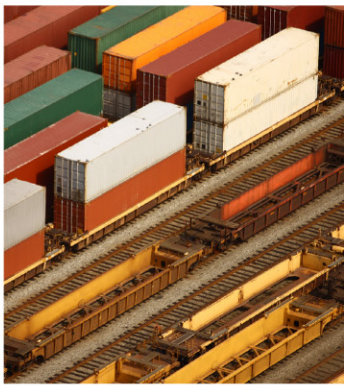

Trade and Investment Opportunities In Africa

THE RAIL FREIGHT SECTOR

May 2018

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Trade and Investment Opportunities in Africa

The Rail Freight Sector

May 2018

By: Tsidiso Disenyana, Sibusiso Ngobese, Sindiso Mpofu, Guy Russell, Nxalati Baloyi, Tebatso Mahlaku

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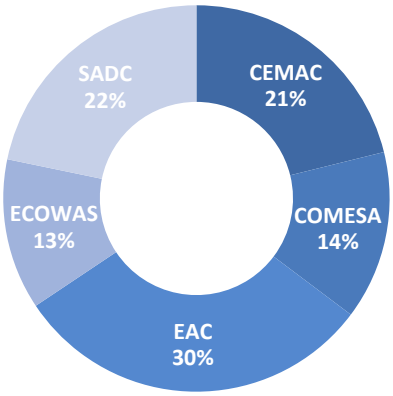
CONTENTS

ACRONYMS

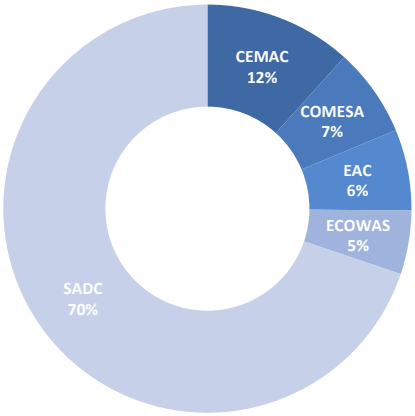
AfDB	African Development Bank
ARTIN	African Regional Transport Infrastructure Network
AUC	African Union Commission
BOT	Build, Operate and Transfer
ECIC SA	Export Credit Agency Corporation of South Africa
EPC	Engineering, Procurement and Construction
GDP	Gross Domestic Product
HS	Harmonized System Codes
ICA	Infrastructure Consortium for Africa
NEPAD	New Partnership for Africa's Development
O & M	Operation and Maintenance
PAP	Priority Action Plan
PIDA	Program for Infrastructure Development in Africa
PPP	Public Private Partnership
REC	Regional Economic Communities
RSA	Republic of South Africa
SPV	Special Purpose Vehicle
SSA	Sub-Saharan Africa

AFRICAN RAILWAY IN NUMBERS

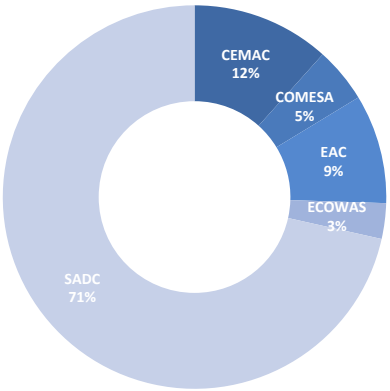
Length of Haul Freight - average (km)



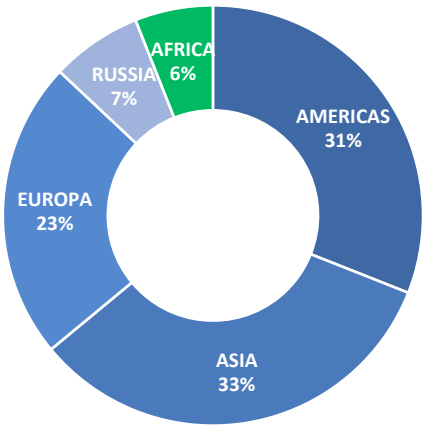
Freight (Number of tons, annually)



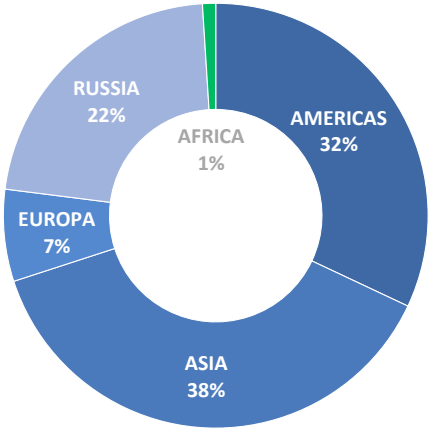
Traffic Unit - Net tonne - km (million)



Distribution of World Railway Network per Region in 2011



Tonne - Km per Region in 2011



Source: World Bank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1

INTRODUCTION

1. INTRODUCTION

Africa has achieved stable economic development since 2000, and annual economic growth rates since 2004 have averaged more than 6%. Resource wealth has been the springboard for the continent's current momentum, catalysed by government spending (based on resource income), structural reforms, the winding down of many conflicts and civil wars, and economic diversification across many sectors—wholesale, retail, transportation, telecommunications and manufacturing. Accordingly, the total of volume of trade has increased over the African continent.

However, trade with the rest of the world is more dominant than intra-regional trade. According to UNCTAD figures, the share of intra-African trade in Africa's total trade over the past decade was only about 13%. The continent is plagued by poor and under-developed transportation infrastructure, limiting accessibility to consumers, hampering intra-regional trade and driving up import and export costs. Unavailability of adequate capacities and technology, and much slower than anticipated private sector participation, has hindered infrastructure development.

With a few exceptions (mainly in South Africa and Northern Africa), African railways lag behind those of most other regions in the world. Rail transport has faced the same constraints and challenges as elsewhere. But, poor economic, technological and institutional conditions have further aggravated the situation. The cost of rail corridors to shippers and operators in the continent is estimated at US$400 million, as a result of shipment by roads.

Given these challenges, investment into Africa's rail transport sector has the potential to transform the continent's economic development. Rail transport and logistics infrastructure has a direct impact on a country's handling capacity for imports and exports, distribution route development, the frequency of shipments and the costs of freight handling, storage, distribution and related services. Current estimates indicate that trade volumes in Africa will more reach 384.0 million tons in 2030, if the trade corridors are completed. In addition, the development of rail corridors will have a substantial impact on intra-regional trade, with trade between African countries expected to more than triple and reach 120.4 million tons in 2030[1].

Closing Africa's rail transport infrastructure deficit will require considerable public and private sector investment, together with the development of "soft infrastructure" - the financial, regulatory and governance systems, frameworks, personnel and institutions to manage the transport systems to their full capacity.

1 African Union (undated). Africa Transport Sector – Outlook 2040. African Union. Addis Ababa.

2

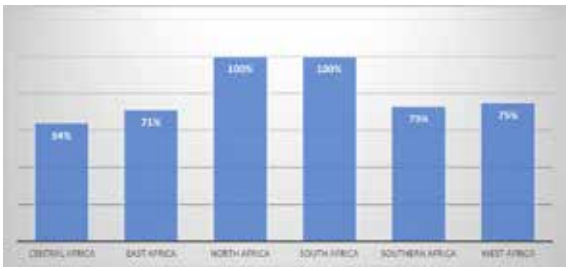
THE STATUS QUO

2. THE STATUS QUO

Africa has a total railway network of 82,000 km, with varying gauges across the regions. Southern and Northern Africa accounts for most of the network. With a few exceptions, almost all the countries' lines are single track and not electrified.

Figure 1 shows that the railway network is not fully operational across the regions, with the exception of North Africa and South Africa.

