inflation.

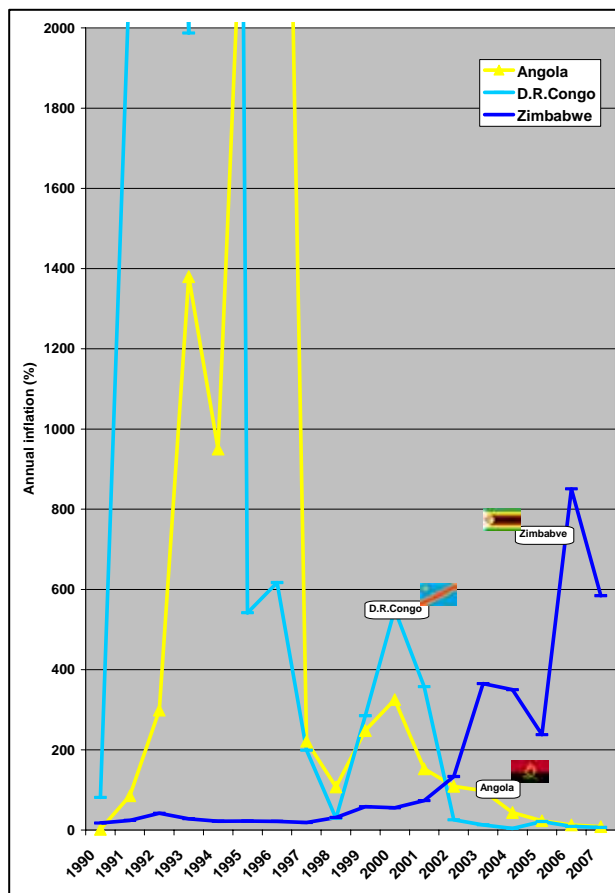


Figure 9-24: Inflation Angola, Zimbabwe and D.R.Congo

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Figure 9-24 shows annual inflation for 3 countries, which during the last 15 years have experienced inflation far above "normal". D.R. Congo and Angola have a history where the annual inflation have been several thousand %, however, performing much better during the last few years. A country like Zimbabwe has a increasing inflation and in 2006 the inflation rate was above 800%. Inflation has impact on the countries development and transportation, however perhaps even more a consequence of a mismanaged economy.

The richest countries are the far north and south of the continent. Arab North Africa has long been closely linked to the economies of Europe and the Middle East. South Africa is by far the continent's wealthiest state, both in GDP per capita and in total GDP, and its neighbours have shared in this wealth. South Africa has a wealth of natural resources, being the world's leading producers of both gold and diamonds, and a well-established legal system. South Africa also has access to financial capital, numerous markets, skilled labor, and developed infrastructure in much of the country and the opening of the Johannesburg Stock Exchange. A country like Botswana has experienced economic success. Over a quarter of Botswana's budget (also a major diamond producer) goes toward improving the infrastructure of Gaborone, the nation's capital, largest city, and one of the world's fastest growing cities. Other African countries are making comparable progress, such as Ghana, Kenya, Cameroon and Egypt. The small, but oil-rich, state of Gabon round out the list of the ten wealthiest states in Africa.

West Africa, with its long pre-colonial history of trade and development, has tended to be wealthier and more stable than the continental average.

Island nations such as the Seychelles, Cape Verde, and Mauritius, have remained wealthier than the continental nations, although the unstable Comoros remain poor.

In East-Africa, Nigeria sits on one of the largest proven oil reserves in the world and has the highest population among nations in Africa, and one of the fastest-growing economies in the world.

The poorest states are those engaged in or just emerging from civil wars. These include the Democratic Republic of the Congo, Sierra Leone, Burundi, and Somalia. In recent times the poorest region has been the Horn of Africa, although it had historically been one of the wealthiest regions of sub-Saharan Africa. Ethiopia in particular had a long and successful history. The current poverty of the region, and the associated famines and wars, has been a problem for decades.

There is considerable internal variation within countries. Urban areas, especially capital cities, are generally wealthier than rural zones. Inequality is pronounced in most African countries; an upper class has a much higher income than the majority of the population.

In this chapter we look into a few drivers which are considered to having major impact on transportation, particularly energy, economic growth (GDP), international trade, economic structure etc.

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### 9.5.1 The Gross Domestic Product<sup>11</sup>

Gross Domestic Product is an aggregate measure of a country's production. It is, together with other variables, considered to be a quantitative measure, indicating economic growth, and various institutions have made their predictions for the future.

Economic growth has a direct impact on transport infrastructure development and maintenance requirements, -and traffic often increases with general economic growth.

"There is a close link between growth in freight transportation and economic growth" (*Bureau of Transportation Statistics, US DOT, 2006*). Empirical experience from other regions of the world may also (to some extent) be relevant when projecting the future development of Africa.

There are different opinions among analysts which variables are most important when measuring economic growth. However, historically, there has been a correlation between economic growth in terms of GDP (gross domestic product) and the demand for passenger and freight transport in OECD countries. Freight transport has been growing faster than passenger transport, although total vehicle kilometers traveled is greater for passenger transport (OECD, 1999). Thus, growth of GDP has been accompanied by a similar growth in overall transport demand, particularly for road transport.

While GDP in OECD countries has grown by 46 per cent from 1980 to 1995, the number of motor vehicles has increased by 55 per cent and vehicle kilometers traveled by 59 per cent. Also growth rates in air traffic have been much higher than GDP growth rates, typically around 9 per cent per annum for passenger traffic and 11 per cent for air cargo (OECD, 2001).

It is often concluded from these results that transport and economic growth (in terms of GDP) are strongly correlated, and that transport growth may be higher than the economic growth.

GDP is a convenient measure to compare economic performance among countries and has been used as the aggregate indicator for economic performance. The problem is that it does not incorporate a number of activities, which are not traded. A considerable amount of passenger transports cannot be easily measured either by the value of goods and services for which that transport is undertaken (because of non-market values) or by the resources consumed in the production of the journey (because of environmental and social externalities). Nevertheless, the GDP indicator is by several organizations used for analysis of trends in transport and economic activity (*Analysis of the link between transport and economic growth, OECD, 2003*)

Similar analysis have (by 2005) been performed in a more European-wide context where changes in economic activities seems to influence the demand for freight- as well as passenger services.

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<sup>11</sup> Gross domestic product is an aggregate measure of production equal to the sum of the gross values added of all resident institutional units engaged in production (plus any taxes, and minus any subsidies, on products not included in the value of their outputs). The sum of the final uses of goods and services (all uses except intermediate consumption) measured in purchasers' prices, less the value of imports of goods and services, or the sum of primary incomes distributed by resident producer units.

GDP at current prices is GDP at prices of the current reporting period. Also known as nominal GDP. A fundamental principle underlying the measurement of gross value added, and hence GDP, is that output and intermediate consumption must be valued at the prices current at the time the production takes place.

This implies that goods withdrawn from inventories by producers must be valued at the prices prevailing at the times the goods are withdrawn and consumption of fixed capital in the System is calculated on the basis of the estimated opportunity costs of using the assets at the time they are used, as distinct from the prices at which the assets were acquired.

GDP based on PPP: Purchasing power parities (PPPs) are the rates of currency conversion that equalize the purchasing power of different currencies by eliminating the differences in price levels between countries. In their simplest form, PPPs are simply price relatives which show the ratio of the prices in national currencies of the same good or service in different countries

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The figure below shows the growth in GDP and transport of goods and passengers among the EU-25 countries from 1995 and up to 2004. The figure shows a close correlation between GDP and transportation for this group of countries. It is important to note that groups of countries contribute to diversification and there might be less visible correlation when looking at the countries one by one.

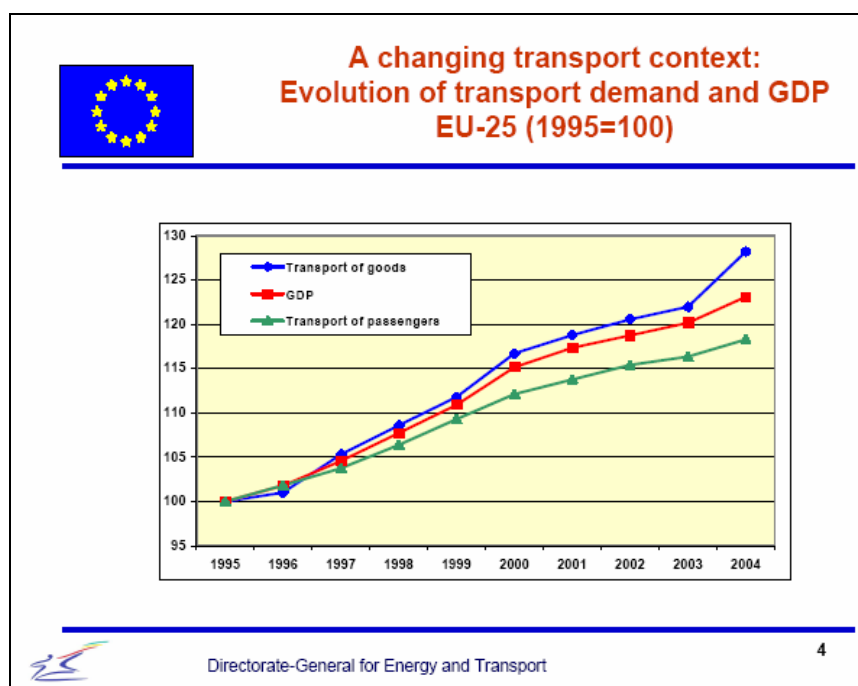


Figure 9-25: Co-variation economic growth and transportation (Europe)

(Source: "Sustainable mobility for our continent" - Mid-term review of the European Commission's 2001 white paper on Transport (June 22-2006)

Similar indications might be shown for USA ((*Bureau of Transportation Statistics, US DOT, 2006*). Even though it is often stated that freight transport has a more visible correlation with GDP, than passenger transport, -the figure (above) may give some indications that there might be a connection. The air business, which is heavily dependent of passenger transport do also include economic growth as a parameter when projecting passenger traffic; "Air travel demand is growing in all regions as a result of economic development, globalization, international trade, declining passenger fares and improved airline services." (*2006-2025 Embraer Market Outlook, 3rd Edition*). he figure above shows a more or less systematic correlation between GDP-growth and passenger transports (EU-25, 1995-2004).

Figure 9-26 shows the relation between world GDP, trade and container traffic. Historically world trade has been growing faster than world GDP and container transports has been growing faster than world trade. The basic assumption, economic growth, for increased container traffic is also valid for Africa. However, capturing this opportunity depends on the railways and the various governments' ability & will to move together with the markets requirements.

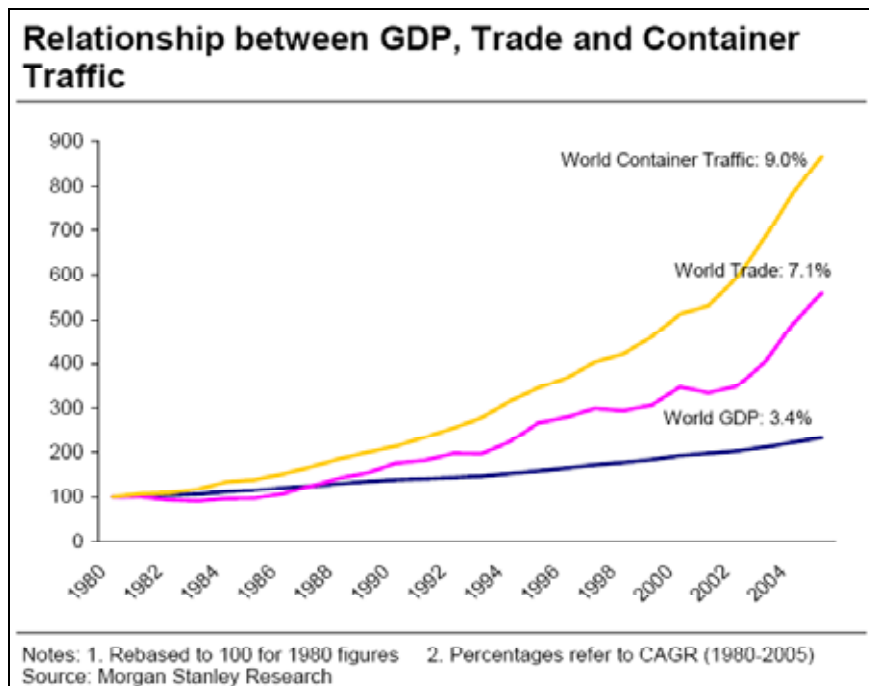
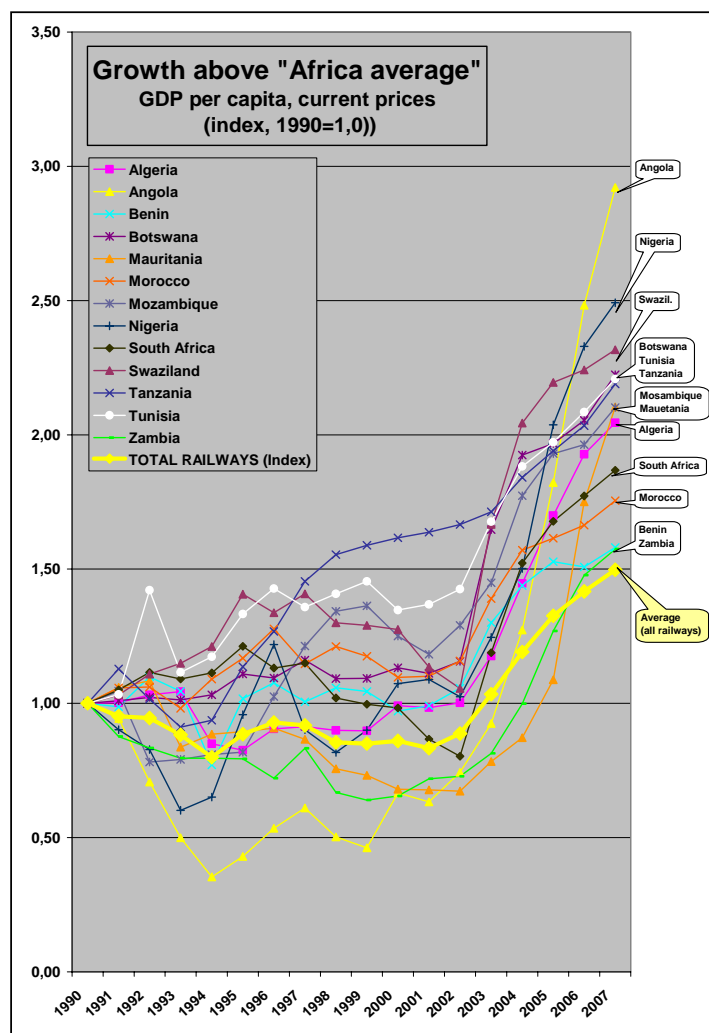


Figure 9-26 The relation between economic growth, trade and container traffic.