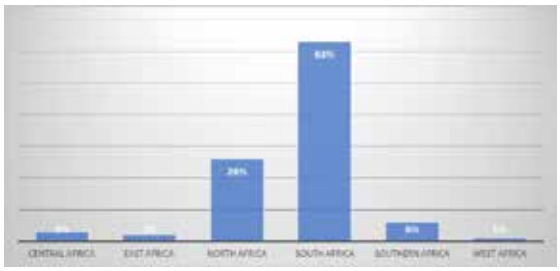
Figure 1: Operational railway lines in Africa



Source: AfDB (2015). Rail Infrastructure in Africa – Financing Policy Options. AfDB. Abidjan

South Africa accounts for almost two thirds of Africa's total rail freight (Figure 2). The regional rail freight transport sector is characterised by long hauls, relatively low volumes and relatively high railway tariffs. It is also generally characterised by inflexibility, unreliability, and inefficiency (in relation to schedules and poor inter-modality), resulting in delays and increased transport costs[2].

Figure 2: Total railway freight in Africa



Source: AfDB (2015). Rail Infrastructure in Africa – Financing Policy Options. AfDB. Abidjan

There is almost no railway interconnectivity between the various regions, which if addressed is one way of making the rail more effective (see Annexure 1 for a graphical representation). Axle loads are generally 15 tonnes to 18 tonnes in the region and up to 26 tonnes in South Africa. To make rail more competitive with road, axle weights should not be less than 20 tonnes. This would allow a railway wagon to carry almost twice as much as a large combination road rig.

Furthermore, the railway network is characterized by incompatibility of gauges and the isolated parallel corridors to the sea. For example, there are 3 different rail gauges in Africa, namely, narrow gauge, standard gauge and Cape gauge, which rarely cross from one country to another. Even along the more frequented sea corridors, most African railways struggle to reach economic viability because of very low traffic volumes. With traffic volume on intraregional rail routes much lower than even that on corridors to the sea, feasible further intraregional integration of rail networks in the near future can be difficult to imagine[3].

2 Disenyana T, Khumalo N, Transport Services in SACU: Accelerating Harmonisation and Liberalisation, Research Report No.1, South African Institute of International Affairs, Johannesburg, 2009.

3 Foster V, Briceno-Garmendia C (2010). Africa's Infrastructure – A Time for Transformation. World Bank. Washington D.C.

3

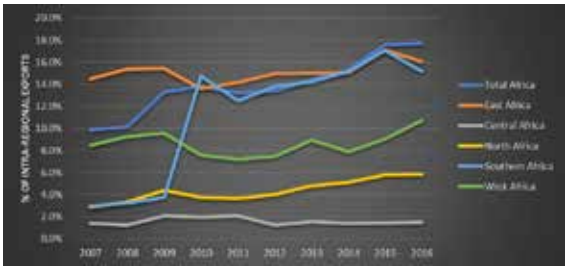
KEY DRIVERS OF CHANGE

3. KEY DRIVERS OF CHANGE

3.1 REGIONAL TRADE INTEGRATION

The impressive number of economic integration efforts in Africa is not commensurate with the level of trade in the region today. Trade within Africa remains the lowest of all regions of the world. As per data from UNCTAD and figure 3 below, intra-regional trade has averaged about 13% over the past 10 years. Low levels of infrastructure connectivity have aggravated matters, since it makes transport over national borders and hinterlands costly and inefficient compared to shipping to the rest of the world.

Figure 3: Africa intra-regional trade (2007-2016)



Source: UNCTAD and own calculations

Given the status quo, African governments have realized that trade liberalization initiatives on their own cannot have the desired effects in terms of promoting intra-regional trade. To this end, Regional Economic Communities (RECs) have concluded that trade liberalisation should be underpinned by robust infrastructure programmes designed to consolidate the regional market through interconnectivity (facilitated for instance by all modes of transport) and to promote competitiveness.

Accordingly, the RECs have adopted development of corridors as a strategy for facilitating trade in the sub-regions as well as the movement of people. By combining the development potential of the region with corridor infrastructure improvement, it is anticipated that the regional corridor development initiatives can enable the revitalization of the entire region and create a virtuous spiral of investment promotion and market expansion.

Rail infrastructure investment has thus been concentrated on those corridors including Northern, Central, Nacala and several Trans-African Highways by the stakeholders such as African Union Commission (AUC), New Economic Partnership for Africa Development (NEPAD), RECs, member states, development partners and the private sector.

Table 1 provides salient features of some of the transport development corridors.

Some of the most recent rail infrastructure corridor developments include:

Ethiopia-Djibouti Railway - This is Africa's second electric railway, which stretches more than 750km. It was constructed to improve transport links between the Ethiopia and Djibouti's Doraleh Multipurpose Port. The railway can transport up to 3,500 tonnes of cargo, and the journey time has been reduced from approximately three days by road to just 12 hours. More than 90% of Ethiopia's trade passes through Djibouti, which accounts for approximately 70% of the port's activity. There are plans to expand this network to connect to Burundi, Djibouti, Kenya Rwanda, South Sudan, Sudan and Uganda.

3.2 GROWTH IN INTERNATIONAL TRADE

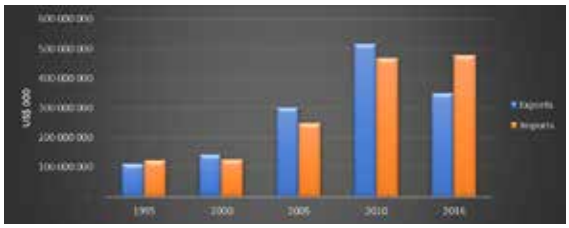
Figure 4 shows that there Africa's trade with the rest of the world has been on the rise over the past 20 years, averaging 9.8%. The majority (87%) of trade is with the rest of the world. The AUC projects a seven-fold increase in the volume of trade with RoW over the next 30 years as countries increase the value added of their exports through processing, consumers with rising incomes importing more-expensive goods, and manufacturing and mining businesses importing more expensive processing equipment.

Table 1: Select infrastructure development corridors in Africa

	Nacala Corridor	Norther Corridor	West Africa Growth Ring
Countries	Mozambique	Kenya and Uganda	Burkina Faso, Ghana, Ivory Coast, Togo, and the West African Economic and Monetary Union (UEMOA)
Development Opportunities and Challenges	Lack of transport infrastructure while rich natural resources (coal and natural gas) and arable land suitable for agriculture remain undeveloped.	Poor logistics networks and high transport costs due to three major bottlenecks: excessive imports, concentration of functions in primary cities and limited value added activity.	Poor infrastructure causing high transport costs, heavy dependence on imported goods in a huge regional market and disparities between urban-rural and coastal-landlocked areas.
Characteristics	• Diversified economic sector developments based on a region-wide corridor network utilising bountiful resources. • Improvements to railways, ports and arterial roads projects using both private and public investment. • Other economic infrastructure and social sector development projects are combined to realise inclusive development.	• Designed by taking into account identified industrial potentials and importance of inclusiveness. • Connecting industrial areas with logistics hubs through cargo-oriented development. • Modal shift from truck to railways and pipelines. • Expected outcomes: decreased transport costs (20-40% road and 30-60% rail) and increased exports such as tea, coffee, textiles and garments.	• Designed by taking into account identified industrial potentials and importance of inclusive regional development • Promotion of intra-regional trade activities through a circular corridor over the four countries while taking into account the expected connection to Nigeria (ALH). • Strenghten of trade facilitation including OSBPs. • Creation of regional value. • Modal shift from truck to railways.
Priority Projects	• Nacala Industrial Park • Nacala Industrial Belt Area Development • Nacala Multi-Modal Terminal • Railway Shunting Yard	• Mombasa Port Development • Mombasa Special Economic Zone • Logistics Highway • Rift Valley Geothermal	• Abidjan-Lagos Highway • Corridor development (Abidjan-Ouagadougou, Accra-Ougaadougou, and Lome-Ouagadougou • Railway-related Projects

Source: ICA (2017). Infrastructure Financing Trends in Africa – 2016. ICA. Abidjan

Figure 4: Africa's trade with the rest of the world (1995 – 2016)



Source: UNCTAD and own calculations

The table below shows the trade forecasts across various regions in the continent. Based on this trade forecasts, the AUC projects that six of 11 cross-border railway lines will need physical expansion by 2020 even if their operations and equipment are greatly improved to reach good efficiency before then. All 11 cross-border railways will need to be expanded by 2040 to meet demand with efficient mode shares for rail services[4].

Table 2: Trade forecasts by region (millions of metric tons)

Region	2009	2020		2030		2040	
		Volume	Avg. Growth (%)	Volume	Avg. Growth (%)	Volume	Avg. Growth (%)
North Africa	20	235	6.3	410	6.3	760	6.4
West Africa	7	176	6.7	300	6.0	556	6.3
Central Africa	21	43	6.8	77	6.4	145	6.5
East Africa	45	96	7.1	181	7.1	360	7.1
Southern Africa	240	408	4.9	617	4.7	1,001	5.0
Total Africa Base	513	958	5.8	1,585	5.7	2,823	5.9
With suppressed demand	513	1,056	6.3	1,822	6.1	3,397	6.4
With new minerals	513	1,175	7.8	1,998	5.5	3,630	6.2

Source: AUC (undated). Africa Transport Outlook 2040

Over the period 2012–20 all African Regional Transport Infrastructure Network (ARTIN) road corridors will need modernisation to improve their efficiency and capacity through facilitation measures (including One Stop Border Ports and "smart corridors") and road improvements (including standards modification, roundabout at intersections, bypasses of urban areas and passing and climbing lanes). Large port expansions will have to be implemented[5].

There is scope for building new, modern rail lines in nine of the 11 corridors, where demand by 2040 is expected to exceed 10 million tons. These forecasts assume that the railways will be run as efficiently as Transnet railways in South Africa.

Regional rail master planning needs to be linked to new and expanded port development - a major departure from existing approach to rail planning. Regional traffic along various corridors to and from landlocked countries are forecast to reach volumes that could justify the building of new, modern railway lines to link these landlocked countries to the sea, assuming that the development of the additional port capacities is concentrated in a few efficient locations.

4 AU (undated). op.cit.

5 Ibid

3.3 EVOLVING ROAD-TO-RAIL POLICY SHIFT

The railway sub-sector has lost traffic to road over the years and has thus become relatively less important in the region. The main reason for the loss of traffic is that the regional railways have failed to provide a seamless, efficient, cost-competitive and predictable service responsive to market needs. Moreover, existing transport policies favour road over rail in so far as the user-cost recovery principle is not applied to roads while railways, by contrast, are responsible for providing and maintaining their own infrastructure. Almost all the regional railway systems, including in Zimbabwe, Zambia, Malawi, Mozambique, Tanzania, Kenya and Uganda railway services have been privatized. Privatisation was done through concession agreements that focus on improving management rather than infrastructure (see Annexure 2).

A feature of the road freight market is the extent to which road freight operators are able to offer competitive rates on the main corridors for the haulage of bulk commodities such as steel, fertiliser, cement, maize, timber, containers, and fuel. The rates are comparable to railway tariffs. However, road freight provides increased flexibility and negotiable back-haul cargoes. While road freight delivery has significant advantages, there is a notion that the great number of freight vehicles on the road contributes to overloading and the subsequent significant deterioration of the road network and traffic congestion.

This has resulted in the development and formulation of road-to-rail strategy in some countries, with a stated official intention to reverse the trend towards increasing volumes of road freight transport, and to reduce the number of heavy trucks on the roads to decrease overloading on the road network. According to policymakers, this shift will lead to a reduction in overall transport and logistics costs and externality costs (e.g. road damage, road accidents, road congestion, noise pollution and carbon emissions).

Furthermore, the motivation for the need to transfer freight from road to rail is usually quoted as the fact that funds to maintain roads at current utilisation levels, are not available (unless fuel taxes are to be diverted from other social objectives). The current fee structures of toll roads result in subsidisation by private motorists, of the industries that are the commercial users of freight transport, not the road carriers, as they pass on all such costs to the clients.

Nonetheless, in evaluating the potential for achieving the objective of shifting a significant tonnage from road to rail it is necessary to question the underlying business case for this shift. What is being moved? Who says the railways concerned will attract freight off the roads? Are governments willing to legislate that certain goods must go by rail? What effect will this have on supply chains? And who are the operating companies of the railways concerned?

Evidence has shown that in most situations only the highest volume railway businesses, with the very best commercial and institutional structures in place, stand any chance of being viable. Such railways do exist: the trans-continental rail businesses in North America are often viable. But their volumes are high and their business models highly commercialised. Most railways in Africa, in contrast, do not have business cases to support the huge investments that are taking place.

4

STRATEGIC INITIATIVES AND PROGRAMMES

4. STRATEGIC INITIATIVE AND PROGRAMMES

4.1 PROGRAMME FOR INFRASTRUCTURE IN AFRICA

In 2012, the AU adopted the Program for Infrastructure Development in Africa (PIDA) and its Priority Action Plan (PAP) for 2020, which have prioritized continental programs to help address the infrastructure deficit that severely hampers Africa's competitiveness in the global market. PIDA-PAP includes 21 priority transport programs broken down into 273 subprojects.

PIDA studies show that growth in Africa's population, economic output, and trade flows will combine through 2040 to raise demand at the regional and continental levels for freight transport, port facilities, and air passenger transport. The growth in demand is likely to outstrip development of the present ARTIN, opening up gaps between demand and supply that will retard future growth if allowed to persist.

The PIDA railway transport infrastructure links Africa's major production and consumption centres, provides connectivity among the major cities, and opens the landlocked countries to interregional and intercontinental trade. Accordingly, PIDA envisages about 30,200 km of rail infrastructure to be built by 2040[6]. Main areas suitable for railway developments in Africa according to PIDA (as depicted in Annexure 2) include (i) corridors from ports to inland markets, (ii) major mining basins, (iii) densely populated areas, and (iv) major metropolitan areas.

4.2 INFRASTRUCTURE CONSORTIUM FOR AFRICA

The Infrastructure Consortium for Africa (ICA) was launched at the G8 Gleneagles Summit in 2005. The ICA is not a funding agency, however, it role is to facilitate and crowd-in private investment and development funding to finance infrastructure projects in Africa.

Railway infrastructure attracted about 4.1% (US$254 million) of ICA member investments in 2016.

The organisation's members include the G8 countries (Canada, France, Germany, Italy, Japan, Russia, the UK and the US), the G20 countries (including South Africa) and multilateral development finance institutions such as World Bank Group, the African Development Bank Group, the European Commission, the European Investment Bank and the Development Bank of Southern Africa. The RECs, AUC and NEPAD also participate as observers in ICA meetings.

To this end, ICA members champion four regional programmes, namely the Horn of Africa Initiative, Eastern and Central Transport Corridors, North-South Corridor and West Africa Power Pool.