#### 9.5.1.1 Status and historical trends for Africa



The GDP (per capita, current USD) for African countries has generally been growing for the last 10-15 years. Exceptions are 9 countries (Cameroon, Côte d'Ivoire, D.R.Congo, Egypt, Ethiopia, Guinea, Malawi, Togo and Zimbabwe).

13 countries have been growing above the average "GDP-per capita" development for the 35 railway countries in Africa.

Figure 9-27 shows an illustration of growth from 1990, for fastest growing railway countries in Africa.

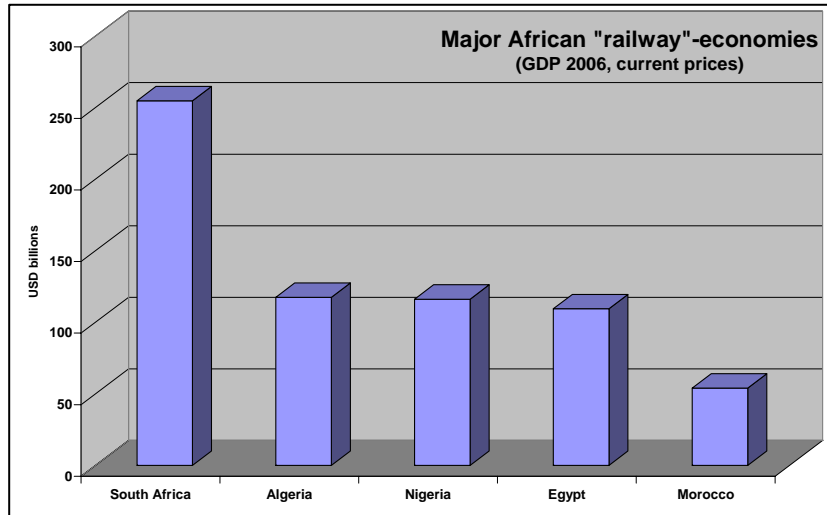
Angola has been the fastest growing country, followed by Nigeria.

Both countries high growth rate is driven by the oil sector, with record oil prices and rising petroleum production.

Figure 9-27: GDP per capita, fastest growing railway countries in Africa

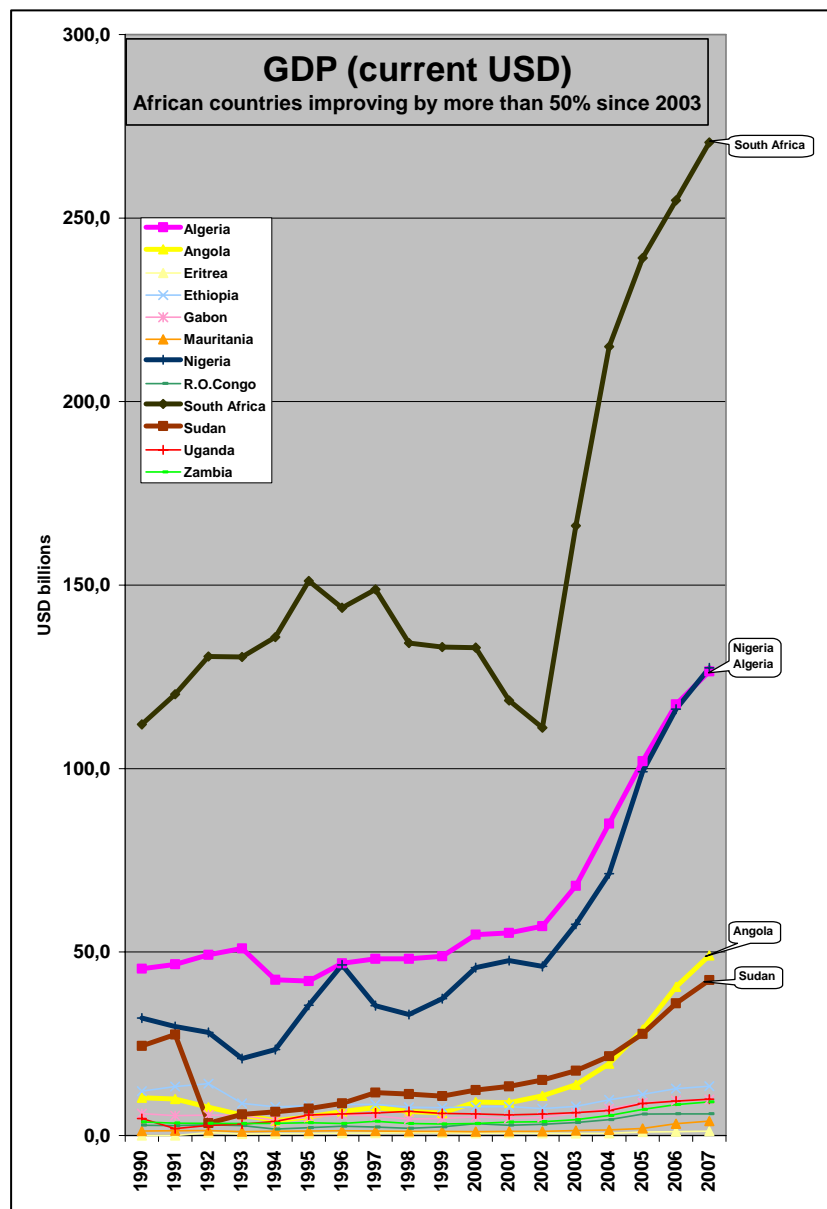


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The largest economy in Africa (Total GDP) is South Africa. The South African GDP is almost 2.5 times bigger than the 3 next countries; Algeria, Nigeria and Egypt. Morocco is the 5<sup>th</sup> largest economy, however only 20% of the South African economy (2006).

Figure 9-28: The largest economies in Africa (GDP, current prices)



The largest economies are also the fastest growing economies.

The South African growth has been tremendous since 2002. Almost the same situation is found in Nigeria and Algeria and to some extent in Angola and Sudan.

It is important to notice that figure 9-29 is based on current USD and this method converts the value of goods and services using global currency exchange rates.

This can offer better indications of a country's international purchasing power and relative economic strength, while the use of domestic currency, or fixed prices, may show a different picture.

Three railway-countries show negative growth for the same period; Guinea, Madagascar and Zimbabwe.

Figure 9-29: The fastest growing economies (2003-2006)  
(Source: IMF, *World Economic Outlook Database*, 2007, graphics by UIC)

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By looking the same countries/periode based on PPP<sup>12</sup> (Purchasing power parities), a slightly different picture occurs.

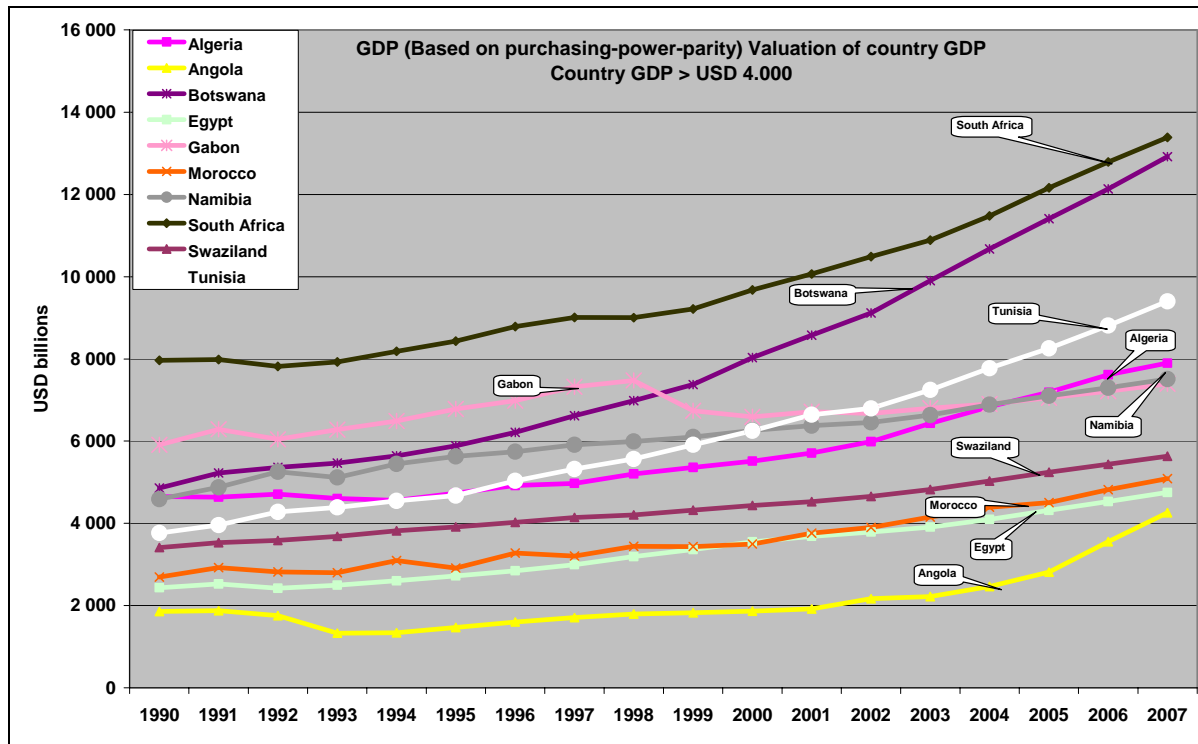


Figure 9-30: 10 fastest growing economies based on GDP, PPP

Source: IMF, World Economic Outlook Database, 2007 (Graphics by UIC)

The differences between PPP and current rates can be significant, as well as by using other GDP measures. The GDP based on PPP valuation is shown in the figure above, where South Africa still ranks above all other countries in Africa. However, South Africa is accompanied by the countries which are close to Europe (Maghreb: Algeria, Tunisia, Morocco as well as Egypt) and oil exporting countries like Angola and Gabon. The mineral exporting country Namibia is number five and Swaziland, which is heavily dependent on South Africa, is ranking no 7 among the top-10.

A country like Botswana (ranking no two) has maintained one of the world's highest economic growth rates since independence in 1966. Through fiscal discipline and sound management, Botswana has transformed itself from one of the poorest countries in the world to a middle-income country with a per capita GDP (PPP) of \$12,100 in 2006. Two major investment services rank Botswana as the best credit risk in Africa. Diamond mining has fueled much of the expansion and currently accounts for more than one-third of GDP and for 70-80% of export earnings. Tourism, financial services, subsistence farming, and cattle raising are other key sectors

### Correlation<sup>13</sup>

Historical data's from many regions of the world seem to support a strong correlation between ton-km by train and GDP development. For the African railways market we can not generally verify the same patterns as for more developed region. The reason is mainly due to insufficient information.

(However, .....Comments to be made, if data from the African railways are obtained)

<sup>12</sup> A PPP exchange rate equalizes the purchasing power of different currencies in their home countries for a given basket of goods. For example, a US dollar exchanged and spent in China will buy much more than a dollar spent in the USA. At the PPP US\$ rate, PPP US\$1 has the same purchasing power in the domestic economy as US\$1 has in the USA.

<sup>13</sup> A measure of the interdependence of two random variables that ranges in value from -1 to +1, indicating perfect negative correlation at -1, absence of correlation at zero, and perfect positive correlation at +1. Also called coefficient of correlation

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### 9.5.1.2 Future growth

The economic growth prospects in the African region are better than the history and above world average. The most recent World Bank estimates predict that over the next decade economic growth in African is 3.4 percent per annum, while India and other South Asian developing nations would have a growth rate of 5.4 percent per annum.

A lot of uncertainties are connected to the future economic situations. For Asia many analysts assume that the historical growth rates cannot continue in the future, and to some extent gradually decrease. For Africa, the growth rates have historically been lower, which to some extent also can justify that most countries in Africa are far away from their saturation point. It is also important to consider that projected economic growth rates are usually higher in developing than in developed regions, but it is not usually assumed that all developing regions will reach the level of developed regions for many years.

Various projections for the future exist. They show different scenarios and growth rates, but they all conclude with future growth in Africa. Most projections are based on information from international organizations like World Bank, United Nations, IMF, OECD etc. OECD expects world growth (GDP) to be an average of 3.5% from 2006 to 2025 and that main growth will come in developing regions of the world.



ExxonMobil has looked at the prospect until 2030 (with reference year 2000) and indicate an annual growth of 3.4% for the non-OECD nations in Africa (real figures 2000). The conclusions from ExxonMobil's analyzes are shown in figure 9-31 (*Source: Long-term outlook, ExxonMobil, 2006*). The two columns (per region) show the GDP level in 2000 (left column) and the expected level in 2030 (right column). Blue columns are non-OECD nations.