6 AfDB, AUC, NEPAD (2011). Study on Programme for Infrastructure Development in Africa: Phase III. AfDB, AUC, NEPAD. Abidjan and Addis Ababa

5

AFRICAN RAILWAY BUSINESS MODELS AND ENTRY STRATEGIES

5. AFRICAN RAILWAY BUSINESS MODELS AND ENTRY STRATEGIES

5.1 BACKGROUND

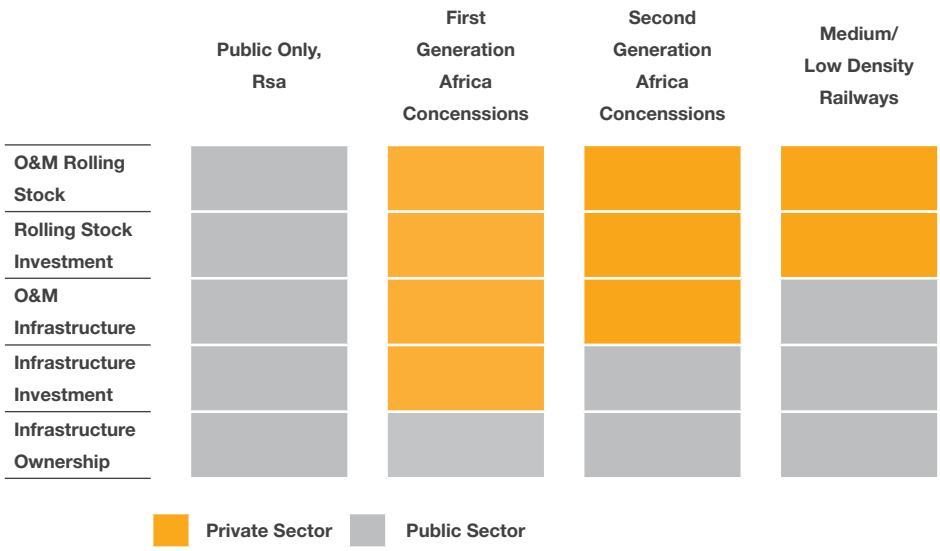
The rail industry is comprised of a set of entities participating in railways, alongside a wide range of economic activities that are tied to the overall rail sector and provided by a variety of players (see figure 5 below). The government is charged with the formulating and implementing policies and strategies for the industry. Rail Regulatory and Safety bodies that are responsible for promoting and/or enforcing competition and health and safety on the railway. Rail operators, run the freight or passenger rail services. Rail supply industry which encompassed manufacturers of all products for the railway operation – i.e. manufacturers of vehicles, control and safety technologies.

Figure 5: Structure of the rail sector

5.2 PUBLIC AND PRIVATE PARTICIPATION

Since the 1970's, most African countries, rail operations and infrastructure were entirely owned and managed by state-owned entities. However, poor management coupled with inadequate investment in the rail sector led to the deterioration of infrastructure and equipment in the continent. This, hindered the ability of railways to compete against other dynamic modes of freight transport. In expectations of revitalizing rail infrastructure and services, governments on the African continent have since entered into various public private partnerships (PPPs) schemes. (see Annexure 3). Figure 6 below, illustrates the railway business models which have been used across the continent.

Figure 6: Railway business models in Africa



Source: AFDB (2015) Rail Infrastructure in Africa - Financing Policy Options

Under the initial PPP arrangements, the state retained ownership of underlying infrastructure and transferred full responsibility to the concessionaire for operation and management of rolling stock, rolling stock investment, operation and management of infrastructure and infrastructure investment as such was the case in Cameroon, Madagascar, Senegal and Kenya. However, the initial concession scheme proved to be too cumbersome for the private sector, as it allocated excessive financial burdens and risk (See case study on the Rift Valley Raillway Concession). The evolved concessioning agreement entails the public sector assuming ownership of infrastructure and regaining responsibility for infrastructure investment, leaving the concessionaire with the responsibility operations and maintenance of infrastructure and rolling stock.

Moving forward, the resurgence of the rail sector worldwide has warranted the need for restructured arrangements between African governments and the private sector. To function optimally, the modern business models must be cognizant of the unique dynamics (competition, politics, densities.) at play in the African market and tailor their models accordingly. Given the African railway network is characterized by low to medium density and operates as part of a network of intermodal freight transportation it is recommended that investment and operations concerning infrastructure rest with the government to solely focus in the building more efficient networks, and the investment, operations and management of rolling stock responsibilities lie with private rail operators. Furthermore, it is suggested that, although publicly-owned, the infrastructure should be managed in a commercial way by an efficient Infrastructure Managing Agencies[7]. Nevertheless, lessons can be learnt from the few successful publicly-owned railways in Africa such as Morocco and South Africa.

7 AfDB (2015). Rail Infrastructure in Africa – Financing Policy Options. AfDB. Abidjan

Case Study:

Rift Valley Railway Concession

The governments of the republic of Kenya and the republic of Uganda agreed in 2005 to concession their respective railways. Rift Valley Railways (RVR) signed the Concession Agreements in 2006. The concessionaire is to rehabilitate, operate and maintain the rail networks as one railway system to improve the management, operation and financial performance of the two rail networks in a coordinated manner. Under this arrangement, the government invests in infrastructure and the private entity covers operational, commercial and governance risks (First generation concession).

Poor management and weak governance structure, lack of technical expertise, and lack of funds for capital injection from the lead investor, led to the near collapse of the concession. According to a report published by the World Bank in 2012 showcases that:

1. Freight volumes had still not increased and remained below the concession baseline with a seven percent shortfall in Kenya and 10 percent in Uganda.
2. Investments in infrastructure in Kenya had been only approximately US$0.85 million against a minimum target of US$5 million, whereas in Uganda it was about US$0.3 million against a minimum target of US$2 million.
3. In the case of passenger services in Kenya the concessionaire had provided only 68 percent of the target.
4. Infrastructure and equipment had not been maintained to the required standards and, as a result, had continued to deteriorate.
5. Safety standards had not been complied with in general.
6. Concession fees had not been paid in either country since January 2008. In Uganda the amount due was about US$1 million, in Kenya US$5 million.

On July 2017, the government of Kenya terminated the 25-year contract.

Source: World Bank

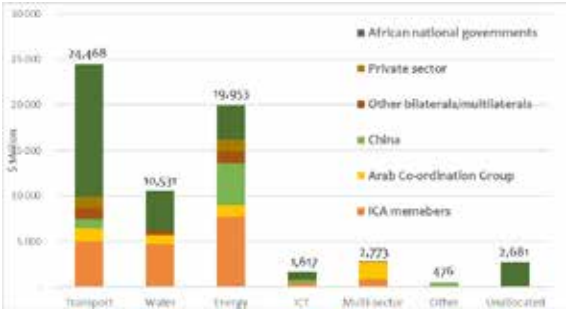
6

INVESTMENT TRENDS IN THE RAIL SECTOR

6. INVESTMENT TRENDS IN THE RAIL SECTOR

Overall commitments to Africa's infrastructure from all reported sources declined to US$62.5 billion in 2016, the lowest level in five years. China's US$1 billion funding for transport in 2016, compared with nearly US$10 billion the previous year, explains most of the overall decline in funding (of 29% or US$10.2bn) for the sector[7].

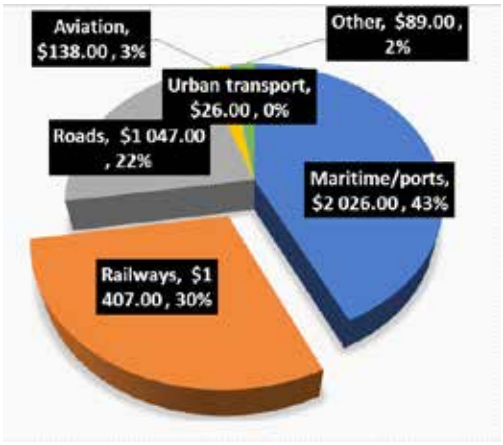
Figure 7: Total infrastructure commitments by sector and funding source (2016)



Source: Infrastructure Consortium of Africa (ICA), 2016

Of the US$62.5 billion committed to Africa's infrastructure in 2016, 39 per cent was allocated to transport infrastructure[8] followed by energy (32%) and water (17%). This allocation highlights the importance of the transport sector, which has strong economic spinoffs. ICA data shows that the rail sector obtained the largest share of funding from Private sector, Other bilaterals/ multilaterals, China and Arab co-ordination group where it was allocated 29.2% from on the transport sector. ICA members allocation for railways was only 4% while that from African national governments was not disclosed.

Figure 8: Transport infrastructure investment by mode



Source: ICA

The sector benefitted from strong Chinese support in 2015 while budget allocations to transport from national governments peaked at US$17.6 billion in 2014 before they were depressed, due to weak commodity prices. Commitments to the transport sector fell sharply in 2016 to US$24.5 billion, compared with US$32.4 billion and US$34.4 billion in 2015 and 2014, respectively[9].

9 ICA. Op. Cit

7 Infrastructure Financing Trends in Africa report - (ICA). www.icafrica.org.2016
8 Transport infrastructure includes rail, roads, ports and airports

7

TRADE TRENDS IN THE RAIL SECTOR

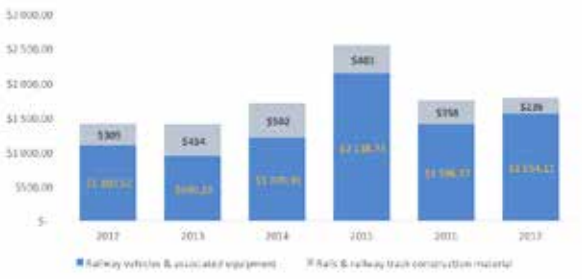
7. TRADE TRENDS IN THE RAIL SECTOR

7.1 IMPORTS FROM REST OF THE WORLD

The trade data on figure 9 displays the imports of rail transport equipment into Africa from 2012 - 2017. The rail transport equipment is classified into two broad categories: (i) railway infrastructure material which includes iron/steel railway track construction material and (ii) rail rolling stock which includes rail vehicles and associated equipment. Rolling stock constitute the majority of total rail equipment imported followed by railway construction material.

In an effort to develop the rail industry, the continent has seen a steady increase in imports of rail transport equipment. Over the past 6 years, the compound annual growth rate (CAGR) in imports of rail equipment was approximately 5 per cent. Notably, in 2015 imports surged by 48 per cent from the previous year to a high of about US$ 2.5 billion. The surge in 2015 was largely due to the delivery of several locomotives into South Africa from Europe and Asia. Since then, imports of rail equipment have continued a steady rise, growing by 1.5 per cent in 2017 from the preceding year.

Figure 9: Imports of rail equipment from the rest of the World (US$ Millions)

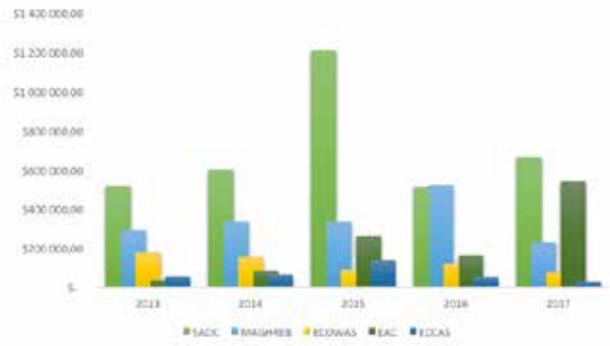


Source: UNCTAD DATABASE

Regarding regional development of the rail transportation, figure 10 below displays the imports of rail equipment by regional economic communities (RECs) from 2013-2017. The SADC region leads the continent in rail development, accounting for approximately 50 percent of imports of rail equipment.

However, recent rail investments have been redirected to other parts of the continent. These developments have been mainly centered around two regions. Northern Africa, accounting for 24 per cent of rail equipment imports, which is off the back of the construction of the High-speed railway line in Morocco. This is followed by Eastern Africa, accounting for 15 per cent of imports of rail equipment, primarily due to the cross-border Standard Gauge Railway (SGR) line. The Western and Central Africa regions have been lagging as far as importing of rail equipment.

Figure 10: Imports of rail equipment from rest of the world, by REC (USD, thousands)

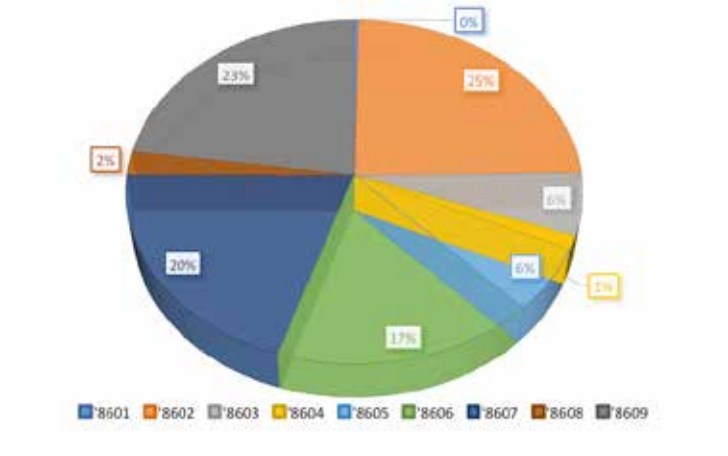


Source: ITC, Trade Map

Regarding the rail equipment supplied by South Africa to the rest of the continent, the figure below displays SA exports into Africa by product. The supply of (diesel) locomotives accounts for the largest share of SA exports into Africa, constituting 25 per cent of total exports of rail equipment from South Africa. This is resultant from the collaboration with international OEM's in manufacturing locomotives.

Furthermore, South Africa has taken advantage of the surge in containerization in global trade with the supply of containers, which accounts for the second-largest share of exports of rail equipment to the continent. This is closely followed by exports of rail components and railway vans and wagons.

Imports by product (2017)

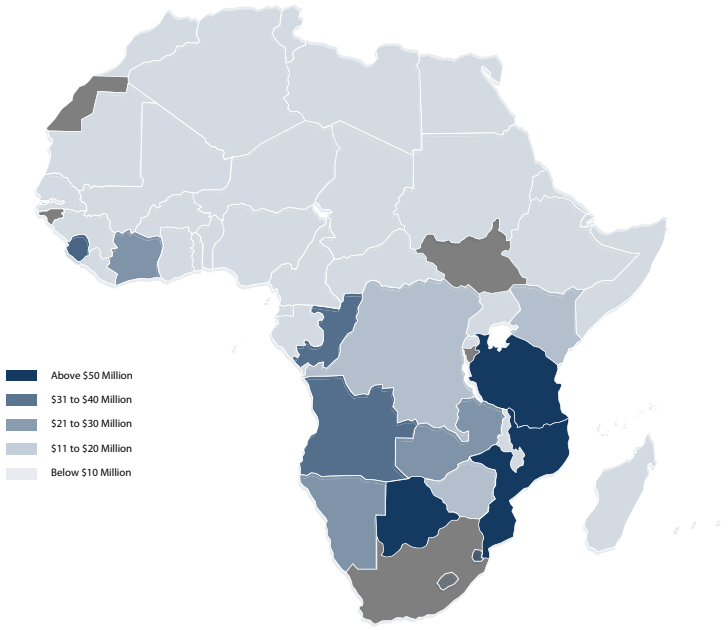


Note: HS86: 8601 – Electric Locomotives; 8602 – Other (diesel) locomotives; 8603 – Self-propelled railway coaches; 8604 – Railway maintenance vehicles; 8605 – Passenger Coaches (Not self-propelled); 8606 – Railway vans and wagons (Not self-propelled); 8607 – Railway/tramway locomotives (parts thereof); 8608 – Railway/tramway track fixtures and fittings; 8609 – Containers.

Source: United Nations Comtrade Database

7.2 IMPORTS FROM SOUTH AFRICA

Figure 11: South Africa's rail equipment exports by geography (2012- 2016)[10]



Source: United Nations Comtrade database

10 HS code 86:

South Africa is well established as the continent's rail hub, possessing skills and expertise as manufacturer, assembler and supplier of rail infrastructure, refurbishment of railway lines and rolling stock infrastructure and components. Given its capabilities and continued collaboration with international rail equipment manufacturer's, South Africa's rail industry is well-positioned to adequately support the potential growth in rail industry on the continent.