Figure 9-31: World economic growth, 2030

The projections in the table below are made by US Energy Information Administration (International Energy Outlook 2006) and it shows average real growth rates per year (based on 2000 level) for various regions and countries from 1978 to 2030.

| Region                            | History   |      |      |      | Projections |           |           |
|-----------------------------------|-----------|------|------|------|-------------|-----------|-----------|
|                                   | 1978-2003 | 2003 | 2004 | 2005 | 2005-2015   | 2015-2030 | 2003-2030 |
| OECD North America .....          | 2.9       | 2.5  | 4.1  | 3.5  | 3.1         | 2.9       | 3.1       |
| United States .....               | 2.9       | 2.7  | 4.2  | 3.6  | 3.1         | 2.9       | 3.0       |
| Canada .....                      | 2.8       | 2.0  | 2.9  | 2.9  | 2.6         | 1.8       | 2.2       |
| Mexico .....                      | 2.9       | 1.4  | 4.4  | 3.1  | 4.0         | 4.1       | 4.1       |
| OECD Europe .....                 | 2.4       | 1.4  | 2.6  | 1.9  | 2.3         | 2.1       | 2.2       |
| OECD Asia .....                   | 3.0       | 1.9  | 3.0  | 2.6  | 2.3         | 1.6       | 1.9       |
| Japan .....                       | 2.5       | 1.4  | 2.6  | 2.4  | 1.7         | 1.0       | 1.4       |
| South Korea .....                 | 6.7       | 3.1  | 4.7  | 4.0  | 4.7         | 2.8       | 3.6       |
| Australia/New Zealand .....       | 3.3       | 3.2  | 3.6  | 2.3  | 2.5         | 2.4       | 2.5       |
| Total OECD .....                  | 2.7       | 2.0  | 3.4  | 2.7  | 2.7         | 2.4       | 2.6       |
| Non-OECD Europe and Eurasia ..... | -0.3      | 7.7  | 8.1  | 6.5  | 4.9         | 3.7       | 4.4       |
| Russia .....                      | -0.5      | 7.3  | 7.2  | 6.1  | 4.2         | 3.3       | 3.9       |
| Other .....                       | 0.2       | 8.0  | 9.5  | 7.0  | 5.9         | 4.0       | 5.1       |
| Non-OECD Asia .....               | 6.7       | 7.6  | 7.8  | 7.5  | 5.8         | 4.9       | 5.5       |
| China .....                       | 9.4       | 9.1  | 9.5  | 9.2  | 6.6         | 5.2       | 6.0       |
| India .....                       | 5.3       | 8.5  | 6.9  | 6.8  | 5.5         | 5.1       | 5.4       |
| Other .....                       | 5.4       | 4.8  | 6.0  | 5.4  | 4.9         | 4.3       | 4.6       |
| Middle East .....                 | 2.6       | 4.8  | 6.4  | 6.7  | 4.4         | 3.7       | 4.2       |
| Africa .....                      | 2.9       | 4.8  | 5.1  | 4.9  | 4.8         | 4.1       | 4.4       |
| Central and South America .....   | 2.3       | 2.1  | 5.9  | 4.5  | 3.8         | 3.5       | 3.8       |
| Brazil .....                      | 2.5       | 0.5  | 4.9  | 2.7  | 3.7         | 3.3       | 3.5       |
| Total Non-OECD .....              | 3.7       | 6.4  | 7.2  | 6.7  | 5.3         | 4.5       | 5.0       |

Figure 9-32: Economic Growth Projections 2030 (International Energy Outlook, 2006)

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Africa is expected to show the exhaustive growth from 2003 to 2030 and is in reality only bypassed by non-OECD countries in Asia (like India and China) and CIS-countries. The projections for Africa are 4.4% per year from 2003 to 2030. Non-OECD countries are expected to grow by 5% per year and OECD countries by 2.6% per year.

The figure below shows (Global Insight, 2005) expected annual GDP growth rates for the period 2005-2025. This scenario does also support strong growth for Africa (4.4%), ranking behind China and India.

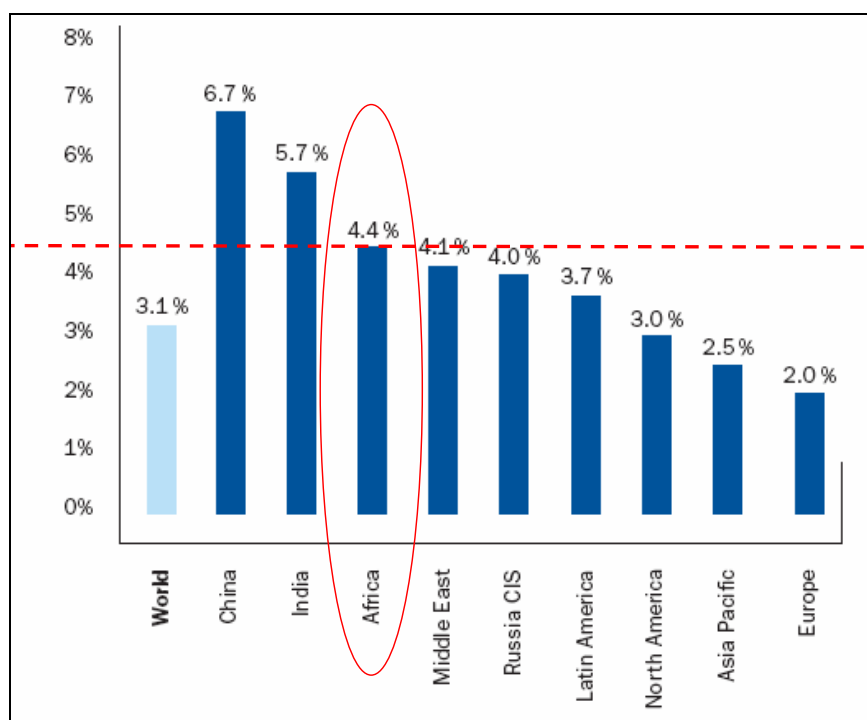


Figure 9-33: Economic growth prospects 2005-2025 (Global Insight, 2005)

(Some country specific information can be included, as well as comments regarding different methods of measuring GDP)

### 9.5.2 International trade

Africa international trade (exports and imports) has been growing during the last few years after a long period without any noticeable growth (see chapter 7.2). Figure 9-34 (below) shows Africa's share of world trade since 1948 and until today. The South African share of world trade is shown as an integrated part of the column. Even though the nominal trade has been growing, Africa has not been able to keep its share of the world trade and from 1948 to 2003 the share is reduced from 7% to 2.3%. During the last years (after 2003) the African growth has been stronger than world average and the share of trade has increased to 2.9% in 2005.

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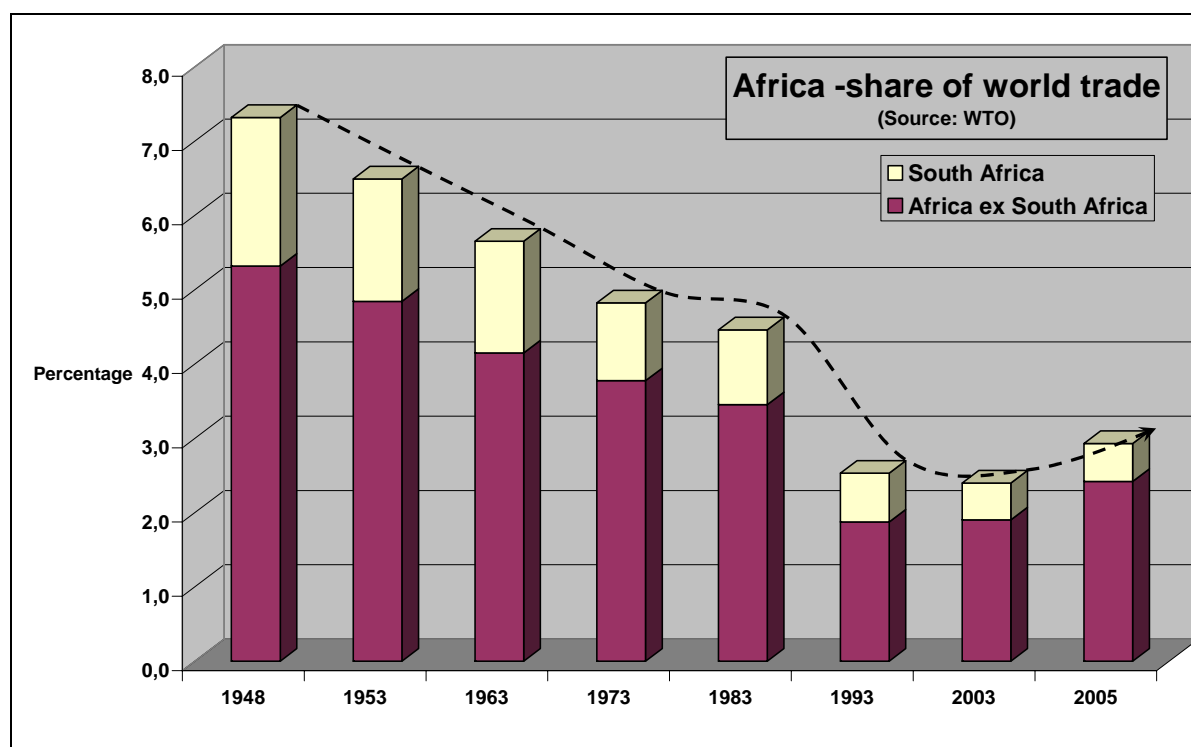


Figure 9-34: Africa's share of world trade

Africa's share of the world trade is low and the African countries trade balance is dominated by the export side and raw-materials. 65% of the exports are fuels and mining products. The import side is dominated by manufactures (70%). Table 9-16 shows Africa's main exports and imports groups. The export is dominated by bulk-materials (dry and wet-bulk) while imports are dominated by commodities which may be more suitable for container transports. A situation like this, creates usually a heavy imbalance when it comes to container supply and demand, as well as a potential imbalance for the bulk-transporters.

| Product group                    | (USD Billions) | Share (%) |         |
|----------------------------------|----------------|-----------|---------|
|                                  | Exports        | Exports   | Imports |
| <b>Agricultural products</b>     | 32             | 11 %      | 14 %    |
| <b>Fuels and mining products</b> | 194            | 65 %      | 14 %    |
| <b>Manufactures</b>              | 63             | 21 %      | 70 %    |

Source: WTO (March 2007)

Table 9-16: Commodity mix, African exports and imports.

The intra-African trade is low. Africans main trade partner is Europe, and 50% of exports as well as the imports are related to Europe. More than 40% of the Africa-Europe export is related to crude oil, gas and petroleum products, on third is manufactures and 15% is agricultures.

The second largest trade partner is Asia and the third is North America. The North American trade is heavily imbalanced and 2/3 of the trade is exports to North America (Source: WTO, March 2007). More than 70% of the exports to North America are oil and oil products. The Asian trade is dominated by a fast growing trade with China.

Trade among African countries accounts for only about 10% of their total exports and imports (Economic Commission for Africa (ECA), World Bank etc) Meanwhile, 40% of North American trade is with other North American countries and 68% of trade by countries in Western Europe is with other Western European nations. While North America and Europe have been richer through trade, Africa has been left standing behind.

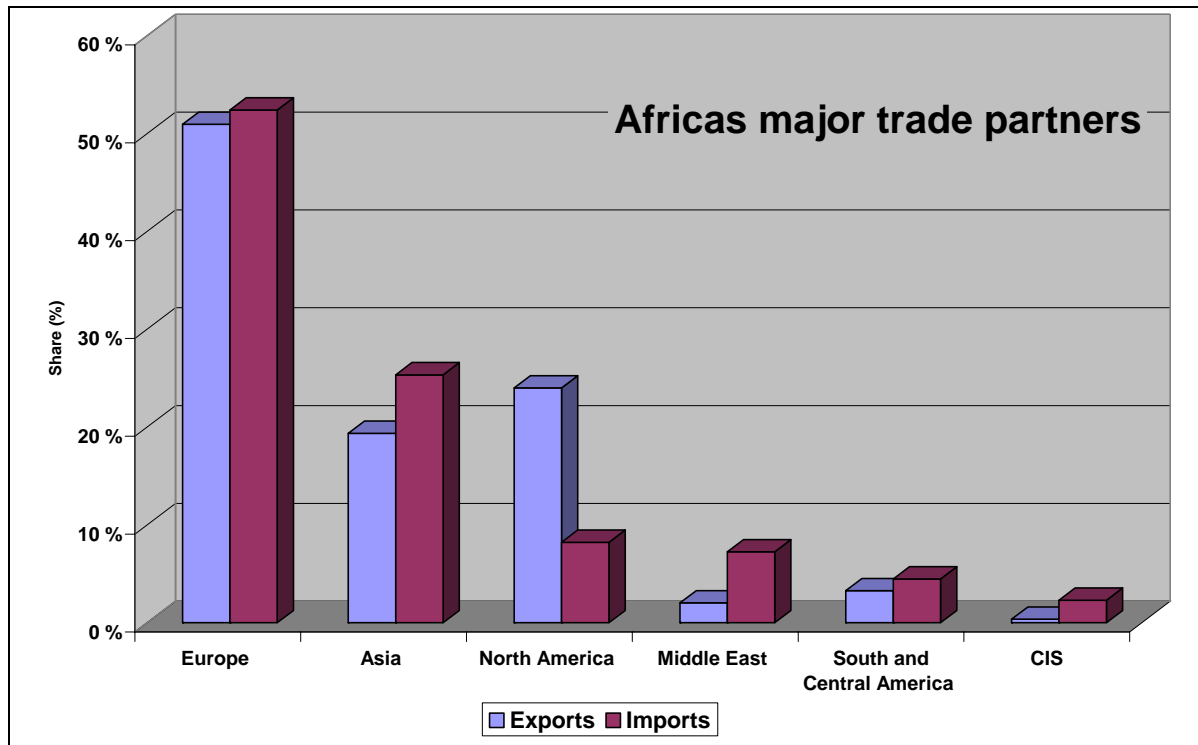


Figure 9-35: Africa's major trade partners (2005).