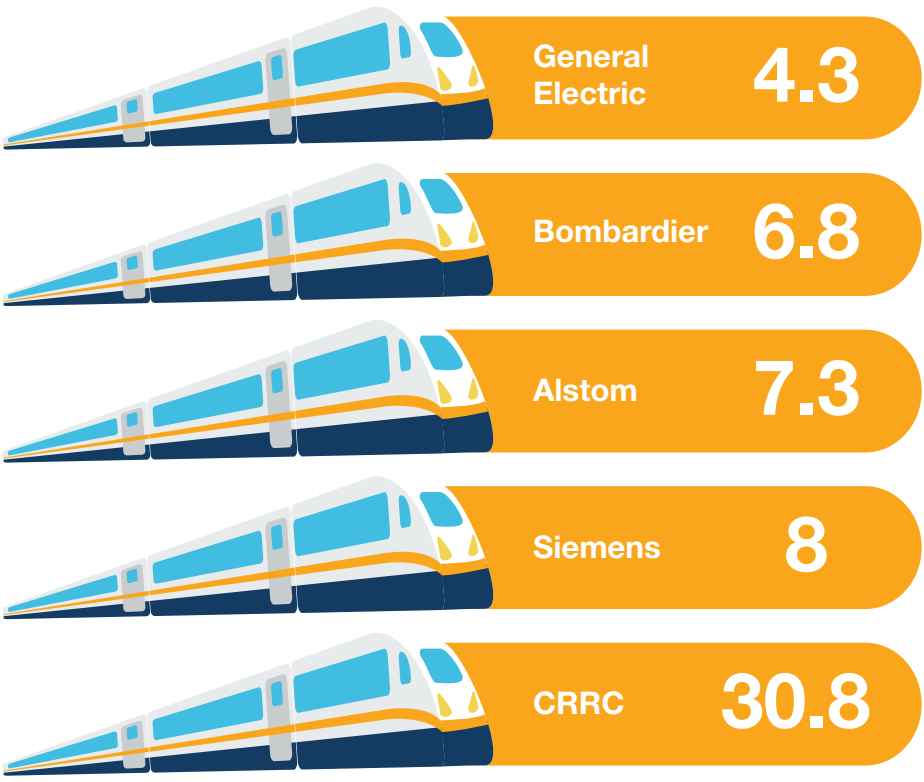
Over the years' South Africa has demonstrated a far-reaching footprint stretching across the African continent in the delivery of rail transport equipment. Given the proximity and bilateral/regional agreements, most of the supply of rail transport equipment has been mainly destined for the SADC market mostly Mozambique, Botswana and United republic of Tanzania. Amply opportunities are still existent for South Africa's rail industry to expand and deepen its footprint across the continent particularly in the Northern and Western Africa.

7.3 MAJOR MANUFACTURERS AND SUPPLIERS PLAYING A ROLE IN THE AFRICAN MARKET

7.3.1 GLOBAL PLAYERS

Figure 12 displays the leading rolling stock manufacturers in 2016, based on their revenue from rail-related activities. Recent mergers and restructuring has brought about a change in the composition of top manufacturers in the rolling stock industry. The recently formed China Railway Rolling Stock Corporation (CRRC) emerged as the dominant global leader of rail vehicle manufacturing in 2016. In that year, the Chinese rolling stock manufacturer, CRRC, generated rail revenue to the value of 30.5 billion euros. In response to the intensified competition a Franco-German merger of Siemens and Alstom in September 2017 will put the two of them on the second place in the global rail market. The well-known, broad-based providers such as Bombardier and GE have fallen off as the leading international manufacturers of rail vehicles.

Figure 12: Global leaders of rolling stock manufacturers by revenue 2016 (EUR billions)



Source: Statista 2018

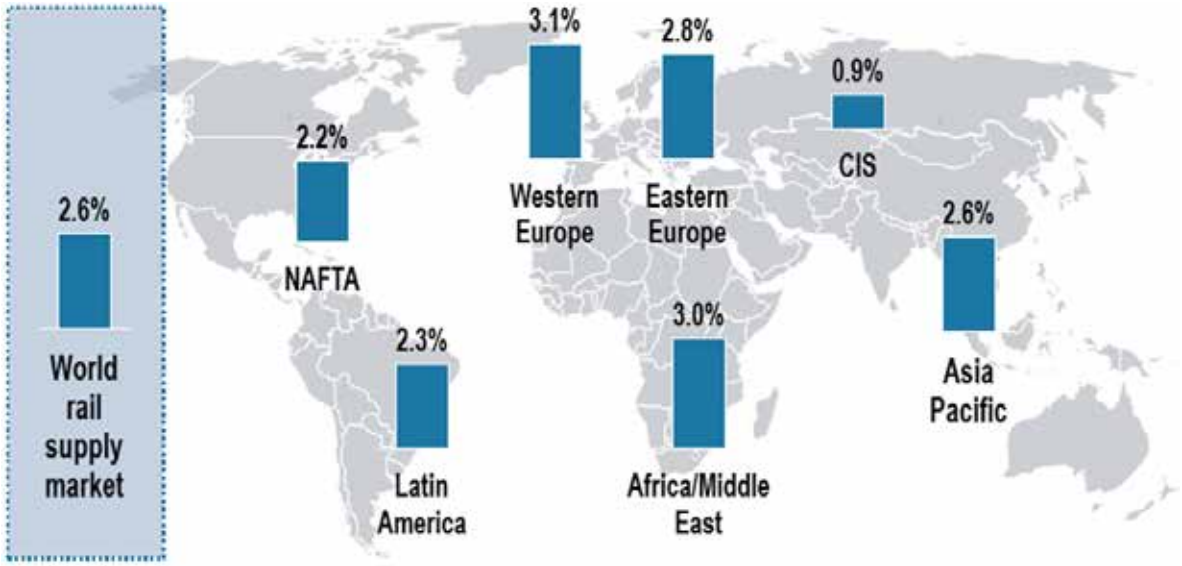
7.3.2 SA EXPORTERS AND PARTICIPANTS

The South African rail industry comprises of several participants, both global and local in the railway locomotives and rolling stock sectors . In the manufacturing of locomotives global OEM's such as General Electric, China Railway Rolling Stock Corporation (CRRC), and Bombardier Transportation have established their facilities in the South Africa. Regarding local manufactures of rolling stock Transnet Railway Engineering, Union Carriage and Wagon, Grindrod Locomotives and DCD Rolling Stock. Concerning manufacturers of passenger coaches' global companies Alstom, Siemens and Bombardier. Locally, Wictra Holdings, Commuter Transport & Engineering and Transnet Railway Engineering. Local manufacturers of freight wagons, including specialised wagons such as ore cars/hoppers, cabooses, car carriers and tank wagons (Transnet Railway Engineering, Grindrod Locomotives and Galison Manufacturing)*.

7.3.3 GLOBAL RAIL SUPPLY MARKET

According to the rail market study conducted by UNIFE, Africa and the middle east is expected to showcase strong growth rates in the rail supply market over the long run. The growth rates have been underpinned by large infrastructure spending, rolling stock orders and greenfield and brownfield projects in the region**.

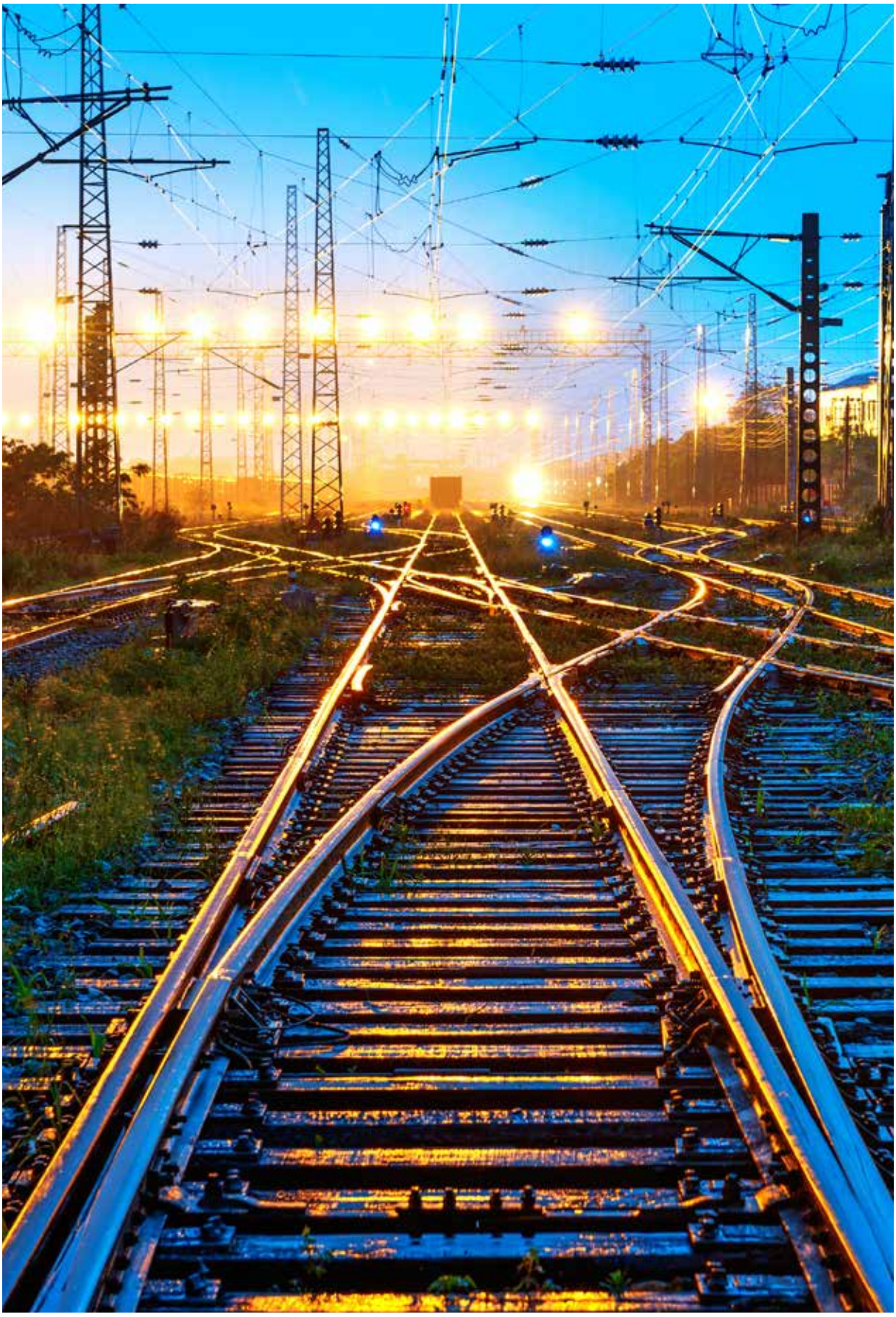
Figure 13: Global Rail Supply Market (CAGR 2019 -2021



Source: UNIFE World Rail Market Study (2016)

*Industrial Development Research Programme (IDRP) Research Project on Public Procurement Railway Locomotives and Transnet: A Case Study (2016)

** UNIFE (2016). World Rail Market Study 2016. UNIFE. Berlin



8

TRADE AND INVESTMENT OPPORTUNITIES

8. TRADE AND INVESTMENT OPPORTUNITIES

8.1 PLANNED PROJECTS

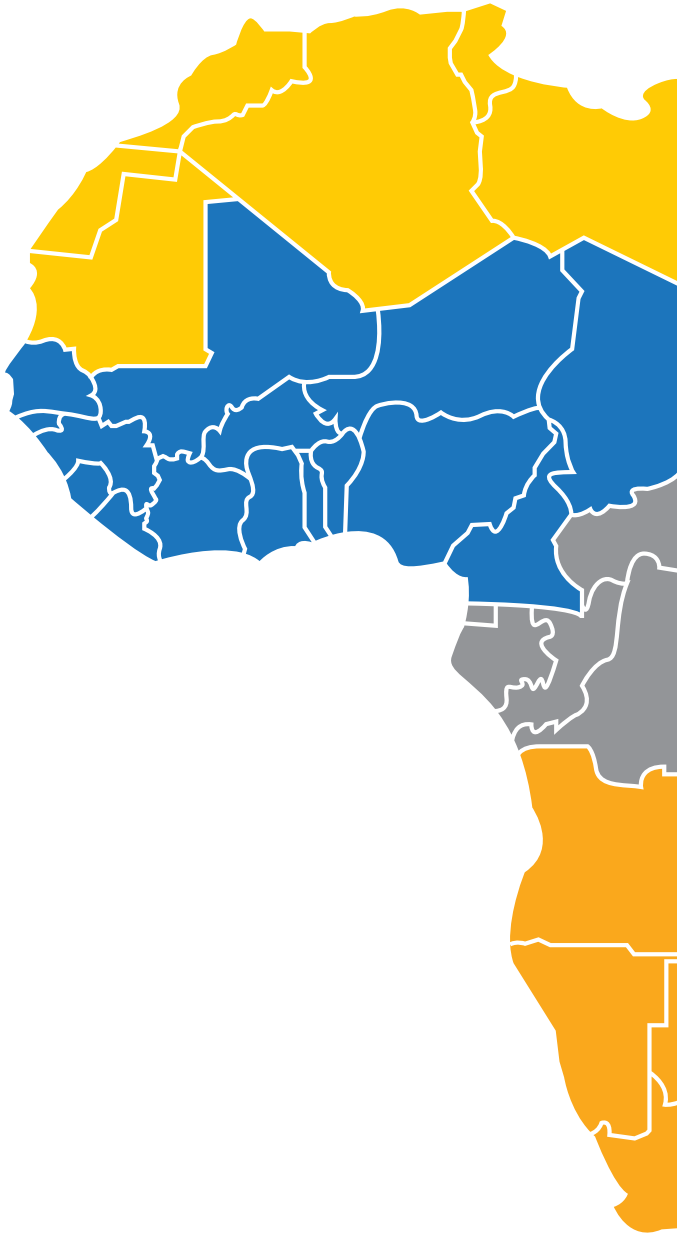
Despite all the difficulties faced by the sector, there has been a strong interest in railways investment in most of the countries in Africa. A variety of projects have been prepared for many purposes and with different levels of ambition. Some of these projects are integrated in a comprehensive master-plan at national level e.g. Cameroon; or at regional level e.g. East Africa Railway Mater Plan proposed by the East African Community (EAC). In other countries, projects originate through the initiative of mines, investors or as stand-alone government projects.

Some of the projects are depicted in the diagram below.

WESTERN AFRICA	
PROJECT	**COST**
Nigeria – Lagos - Kano	**US$ 6.7 bn**
Cotonou - Niamey	**US$ 2.2 bn**
Ghana – Burkina Faso	**Unstated**

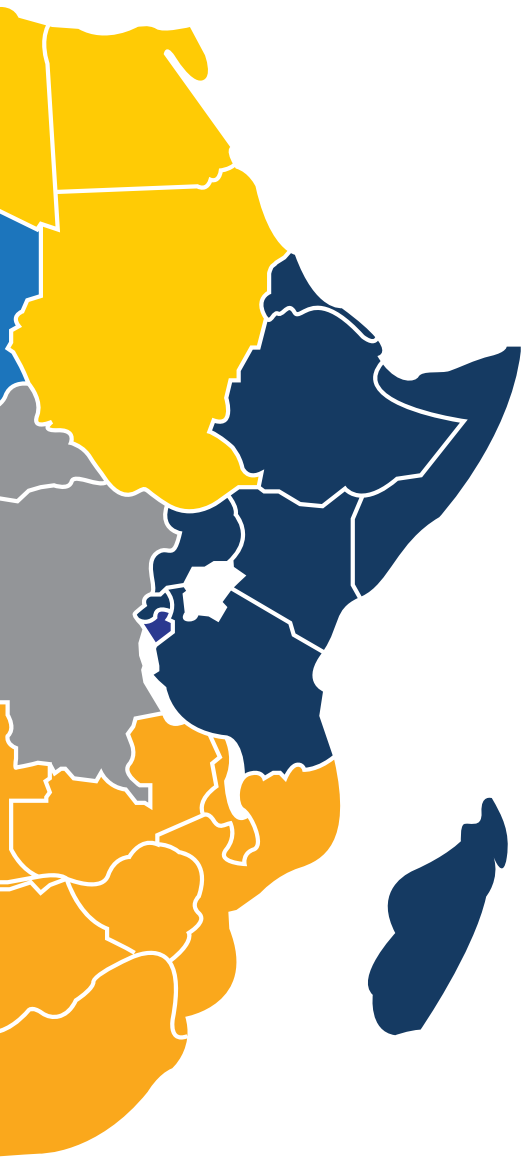
CENTRAL AFRICA	
PROJECT	**COST**
N'Gaoundere(Cameroon) - N'Djamena (Chad) Rail Link	**US$ 9.2 bn**