The lack of intra-African trade is a missed opportunity, because increased trade between countries creates a demand for better roads and railways, something Africa desperately needs, and provides the wealth to build and maintain them.

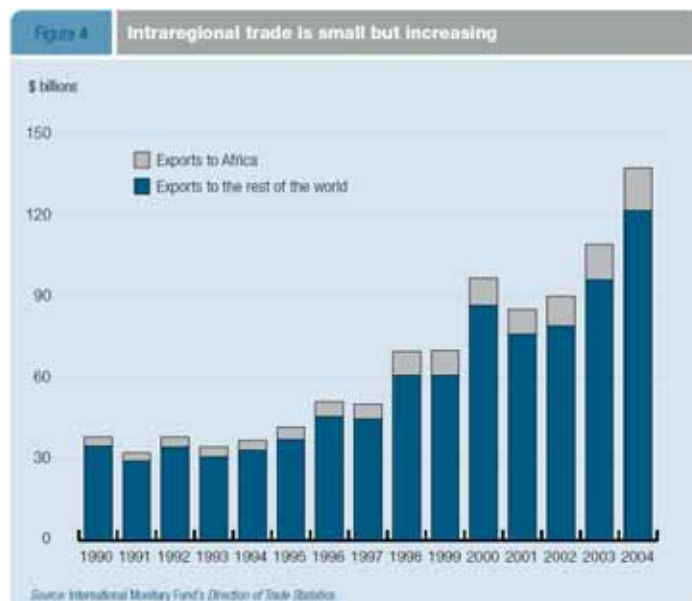


Figure 9-36: African intra-regional trade

larger Asian economic community is already emerging. The same is not obvious for Africa, however even though the intra-African trade is small, -it is increasing (see figure 9-36).

Even though some blames the continuing low level of trade on poor transport, there are more probably more than one trade barrier which has created this situation. Effective improvements can most probably only happen through various measures (formal and informal trade barriers, infrastructure investments etc).

Africa's dependence on demand in European has been increasing and this situation may continue for many years.

In Asia (UIC Visions 2025 for Asia) there where projections which indicated that a

The trade flow between African regions and the rest of the world is expected to grow and the growth in trade has a direct consequence for international transportation, particularly container transports, which is also the most suitable loading unit for international railway transports.

### 9.5.3 The economic structure

An expanding manufacturing sector creates increasing demand for transports. Historically, a raise in the per capita GDP tends to be accompanied by a decline in the share of the GDP occupied by the agricultural and manufacturing sectors, which means a raise in the share occupied by the service sector. It is also important to consider that projected economic growth rates usually are projected to be higher in developing than in developed regions.

Economic growth for developed countries have slowed down, while growth of developing countries is above world average (2005). Africa is no exception and Latin America and Middle East recorded economic growth between 4-5% in 2005 (world 3.6%). These growth figures are based on GDP (constant USD 1995). Even though there are a connection between economic growth and trade, the merchandise trade is a better indicator when projecting transportation work. The World Banks "World Development Outlook 2007" concludes that "Current projections suggest that developing countries will continue to grow more rapidly than high income ones in the next 25 years."

The World Bank does also state that not all developing countries are growing, and "At the slow end of the spectrum are countries that have experienced major conflicts or financial crisis in the last decade, are landlocked, or are far away from major trade routes. Most of them are located in Sub-Saharan Africa."

Merchandise trade is generally growing faster than GDP and the merchandise trade is growing faster for developing than developed countries. Even though history shows that it is dangerous to generalize, this information gives valuable inputs to the vision of Africa.

The generalized figure (Figure 9-37) intends to show that when GDP is growing, merchandise trade is usually growing and usually at a higher level than GDP. However, we can not expect that merchandise trade is growing faster than GDP before a certain level of basic development conditions are fulfilled (A), -e.g. relevant infrastructure and business climate. The figure does also indicate that developed countries have a larger share of service industry and a lower relative share of manufacturing industries. This structure creates a lower share of physical transportation needs. The economic structure, future prospects for this structure, development of infrastructure, management and business climate is of crucial importance for the development of railway transports.

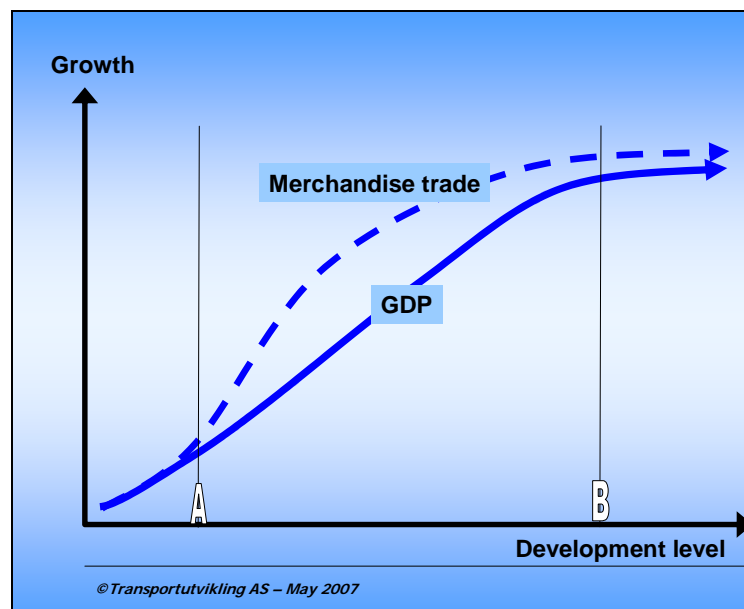


Figure 9-37 Trade and development levels

In fact, there has been little change in the production structure of most African economies in the post-colonial era. Africa has traditionally relied on exports of primary products-agricultural commodities, timber, minerals and in more recent decades, petroleum in a few countries. But the share of primary



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products in world trade has fallen by half since the 1960s and the manufacturing sector in Africa accounts for a small proportion of total output, and the share of the manufacturing sector in GDP is significantly lower in Africa (below 10%) than in other developing countries. The failure to diversify out of traditional primary commodity exports into more dynamic export sectors is one factor linked to the declining position of Africa in world trade. In addition to that there is also a slow growth in global demand and Africa's is declining its share even for the traditional exports.

### 9.5.4 Poverty and aid dependency

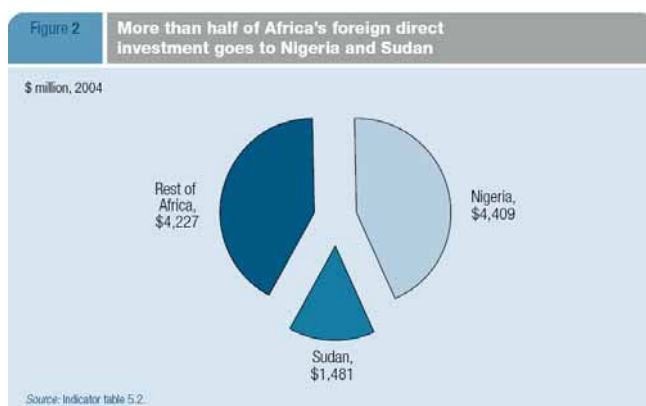
Africa has a tremendous poverty challenge and there is a general acceptance that Africa needs additional aid, particularly with respect to MDG<sup>14</sup>. The UN Millennium Project has made analysis which indicates that MDG goal financing gap in 2006 was USD 73 billions and that the gap will increase up to USD 135 billions by 2015. The current aid is USD 45 billions (2006).

Development aid has been the most important element in capital transfers to Africa for many years. Africa receives the highest share of aid in per-capita terms and as a percentage of GNP of all developing regions. However, in the 1990s the debate over aid has focused on aid –effectiveness (or perceived ineffectiveness), aid-dependence (the risks there of), and aid fatigue. Donor aid fatigue is clearly real and of major importance for Africa. Those aid conditions weighed heavy on political environment in many African countries, creating then a new economic climate. For example, in some countries, liberalization reforms have been achieved by decree, but not followed by appropriate legislative steps, creating an atmosphere of uncertainty for traders and investors. Many countries have attempted to promote trade expansion through export processing zones, but aside from a few countries these have generally not worked well.

The number of people living on less than \$1 a day in developing countries fell by more than 260 million over 1990-2004, thanks in large part to massive poverty reductions in China. In contrast, the number of poor people continued to increase in Sub-Saharan Africa, rising by almost 60 million (World Development Indicators 2007, World Bank). It is obvious that this environment creates substantial challenges and there are stronger focus on other issues than developing railway transports.

### 9.5.5 Foreign investments

Extraction of Africa's natural resources accounts for the uneven spread of foreign direct investment (FDI) flows across the continent. The 24 African countries classified by the World Bank as oil- and mineral-dependent have, on average, accounted for close to three quarters of annual FDI flows over the past two decades. In 2004 more than 50% of the FDI was going to Nigeria and Sudan (See figure



9-38) This has created structural biases where the FDI regime has low value added, limited reinvested earnings and periodic profit surges.

Reports claim that global FDI inflows rose substantially in 2005, with the strong growth leading to an increase in the inflows to developed countries. Rising global demand for commodities was reflected in the steep increase in natural resource-related FDI, although the services sector continued to be the major recipient of FDI.

Figure 9-38: African FDI (Source: African Development Bank)

<sup>14</sup> Millennium Development Goals



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Africa received record high FDI inflows in 2005 of \$31 billion, but this was mostly concentrated in a few countries and industries, according to a new World Investment Report 2006, put together by the United Nations Conference on Trade and Development (UNCTAD).

FDI continued to be a major source of investment for Africa as its share in gross fixed capital formation increased to 19% in 2005. However, the region's share of global FDI remained low at about 3% in 2005.

Africa's top ten recipient countries (2005) accounted for close to 86% of the regional FDI total:

1. South Africa
2. Egypt
3. Nigeria
4. Morocco
5. Sudan
6. Equatorial Guinea
7. Democratic Republic of Congo
8. Algeria
9. Tunisia

In eight of these countries, FDI inflows exceeded \$1 billion (more than \$3 billion for Egypt, Nigeria and South Africa in particular). At the other extreme, FDI inflows remained below \$100 million in 34 African countries. These are mostly least developed countries (LDCs), including oil-producing Angola, which witnessed a drastic decline in FDI receipts in 2005.

FDI inflows to the region were concentrated in a few industries, such as oil, gas, and mining. Six oil producing countries (Algeria, Chad, Egypt, Equatorial Guinea, Nigeria and Sudan, in descending order of the value of FDI) accounted for about 48% of inflows to the region.

FDI outflows from Africa in 2005 remained small and originated from a few countries. Six home countries (Egypt, Liberia, Libya, Morocco, Nigeria and South Africa) accounted for over 80% of total outflows.

## 9.6 Other conditions & restrictions

### *9.6.1 International focus on Africa*

External factors influence internal/regional conditions, for instance a positive picture of developing country trade with the EU. Exports are expanding in all sectors and in all regions. The European Union access preferences program for Least Developed Countries (LDCs) provides duty and quota-free access to all types of exports from those countries with permanent exception of arms and ammunition and a temporary exception for bananas, rice and sugar. Japan and Canada introduced also eligible programs for duty free on some products. The African Growth and Opportunity Act (AGOA) passed by the USA congress into law in 1999 started to show effects. The purpose of this bill was to authorize a new trade and investment policy between US and Sub-Saharan Africa. Concretely, more than \$500 million in new investments and approximately 250,000 jobs have been created in Africa as a result of AGOA. Through AGOA, Africa enjoys a more extensive list of eligible products than other apparel watches, electronic articles, steel articles, footwear, handbags, and luggage). AGOA also provides more stability because the product list is reviewed less frequently than others. In order to qualify for AGOA, countries must be working to improve the rule of law, human rights, and respect for core labor standards. Currently, 37 of 48 Sub-Saharan African countries qualify.

Involvement in international organization does also have an impact on demand. A WTO-membership may lead to more uniform administrative agreements, a change in the restrictions on trade such as taxes and tariffs, and a more "international" judicial review. All these factors combined can lead to

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stronger economic growth than projected in many Africa countries, and thereby contribute to the railways industry.

### Europe

Europe's relationship with Africa is deeply rooted in history and has gradually evolved into a strong partnership. The European Union is already the world's largest donor in Africa and is the continent's most important economic and trade partner. The European Union states that they have a particular role to play and a particular responsibility towards the African continent.  
([http://ec.europa.eu/development/Geographical/RegionsCountries/EUAfrica\\_en.cfm](http://ec.europa.eu/development/Geographical/RegionsCountries/EUAfrica_en.cfm))

In December 2005, the Heads of State and Government of the EU adopted a new Strategy for Africa, with the title "The EU and Africa: Towards a Strategic Partnership". This new Strategy has been drawn up on the basis of a proposal from the Commission. The purpose of this Strategy is to give the EU a comprehensive, integrated and long-term framework for its relations with the African continent. It designed to guide interaction between the whole of Europe and Africa at all levels: pan-African institutions such as the African Union, regional organisations and African countries.

Every two years, the highest political body in the EU, the European Council, will consider the progress in implementing the Strategy. The overarching goals of the Strategy are to support Africa's efforts to reach the UN Millennium Development Goals (MDGs) and make Europe's partnership with Africa more efficient.

The EU states that without good governance and peace and security, no lasting progress is possible. The EU will therefore support both the African Union and individual African countries to make progress. Furthermore, trade, regional integration and interconnectivity are necessary factors to promote economic growth. And without economic growth, it is not possible to beat poverty. The EU will therefore make efforts to conclude trade agreements with African regions and will support Africa in building regional markets. A new Europe-Africa Infrastructure Partnership has been proposed, to improve transport, energy, water and ICT networks on the African continent.

More support is needed in areas that increase the living standards directly, such as health, education, and a safe environment. Most of the actions in these fields need to be taken close to the people will therefore be part of the country-specific programmes.

As far as the European Commission is concerned, in addition to the specific instruments with a continental dimension, the strategy will be implemented via the aid channelled coming from the European Development Fund. The EU is currently negotiating specific strategies with each partner country and region for the period 2008 – 2013.

In addition, as the African continent is vast and varied, there is a need for more specific frameworks for certain countries or regions. The first proposal for such a strategic specific framework was presented on 28 June 2006 by the European Commission and proposes to upgrade EU's relations with South Africa to a Strategic Partnership. To deepen the relations with South Africa is an important further building block in the overall EU-Africa partnership and would fully take into account the country's position as an anchor in the region and its important role on the African continent and in international relations.

### ***9.6.2 Political conditions in countries and regions***

The railways industry in Africa is strongly influenced by political conditions. Most railway companies are national monopolies and competition does only exist as competition between modes. Market correctives obtained through railway-railway competition is less widespread.

The infrastructure is owned by the governments, unlike USA, and recent studies undertaken showed that Africa will need huge infrastructure investment over several years to meet the demand for transport, energy and utilities. The same situation is found in Asia and according to Asian Development Bank (2005), this level of investment is clearly beyond the capability of the state-owned

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railway systems, or the public sector as a whole. ADB put focus on this situation and concludes by a question; "Where will the money come from to build these systems?."

African governments are well aware that private sector participation, including foreign investment, is needed to meet these enormous challenges. And it is not only a matter of financing. Given the history of state ownership, there is a serious need to make the rail sector more efficient and cost-effective, through innovations and productivity gains. Governments increasingly recognize that the private sector has much to contribute in this respect

Trade liberalization is also considered to be an important driving force for increased railways transports in Africa. The matter of trade facilitation is political due to government's involvement. Subsequent to the political process, it will become an economic matter, and this is a strong force of change (Wilson, 2004). There is no economy that has sustained fast growth that has not undertaken a significant degree of trade liberalization (*Berg and Krueger, 2003*)

Political instability has a clear impact on the demand for transportation, even though countries may be perfectly located as transit countries in intermodal logistical chains. The future political situation in many countries is not easy to predict. The economic and transportation performance may fluctuate from year to year for a number of reasons, such as natural disasters (see chapter 9.6.4), displacement of population due to instability, armed conflicts, price fluctuations (see chapter 9.5), annual level of foreign investments.

In 2005, 7 of the 16 peacekeeping missions of UN were located in Sub-Saharan countries. For the purpose of the prospect for future railway transports such conditions are important, -perhaps not always a driving force, however a trigger for the initial development phases. Political conditions do strongly influence parameters which are crucial for the development of transportation (particularly passenger transportation), -like poverty, income disparity and lack of transparency.

Furthermore, there are other forms of barrier that doesn't appear in the formal figures. Roadblocks and arbitrary fees within countries have negative impact on trade and transportation. *The Economist's* Robert Guest found that a journey in Cameroon that should have taken him three-quarters of a day took him four days. Customs posts are challenged by corruption, while roadblocks and arbitrary fees demanded along the way have hobbled trade. However, it has to be emphasized that most African countries enjoy relatively stable political conditions and are governed by democratically elected regimes. Their efforts are directed at economic reconstruction and at combating poverty and underdevelopment, including through NEPAD (UN Progress report of the Secretary-General, 2004). There are positive developments, like the development in Botswana, South Africa and Tunisia, -as well as the anti-corruption conventions for North Africa<sup>15</sup>.

### 9.6.3 Security

Security is closely related to political conditions. The term "security" covers not only issues like terrorism and armed conflicts, but also political and economical risks, which may influence logistical qualities like no-thefts and no-damages. Lack of market oriented security systems is critical to the development of transportation in many countries. Other logistical criteria, like low price, will not compensate for insufficient security standards.

African countries may develop to be important markets for export and import, and many countries are influenced by external evaluations of their risk. It is not a satisfactory condition that a government representative states that the risk in his country is low. Transportation, the choice of routes and markets are influenced by the markets players' perception.

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<sup>15</sup> As part of a regional series on civil society work on anti-corruption conventions, Transparency international published Anti-corruption Conventions in the Middle East and North Africa. It has become a principal handbook on setting anticorruption standards in the region.

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Terrorism risk, as well as political and economical risk, exist several places in Africa. The map below is produced by AON (2006) and it shows political and economical risk, not terrorism risk. By using colors AON indicate where the risk is low, medium or high.

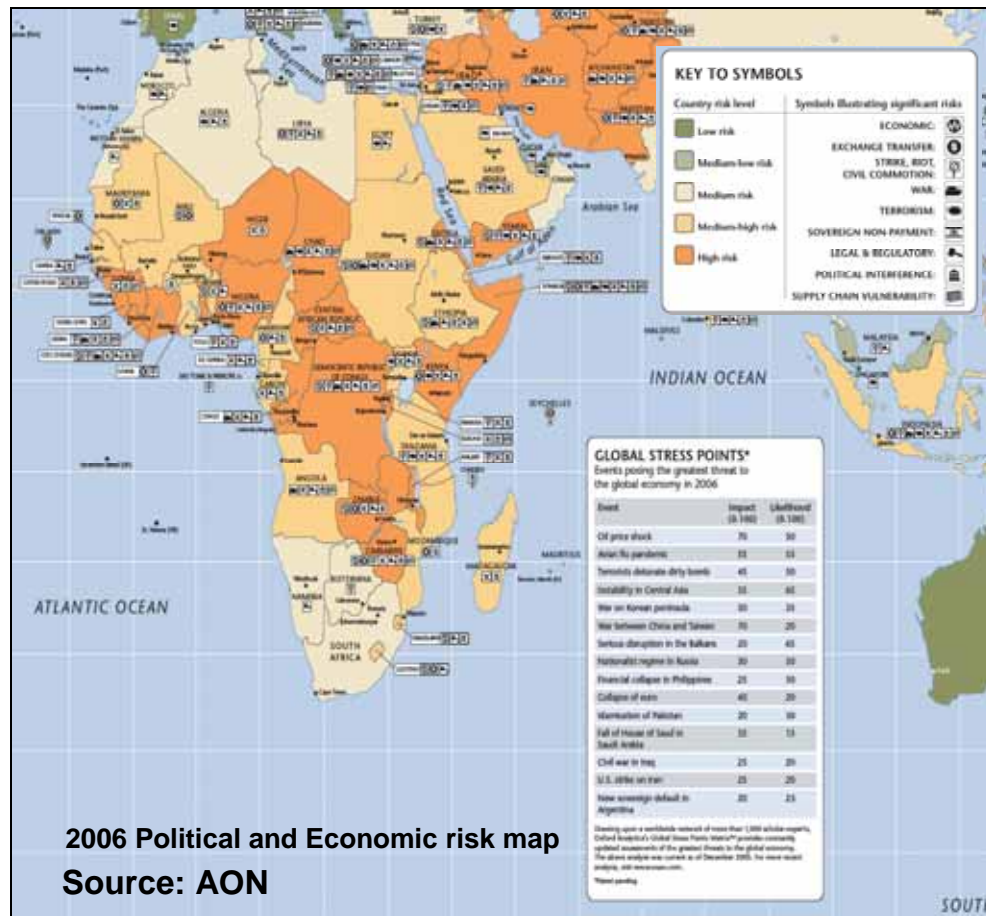


Figure 9-39: AON, Political & economic risk map, 2006

According to AON no countries in Africa are considered are classified as "low" or "medium" when it comes to political and economical risk. They are all classified as "medium", "medium-high" and "high" risk countries. Countries with the best score in Africa ("medium-risk") are in the south and north (Maghreb, South Africa, Namibia and Botswana).

Political & economical risk is an important element in risk evaluations markets players do. To day, terrorism risk is considered to be one of the most important issues when judging a regions business climate.

The African section of AON's global "Terrorism Threat Map" is shown in figure 9-40. Many countries in Africa are classified as "low" or "guared" risk. Only five countries are classified as "high" risk and none as "severe" risk. Three out of five "high" risk countries are railway-countries (Algeria, Egypt and Uganda).

However, even though countries may have low risk, some cities may be considered as cities with particular risk. Such cities may be cities with important ports, capitals etc. In Africa, AON, consider such cities to be Cairo, Luxor, Sharm-El-Sheik, Casablanca, Marrakesh, Nairobi, Mombasa, Dar-Es-Salam, Pretoria and Cape Town.



Figure 9-40: AON Terrorism Threat Map 2006 (Africa)

AON has also made a separate map where disruption of global supply chains may be influenced by various risk components. These evaluations, right or wrong, influence transportation in general as well as railway transportation.

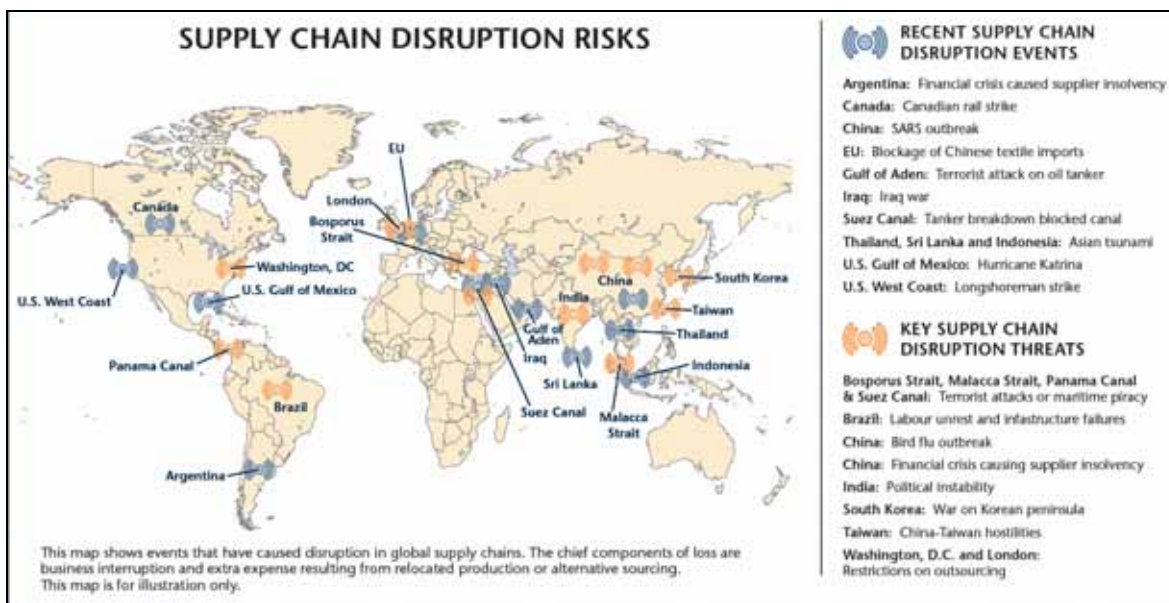


Figure 9-41: Supply Chain Disruption Risk (AON, 2006)



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Due to the fact that Africa is considered to be “periphery” when it comes to the major trade lanes of the world, the map does not particularly specify such risks in Africa, except for the Suez canal. The map shows recent events and potential threats considered to have impact on supply chains. The events/threats are discussable and others may be included.

By looking at the total picture (political, economical and terrorist risks), the “high-risk” regions of Africa influence nearly all potential long-distance railways corridors. An example is the Maghreb region, which is considered to be relatively stable when it comes to economical and political risk. This corridor is not only influenced by border disputes between Morocco and Algeria, however also the classification of Algeria as a “high” risk country when it comes to terrorism threats.

### 9.6.4 Natural disasters and climate

Natural disasters are increasing in number and frequency, and affect most countries in Africa. Droughts and floods severely impact on food and water security in Africa. Droughts and floods have had major human and economic costs in east and southern Africa. The ENSO floods in 1998 in east Africa resulted in human suffering and deaths, as well as extensive damage to infrastructure and crops in Kenya (Magadza, 2000). Floods in Mozambique in 2000 and in Kenya in 1997-1998 sparked major emergency relief as hundreds of people lost their lives and thousands were displaced from their homes (Brickett et al., 1999; Ngecu and Mathu, 1999) The cost in Kenya alone was estimated at US\$1 billion (Ngecu and Mathu, 1999).

Natural disasters are believed to have 7 times more impact on the African continent than conflicts.

According to UNEP (Nairobi, 10 April 2007) Africa requires urgent assistance to adapt to climate change and action by industrialized countries to deliver deep cuts in emissions if the Continent and its people are to thrive in the 21st century. The regional report by Working Group II of the Intergovernmental Panel on Climate Change (IPCC) predicts that continued increase in greenhouse gases will later this century put up to 1.8 billion more people in Africa at risk of water stress. Furthermore, the report (models) shows serious negative impact on water flows in some river systems, more extreme dry and wet years, more frequent and intense tropical storms etc. Malaria is also likely to rise, parts of the Sahara are expected to suffer most with agricultural losses equal to up to seven per of GDP predicted, decreasing fisheries productivity etc.

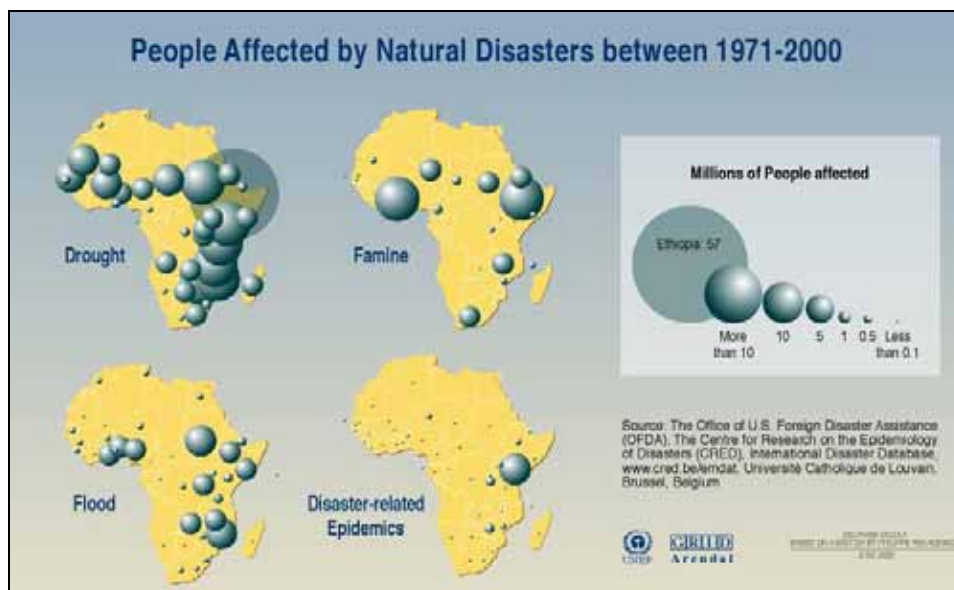


Figure 9-42 People affected by natural disasters 1971-2000

This situation will also have serious impact on transports in general and railways transports. The report indicates also negative impact on tourism, much of which is based on nature.

## 10 The future

### 10.1 Transportation work

Projecting the level of future railway transport in Africa includes serious uncertainties and should be further looked into by the UIC. The causal connection among drivers (see chapter 9) influencing railway transports and the actual railway transport are complicated to assess. These drivers impact on various conditions are also estimated on different levels by different players, and the railways are heavily dependent on political decisions.

By assuming that there is a connection between economic growth and freight transports, and between population growth and passenger transports, - estimates are possible to make. Historically, this connection is possible to verify for some countries in Africa, but changes in other variables may counteract the predicted outcome. Furthermore, no changes or improvements in conditions like infrastructure or operational systems may also influence the projections, due to lack of capacity or quality.

The main focus is put on countries where information is accessible, like South Africa and North Africa. Many of these countries are also dominating the African railway transportation and reliable figures are possible to retrieve. Based on this baseline it is also possible to make indications for other countries. (May be updated, depending on information)

#### Passenger transport

Statistical measures like correlation do not indicate a causal connection, however a co-variation. For the last 10 years, passenger transports (pax-km) in Africa, as an average, has not been growing faster than the growth in population (as we could verify for many Asian countries). During the last 15 years, the African population has increased by 40%. During the same period passenger km by rail has decreased by 25% for the 9 countries evaluated.

For many other countries in Africa, there is not a systematic change which can be generalized for all countries and measured on an annual basis.

Population, as a single variable, is not a satisfactory driver when future passenger transport by rail is to be projected. Population growth is of course an obvious factor causing demand for passenger transports. The demand side is also influenced by other variables, like the customer's access to transports and their economical capabilities to buy transports. A positive correlation between population growth and passenger transports is however found for a few countries and this positive correlation is usually connected with stable political environment as well as relatively stable economic growth. This may be the future for many African countries.

Economical capabilities are often indicated by GDP per capita. GDP per capita have for the last few years increased by 70-80% in Africa and 50-60% for the 9 countries listed in chapter 8.7 decade.

| City                   | Country       | Population (mill) |       |        |
|------------------------|---------------|-------------------|-------|--------|
|                        |               | 2006              | 2020  | Change |
| Lagos                  | Nigeria       | 11,70             | 21,51 | 84 %   |
| Cairo                  | Egypt         | 11,29             | 14,02 | 24 %   |
| Kinshasa               | Congo         | 5,89              | 10,04 | 70 %   |
| Khartoum               | Sudan         | 4,63              | 6,46  | 40 %   |
| Casablanca             | Morocco       | 3,83              | 5,09  | 33 %   |
| Alexandria             | Egypt         | 3,81              | 4,77  | 25 %   |
| Abidjan                | Côte d'Ivoire | 3,62              | 5,11  | 41 %   |
| Johannesburg           | South Africa  | 3,44              | 4,67  | 36 %   |
| Algiers                | Algeria       | 3,37              | 4,93  | 46 %   |
| East Rand (Ekurhuleni) | South Africa  | 3,23              | 4,82  | 49 %   |
| Cape Town              | South Africa  | 3,21              | 3,92  | 22 %   |

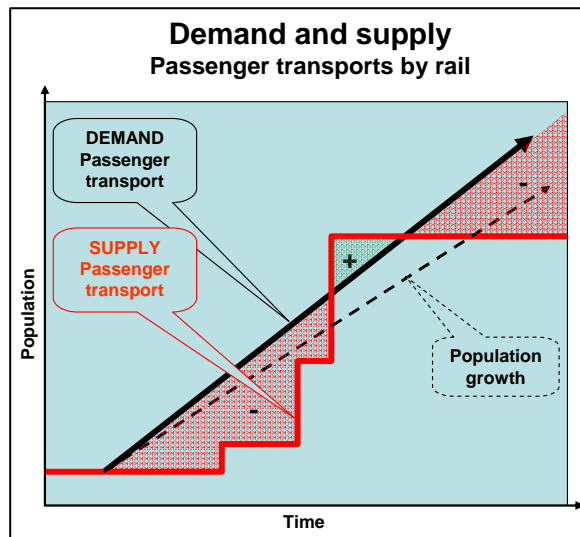
Table 10-1: Population growth-major cities of Africa

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The growing urbanization in Africa normally influence the demand for railway transports in the regions/cities where strong urbanization is projected. Cities in Africa where the strongest growth is expected between 2015 and 2015 are shown in table 10-1.

3 of eleven cities are located in South Africa, however together only 2/3 of the projected population in Lagos (Nigeria). The largest cities in 2006 (Lagos, Cairo and Kinshasa) are also expected to remain the largest in 2020. The strongest growth is expected in Lagos, by 84% between 2006 and 2020.

These cities are presently facing serious congestion and environmental challenges, where the railways in the future can make a strong contribution in relieving pressure and environmental problems.



Growth in passenger transport by rail is not only depending on the demand side. Satisfactory supply of railway services is required if the potential caused by increasing demand is going to be met. Railway capacity, which is not only an infrastructural matter, has to be developed accordingly, and the railways have to be competitive compared with other modes.

The figure, left, is an illustration showing continuous growing demand, while capacity often has to be increased stepwise.

In a market where demand is growing, capacity can not be solved by single actions. The process of supplying railway capacity has to be an ongoing process.

Figure 10-1 Demand and supply for passenger transports  
(Source: Transportutvikling AS, 2005)

Based on the history from 1990 to 2005/6, and a linear projection, passenger kilometers by rail in Africa are not generally projected to increase. Lack of reliable information and volatility in historical output are obvious reasons. However, the potential is there and development of the supply side and improved business climate should make it possible to capture this business opportunity.

For all railway countries of Africa, additional 390 million people (2025) may require passenger transports compared with the present situation. The real demand for passenger transport services may most probably be even larger than the population increase indicates, due to other variables like improved buying power (GDP per capita), impact from urbanization, improved business climate etc. The expected population growth in the African railway countries between 2005 and 2025 corresponds to 1.3 times the present population in USA

### **Freight transport**

For the last 15 years, freight transports (ton-km) in the 9 evaluated countries of Africa (see chapter 8.7), as an average, has been stable, even though there are variations among the countries. For the last five years, the African GDP (current prices) has increased by 70-80%. During the same period, ton km by rail has slightly decreased.

Projecting freight transport, by the use of a single variable like GDP is not satisfactory when future freight transport by rail is to be predicted. Due to lack of correlation between GDP and freight transport, it is not possible to make future base-line indications where historical co-variation is taken into consideration. However, historic data's from other regions of the world support this co-variation.



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As for passenger transports, the demand for freight transports are influenced by other variables, as well as for the supply side where capacity, competitiveness and stability are main factors.

GDP projections for Africa (2025) are, by most analysts positive. Africa's elasticity (unit ton-km change vs. unit GDP change) has not been possible to estimate on a reliable basis. However, the projected GDP growth creates opportunities which are possible to capture. As an example, companies like South Africa's Spoornet projects stable growth in their freight volumes until 2011/12.

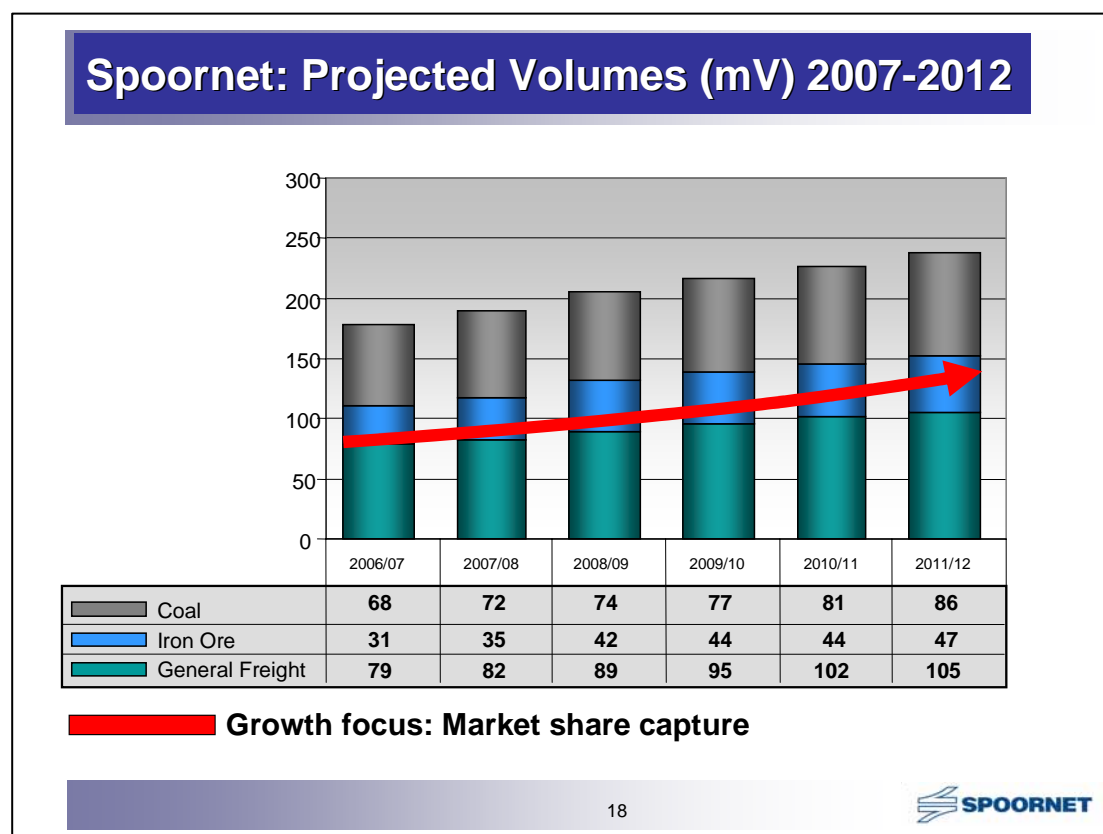


Figure 10-2 Spoornet – projecting stable growth 2006-2012

(Spoornet: What is mV?)

### 10.2 Future infrastructure requirements

Africa's railway density (tracks per km<sup>2</sup>) is approximately one tenth of the densities found in the United States (UNCTAD, Review of Maritime Transports, 2006). The density measured per capita is one fifth of Europe.

A huge share of the African railways is of bad standard due to lack of investments and maintenance. In some countries the railway infrastructure is more or less damaged and abandoned due to conflicts and civil wars.

Huge infrastructure investments are necessary to meet demand for transport in Africa. The level of investments is clearly beyond the capabilities of the state owned railways or the public sector as a whole.

Tremendous future investments are necessary if the railways are going to meet the possible demand as well as to fill the gap due to many years of unsatisfactory investments.

The railway network of Africa is as per 2007 approximately 83.000 kilometers. If the railway network is to be developed according to projected economic growth, more than 130.000 km has to be

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constructed within 2025. The 2025 network should be 2.4 times the 2007 level (figure below). However, capacity is a comprehensive concept and addition volumes can also be handled by upgrading existing lines and improving operational conditions.

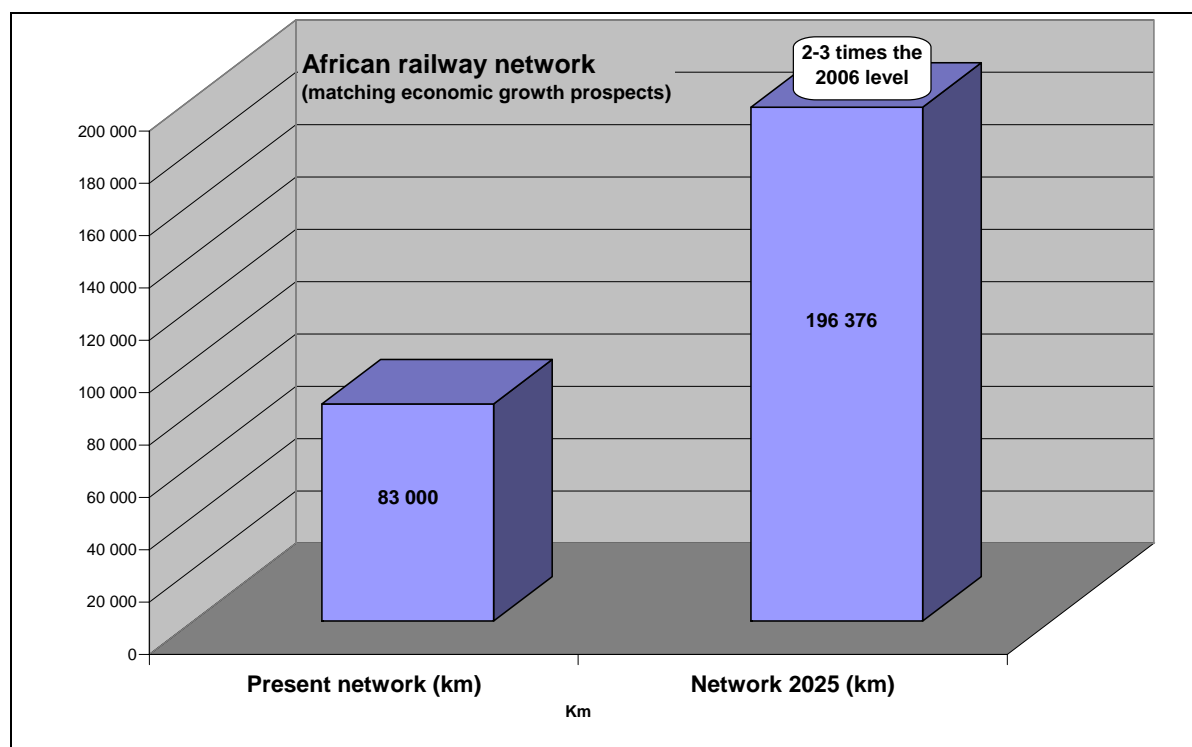


Figure 10-3: Investments matching economic growth

The figure above shows only investments in additional tracks, not the investments required to improve the quality of the existing network.

Furthermore, it is reasonable to believe that the track-density in Africa is lower than required by the potential market. The average track density per 1 million inhabitants in Africa is 98 kilometers, while the average of EU-25 is 486 kilometers.

Bringing the Africa average up to the EU average requires investments of 320.000 kilometers of tracks, which gives a total network 5 times the present level.

It is projected that more than 390 million additional inhabitants, belonging to the railway countries of Africa, may require passenger transports compared with the present situation, and that the real demand for passenger transport services may even be higher, due to increased buying power.

If the African railways should offer the same track-density as the average of EU-25 (immediate investments) and further develop according to the population growth prospects, the blue line in the figure below shows an indication of how the network should expand. The immediate investments are 320.000 kilometers and additional 175.000 in 2025, totaling a network of 580.000 kilometers in 2025.

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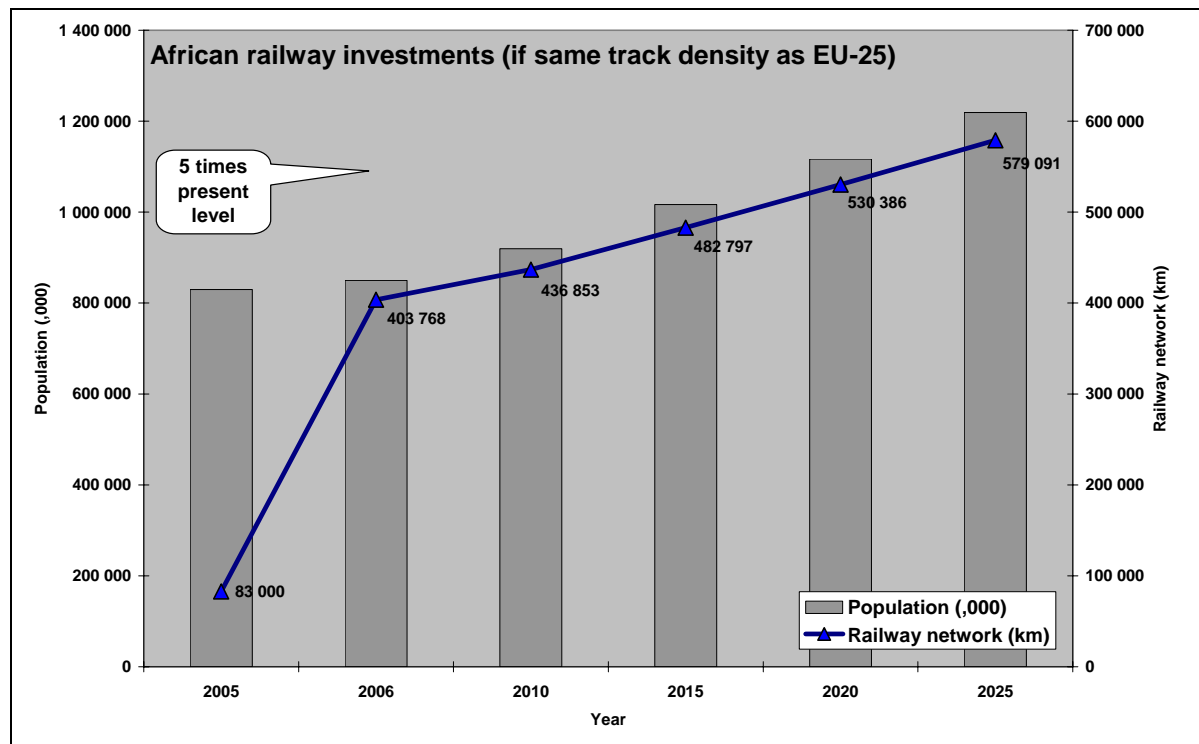


Figure 10-4: Investments matching EU network and population growth

The illustrations above are of course simplifications of the reality, -however still an indication of huge investment requirements. This level of investments depends of course on funding opportunities as well as the ambitions/goals for the African railways and the general investment climate.

### Energy, economy and railways

The energy situation is important for further development, not only because many African countries are large exporters, however also because the energy situation have impact on economic growth in general and transportation costs.

Based on crucial variables like economy and energy it is interesting o look into which potential exists for development of the railways. A few limitations will be made to answer this question, first of all, as already mentioned, the countries which are looked into, do already have railways. As previously mentioned, analysts differs in their views on what drivers to consider when evaluating economic growth as well as the relationship between economic growth and transportation.

For the scenario mentioned above, a few assumptions have to be made. First, that TPES (Total Primary Energy Supply) has a link to transportation as such. Second that the higher the energy production the higher potential for economic growth. TPEC is used as a measure as to what degree energy is available in each country. Development of transportation depends upon available energy. Furthermore a positive growth of TPEC is assumed to have a positive influence on the development of the transportation sector. Electricity generation is also assumed to have some correlation with railroad transportation, -both in terms of future electrification of the railways but also indirectly as an indicator of economic growth. A high GDP, also in terms of GDP PPP per capita GDP and positive development of GDP, will be a potential for increased transportation, including railroads.

Based on these assumptions, the likelihood of development of railroad transportation is illustrated in figure 10-5. Countries depicted with "Very likely" have a GDP above 30 Billion USD and have railroad at present. Countries depicted "Very likely" are; South Africa (272,2), Nigeria (141,3), Algeria (137,2), Egypt (129,1), Angola (66,8), Morocco (61,1), Sudan (45,7) and Tunisia (33,1). (Numbers in ( ) are GDP in Billion USD). All of these countries have oil production, ranging from Morocco with 0,2

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thousand bbl/day to Nigeria with 2329 thousand bbl/day. They also have a positive growth in GDP, ranging from Egypt with a growth of 41% from 1990 to 2007 to Angola with a growth of 550% from 1990 to 2007. All countries apart from Sudan also have a relatively high TPEC per capita, ranging from South Africa with 33741 kWh per capita in 2004 to Nigeria with 2359 kWh per capita in 2004. Sudan had TPEC per capita of 1109 kWh in 2004.

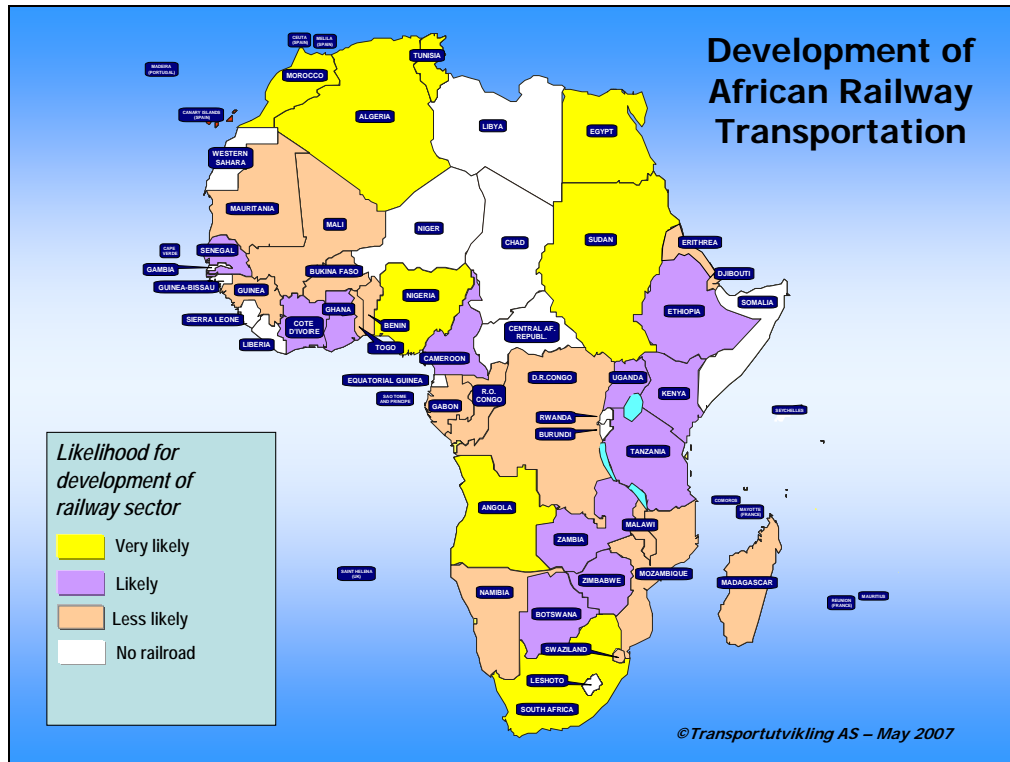


Figure 10-5 Railway development- a scenario based on energy and economy

The countries depicted "Likely" have a GDP ranging from 10,2 Billion USD to 26,4 Billion USD. Countries depicted "Likely" are; Zimbabwe (26,4), Kenya (24,8), Cameroon (20,1), Cote D'Ivoire (18,7), Ethiopia (15,0), Tanzania (14,3), Zambia (13,1), Ghana (12,2), Botswana (11,9) Uganda (10,3) and Senegal (10,2). (Numbers in ( ) are GDP in Billion USD). Of these countries only three have oil production, Cameroon with 66,0 thousand bbl/day, Cote D'Ivoire with 35,0 thousand bbl/day and Ghana with 7,0 thousand bbl/day. GDP growth from 1990 to 2007 is positive for all countries, ranging from Ethiopia with 24% to Zambia with 252%. Botswana is the country with the highest TPEC per capita of the countries depicted "Likely" in the above figure with 9558 kWh and Ethiopia has the lowest with 344 kWh. This also illustrates that there are no clear cut answers towards predicting the likelihood for railroad transportation. Here the main selection criteria for countries are GDP. This is then followed by a subjective evaluation of the different countries. If TPEC per capita were to function as the main selection criteria the conclusions would differ from what is presented here. However, GDP and economic growth is, as mentioned above, by many analysts thought of as having the closest correlation towards transportation development out of the different variables that are presented in this chapter.

The countries depicted "Less likely" have a GDP below 10 billion USD. Gabon has the highest GDP (2004 numbers) of 9,9 billion USD and Djibouti the lowest with 0,823 Billion USD. The other countries are as follows: Congo, Democratic republic of (9,3), Congo, republic of (7,4), Mozambique (7,2), Namibia (6,9), Burkina Faso (6,8), Mali (6,7), Madagascar (5,8), Benin (4,8), Guinea (3,6), Mauritania (3,5), Swaziland (2,7), Togo (2,5), Malawi (2,3) and Eritrea (0,858). Three of these countries have oil production, Gabon with 239,1 thousand bbl/day, Congo, Democratic Republic of, with 21,1 thousand bbl/day and Congo, republic of, with 235,5 thousand bbl/day. This group of countries has a large variation in terms of TPEC per capita. Of these countries Djibouti is highest with a TPEC per capita of 16358 kWh and Mali is the lowest with a TPEC per capita of 295 kWh. Djibouti is a small country with only 0,47 millions inhabitants. Total primary energy consumption in Djibouti is 7,6 TWh.

Even if there is a considerable variation between the different African nations of which many experience a high growth both in terms of GDP and energy use, per capita consumption will still remain much lower than for the rest of the world. (IEA World Energy Outlook 2004).

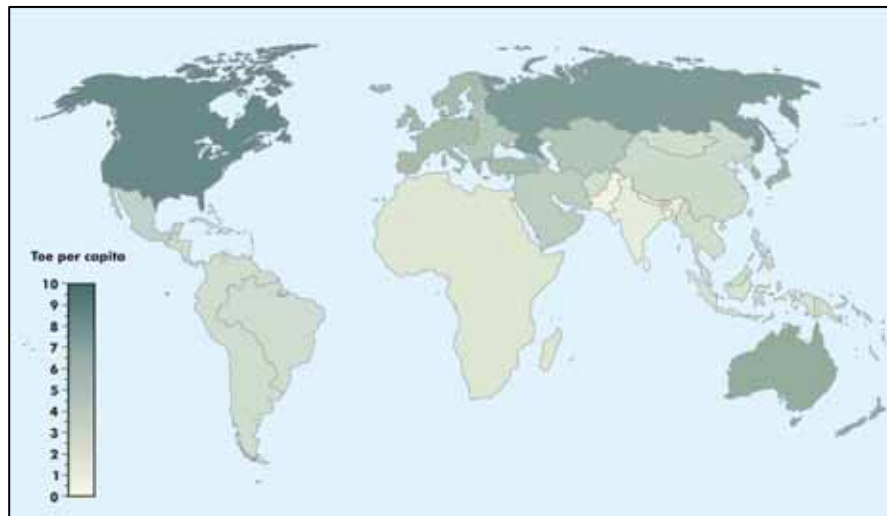


Figure 10-6 illustrates that even if several African countries experience a high growth rate, both GDP and per capita use of primary energy remains far below that of the industrialized countries.

*Figure 10-6: Primary Energy Consumption*  
Source: IEA World Energy Outlook 2004

## 11 Discussion and conclusions

The railway production in Africa over the last years has shown volatile output for several countries. For many countries the market share has declined, their assets have steadily deteriorated, their quality of service has reduced, and they are in many instances only a minor contributor to solving the transport challenges in Africa. Like in Asia, many of the publicly-owned railways are in deep financial trouble, deficit-ridden, under-funded and plagued by low productivity. These important transport links are struggling to meet growing demand, keep up with technological change, facing competition from other modes and competing for finance with other important public priorities.

Africa have several competitive challenges like political and economical instability, growing population, trade barriers, poverty, natural disasters, lack of infrastructure investments and integration, trade imbalance, monopolies and lack of management procedures.

However, this is not a homogenous picture. The countries of Africa are heterogeneous. Africa has populated countries and less populated, they have rich and poor countries, open and closed economies, growing and declining indicators, improving democracies and countries where human rights are violated every day. Each emerging market has different conditions that need to be accommodated. Despite many common challenges, it is not proper to consider Africa as a homogenous region.

Railways are important comprehensive transport networks that are urgently needed to bring more people and more countries into the process of globalization and growth. There are 15 landlocked countries in Africa and some "coastal" countries have large inland regions, which are at a very long distance from any ocean port. Africa's land area is 7 times that of the European Union and distances are on a scale at which operational railways could find full economic justification, -both domestically and internationally. Traffic demand continues to grow and rail is recognized as safe and environmentally-friendly.

The drivers discussed in this report are mostly external factors where the railways themselves have less influence on than their own internal procedures, market orientation and commercialization.

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As we have seen from empiric data's in Africa, it is not a static causal connection between economic growth/population growth and railway transport. In Africa several external challenges and lack of stable business/development climate has caused less clear connections between railway transports and economic/population growth. The level and share of railway transports do also depend on the railways' capabilities to capture growth opportunities. There is a huge variation among countries in Africa and several variables have impact on the outcome.

However, there are common trends which will have impact on railway transports. Even though methods and conclusions may be discussed, it seems to be possible to conclude that:

### Trade and economy

- Globalization is largely irreversible. The development in Africa is also influenced by the development in other regions of the world. For most nations, globalization and trade liberalization are on the agenda, - and as a consequence international transport is growing. The economies of the world will be substantially larger in 2025 and a strong western economy will usually benefit the export-oriented African countries, while a weak economy may have the opposite impact. Western economies, like Europe, may in 2025 still be the main trade partner of Africa and influence the African trade and transportation in the future. However, stronger influence from Asia is projected.
- Africa is a region in the global logistical chain. Africa can improve their international logistical relations and generate significant spin-offs for the continents internal development.
- Internationally, the huge potential for railway transports among African countries as well the railways as inland connector for intermodal trade between for instance Africa and Europe. These trade routes are not only hampered by various administrative challenges, but also logistical, management and infrastructure challenges like track standards, missing links, terminal structures and lack of well-functioning intermodal systems.
- The African economy (GDP) is generally projected to increase and there may be a stronger correlation between freight transport by rail and GDP together with improved business climate and infrastructure investments. Several countries in Africa have positive prospects and some are believed improve significantly 2025. For some of these countries, improvements are strongly connected to the market price of energy. For the railways, as an important element of national and international economies, it is important to support the economic growth agenda and general industry expansions.
- The African trades, as well as many railway links are imbalanced. Imbalance is not only a challenge; - it is an obstacle when developing internationally competitive transport solutions. Balance can be improved by market- and corridor development, however depending on a viable supply side accepted by the market.
- The intra-Africa trade has historically been low, however slightly growing. Depending on e.g. infrastructure investments and operational development, Africa's intraregional trade may grow and "internal" transportation needs will most probably be substantially larger in 2025 than 2007. This intra-regional growth may contribute to a certain diversification, which makes many African countries less vulnerable with respect to external (western) economies and perhaps a more stable climate for the development of the continents railway system. However, the influence from western economies will still be strong. Economic integration in Africa will benefit the regions railway transportation due to for instance more homogenous border crossing procedures and more committed cooperation.
- Future (to be completed when some additional data's are obtained)

### Energy

- The cost of energy has strong influence, directly and indirectly, on railways transportation, -even though the railway is an environmentally friendly mode of transport. Unstable supply and strong growth in demand for crude oil will influence many of the energy-intensive economies of Africa. A lasting high oil-price will influence the GDP projections, and contribute to less growth in GDP for many oil-intensive economies. Relatively large oil producing countries in Africa may experience a different development. These are countries like Nigeria, Algeria, Angola, Egypt and Libya (railways under development). However, oil consumed by the transportation business is expected to grow steadily until 2030.

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- The global energy situation has major impact on Africa. Transportation energy demand is projected to increase. This is usually a spin-off from the projected GDP increase (or vice versa); however a strong signal that analysts believe that transports will experience strong global growth. Freight transportation by rail is no exception. Africa is generally more complicated to project, even though the global environment is positive.
- Future restrictions on the use of coal, due to environmental concern, may have a negative impact on some African railway legs.

### Population

- Population and GDP are expected to grow in African countries and a dramatic change is expected by 2025, if the projections come into truth. Among the 35 railways countries of Africa, there may be 390 million more people who require transportation in 2025 and more than 900 millions by 2050. Most of the growth will be consumed in urban areas and large cities which are growing in multiple correlations with the increasing population, urbanization and trade. The potential demand for passenger transport by rail will be considerable higher in general and the transportation needs in certain mega cities will face even more serious challenges.
- Countries which are facing capacity challenges today will face even more capacity challenges in the future, especially when poverty decreases (ability to buy transports increases) and the political and administrative environment improves. Urbanization increases even stronger than the population growth and several cities in Africa faces, and will face, serious challenges coping with this centralized demand for transportation services. The surface railways/light railways may for many cities be a most relevant option.

### Investments

- The African track density is low (per capita and per square-km of land area), compared with most regions of the world. Investments are required. The African railways have suffered by a historical underinvestment in track and asset replacement as well as renewal and maintenance. For many countries the required investments are far beyond their financial capabilities and the business climate is not satisfactory when attracting private capital. For other countries it is a challenge to manage the fragile balance between continuous capital investment and marginal returns. For many countries PPP (Private Public Partnerships) and liberalized funding opportunities will have an impact on investments and trade flows. Strong international focus on Africa may contribute to additional funding opportunities.
- Investments are required for existing infrastructure and operational systems, as well as for new infrastructure improving regional interconnectivity.

### Environment

- Environmental concerns are on the global agenda. Several environmental challenges can generally be reduced by a stronger focus on the railways. Rapid urbanization may seriously strain the existing transport systems and contributing to air pollution and global greenhouse gas emissions. Railway systems are known to be among the most cost-effective, energy- and space-efficient, and environmentally-friendly forms of urban transport. Building such systems is perhaps the best way Africa's large cities can serve their burgeoning populations in a sustainable, equitable manner.
- Environmental conditions will influence future transports and shift among modes. The railways' own strategy, as well as political priorities, may have positive impact on the future development.

### Security and transparency

- The market player's perception of security and transparency is fundamental for the development of many services in Africa. Best practice, and even better than that, security standards are a fundamental issue when the future potential until 2025 is to be materialized. Strong focus on security and transparency may improve the future outcome.

### Intermodality, logistical chains and interoperability

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- There has to be developed effective port/rail corridors which are attractive for the freight flows. They should not be fragmented and the customer's perception should be a seamless chain.
- The size of Africa may be one of the factors justifying transit corridors as well as the potential synergy between transit corridors and the development of regional corridors.
- Modal cooperation and development of effective intermodal chains are required. A logistical chain is not stronger than its weakest point.
- Gauge is a challenge, not a definite obstacle for effective chains. Different gauges exist several places around the world. There should be a stronger focus on interoperability and not necessarily a common gauge for Africa.

### Supply side and final outcome

- The railways supply side and operational efficiency's influenced by various drivers and these drivers may have different influence on railway transport, depending on changes in the circumstances listed above. The railways' competitiveness is the total of several variables, including political frameworks, information systems, human capital/skills, logistical systems, market orientation, security and infrastructure investments/material and liberalization. The African railways (countries and regions) are not homogenous. The countries/regions have to focus on the challenges which are most important in each region when developing their internal systems. Furthermore looking into national discontinuity when developing international logistical supply chains. Such chains can only be developed by national improvements together with international cooperation.
- The final outcome of future projections will be strongly influenced by how the railways are able to improve their competitive advantages, compared with other modes of transport. Development of products generally accepted by the market players is of fundamental importance. Growth perspectives may furthermore not be capitalized by the railways if the capacity<sup>16</sup> limits the growth, or the supply side (the railway product) is not considered competitive compared with other modes. Furthermore, competitors in the market will continue to develop their products, which indicate that the railway has to improve their performance continuously. "It is a challenge to improve the railways market share in an aggressive & competitive environment" (Spoornet/Gama, Delhi, March 2007).
- Cooperation among African railways is required. Success depends on collective contribution of all African railways and integrated and coordinated development.
- A positive development is possible, and there are successful improvements in many countries.

## 12 Progress (not completed)

Even though future is insecure, it is believed that the demand for railway transport will grow and to some extent, and for some countries, the growth can be considerable, - both for passenger- and freight transport.

Only a few of the railway nations of Africa, where growth prospects are strongest, are active members of UIC. Capitalizing the growth prospects in these UIC countries are not only depending on well-functioning port connections, but also well-functioning inland connections and corridors. Many of these inland countries, which will influence the productivity of UIC member countries, are not presently active members of the organization. Through the new UIC, these countries should be encouraged to join the organization and a strategic action plans should be developed. The most relevant non-members, based on e.g. their position in future international/intermodal chains, should be identified. Smaller countries may be important transit-partners.

Through UIC, the railway countries of Africa should step-by-step develop their regional cooperation; define common strategic actions as well as defining single development tasks.

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<sup>16</sup> Capacity is the outcome of several variables, not only investments.



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The recommendation for UIC's next step next is to develop a strategic plan/action plan for the African railways based on principle discussions in UIC and among the respective members. The work should emphasize the process where members are involved. During the process, where some tasks may take several years, at least the following goals may be obtained for the African Railways:

- An acceptance of a common visions and goals
- Identifying some main common development areas
- Specific strategies related to the huge investments required by the African railways as well as plans for closer cooperation and integration.
- A strategic description of the African railways supply side (various products and corridors), - based on commercial criteria's, and where the railways is believed to have their strongest competitive advantages.
- Development of a member ship strategy and organizational matters
- A plan for implementation and how to secure continuity

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## 13 Enclosures

### I. Countries defined as Africa

#### Railway countries (35)

|    |                                       |
|----|---------------------------------------|
| 1  | <b>ALGERIA</b>                        |
| 2  | ANGOLA                                |
| 3  | BENIN                                 |
| 4  | BOTSWANA                              |
| 5  | BURKINA FASO                          |
| 6  | CAMEROON                              |
| 7  | REPUBLIC OF THE CONGO (*)             |
| 8  | COTE D'IVOIRE                         |
| 9  | DEMOCRATIC REPUBLIC OF THE CONGO (**) |
| 10 | DJIBOUTI                              |
| 11 | EGYPT                                 |
| 12 | ERITREA                               |
| 13 | ETHIOPIA                              |
| 14 | GABON                                 |
| 15 | GHANA                                 |
| 16 | GUINEA                                |
| 17 | KENYA                                 |
| 18 | MADAGASCAR                            |
| 19 | MALAWI                                |
| 20 | MALI                                  |
| 21 | MAURITANIA                            |
| 22 | <b>MOROCCO</b>                        |
| 23 | MOZAMBIQUE                            |
| 24 | NAMIBIA                               |
| 25 | NIGERIA                               |
| 26 | SENEGAL                               |
| 27 | <b>SOUTH AFRICA</b>                   |
| 28 | SUDAN                                 |
| 29 | SWAZILAND                             |
| 30 | TANZANIA                              |
| 31 | TOGO                                  |
| 32 | <b>TUNISIA</b>                        |
| 33 | UGANDA                                |
| 34 | ZAMBIA                                |
| 35 | ZIMBABWE                              |

#### Countries- no-railways (19)

|    |                          |
|----|--------------------------|
| 36 | BURUNDI                  |
| 37 | CAPE VERDE               |
| 38 | CENTRAL AFRICAN REPUBLIC |
| 39 | CHAD                     |
| 40 | COMOROS                  |
| 41 | EQUATORIAL GUINEA        |
| 42 | GAMBIA                   |
| 43 | GUINEA-BISSAU            |
| 44 | LESOTHO                  |
| 45 | LIBERIA                  |
| 46 | <b>LIBYA</b>             |
| 47 | MAURITIUS                |
| 48 | NIGER                    |
| 49 | RWANDA                   |
| 50 | SAO TOME AND PRINCIPE    |
| 51 | SEYCHELLES               |
| 52 | SIERRA LEONE             |
| 53 | SOMALIA                  |

#### Others - no railways (7)

|    |                            |
|----|----------------------------|
| 54 | Western Sahara             |
| 55 | Canary Island (Spain)      |
| 56 | Ceuta (Spain)              |
| 57 | Madeira Islands (Portugal) |
| 58 | Mayotte (France)           |
| 59 | Melilla (Spain)            |
| 60 | Reunion (France)           |
| 61 | Saint Helena (UK)          |

Note:

**Active UIC members, July 2007 (green/bold)**

(\*) In the vision document called R.O. Congo

(\*\*) In the vision document called D.R. Congo