MAJOR RAILWAYS



NORTH AFRICA	
PROJECT	**COST**
Luxor to Cairo, from Alexandria to Cairo, and from Luxor to Hurghada	**US$ 731 mn**

PROJECTS



EASTERN AFRICA	
PROJECT	**COST**
Kenya (Mombasa Port) - Uganda (Malaba - Kampala) – Rwanda (Kigali) - South Sudan (Juba) Rail Project	**US$ 14 bn**

SOUTHERN AFRICA	
PROJECT	**COST**
Trans-Kalahari Railway Line Project	**N$100 billion**
Swazi Rail Link Project	**US$ 1.3 bn**
Port Techobanine Heavy Haul Rail Project (Botswana-Zimbabwe-Mozambique)	**Unstated**

Observation from some of the planned railway projects raise the following issues:

- In most cases an integrated approach with road transport has not been made, with a few exceptions. This means that the competition between road and rail transport are not fully considered which can lead to inadequate traffic forecasts.
- Governments are simultaneously pushing road and rail projects along the same corridor. e.g.: Dakar-Bamako, Yaoundé-Ngaoundéré or Mombasa-Nairobi
- In many countries new projects are planned in standard gauge, which will involve interoperability problems with the existing network. In some cases the approach is rather cautious and basically involves that any new structural work is made to conform to standard gauge (Tanzania).
- In countries with concessioned railways, new lines may challenge the existing concession agreements as new competition or unforeseen changes in the rules of the game may occur.
- Many new schemes still propose passenger services for political or social reasons. However, the long-term costs and implications of operating and subsidizing these new lines in the future have not been properly addressed.

8.2 GOVERNMENT PROCUREMENT

Africa is a multifaceted and diverse continent – countries have many differences in legal traditions, regulatory environment, levels of political stability, human capacity, financial sector maturity, historical background, languages, natural resources, climate, geography and so on. These variables can create real differences for infrastructure investors and thus can significantly affect a country's attractiveness to private investment.

Africa's legal, regulatory and institutional framework pose constraints to attracting investment to private capital. [11] This includes the lack of effective institutions and implementation of decrees.

Each country has a specific policy on infrastructure procurement and this runs through to the rail sector. With regards to the SADC; Chapter 7 of the Protocol on Transport, Communication and Meteorology, emphasizes harmonisation of policies for railway use and implementation to facilitate an efficient and reliable railway service that helps to integrate the region. The harmonised policies aim for common standards and procedures, in terms of infrastructure[12].

In terms of the regulatory environment, South Africa has made significant strides in creating certainty. The country has the capacity of both sectors (public and private) to get deals done and it has completed more PPP infrastructure deals over the past 25 years. The call for tenders in South Africa for railways include a local production strategy - keeping in line with the National Development Plan. From a policy perspective; the Green paper on National Rail Policy was published on 22 September 2015. The policy aims to revitalise the rail industry and focuses on making railway networks in South Africa fit for generations, recognising the importance of sustainability and innovation. Most policies maximise on local value-add and spillovers from foreign direct investment (FDI).

Mauritius, Botswana and Rwanda have strong regulatory environments for infrastructure investment but they are relatively small markets. Nigeria, Tanzania and Ethiopia have regulatory environments with sufficient economic opportunity to be attractive to investors. Zambia, Ghana and Kenya have improving regulatory environments and are growing in public and private sector capacity. However, successful investments in these countries still require a lot of effort. Cote d'Ivoire, Cape Verde, Gabon and the Gambia lack strong enabling environments or significant opportunity, but these countries have enjoyed deal flows and their governments have been relatively attractive project partners. Comoros, Equatorial Guinea, Lesotho, Mauritania, Niger and South Sudan currently lack the enabling regulatory environment for private infrastructure investment while the Democratic Republic of Congo (DRC) has no structural regulatory framework for private investment in infrastructure. Sector ministries in the DRC have negotiated one-off deals using their own guidelines (particularly in mining, power and cement sectors)[13].

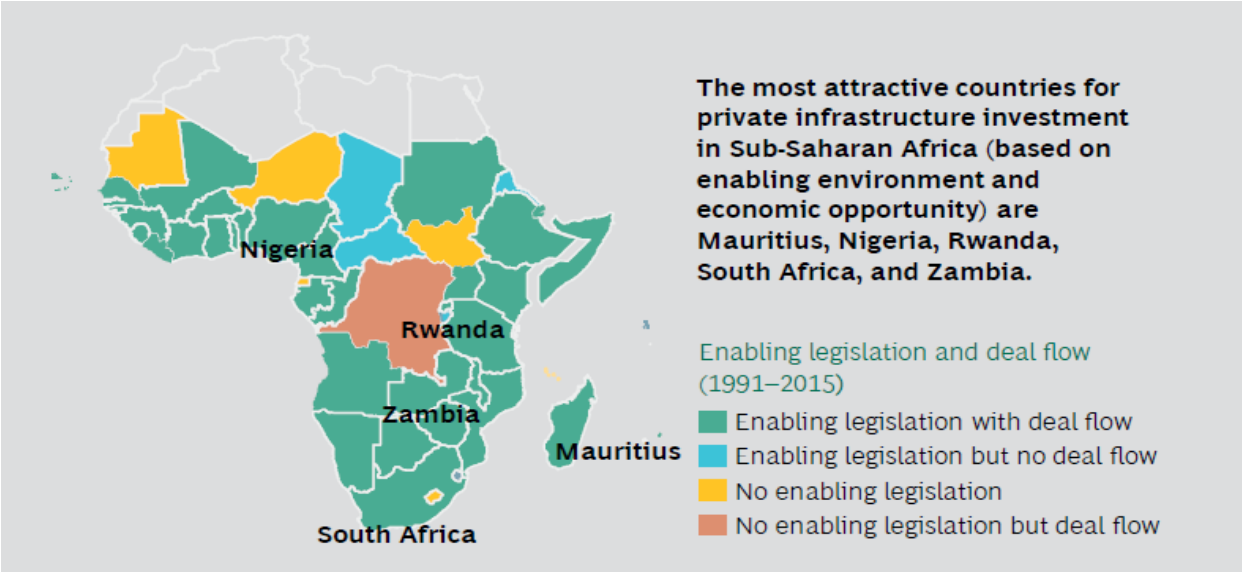
11 Africa's infrastructure. Afdb. 2015

12 Accessed at: http://www.cbrta.co.za/wp-content/uploads/SADC-PROTOCOL-ON-TRANSPORT-COMMUNICATONS-METEOROLOGY.pdf

13 Boston Consulting Group and Africa Finance Corporation (2017). Infrastructure Financing in Sub-Saharan Africa: Best Practices from Ten Years in the Field. The Boston Consulting Group. Lagos

Enabling legislation supports infrastructure investment by allowing governments to contract with private partners and it provides a more transparent process to reassure international investors.[14]

Figure below depicts the enabling legislation with deal flow in SSA. South Africa, Mauritius, Nigeria, Rwanda and Zambia are the most attractive countries for private infrastructure investment based on an enabling environment and economic opportunity.

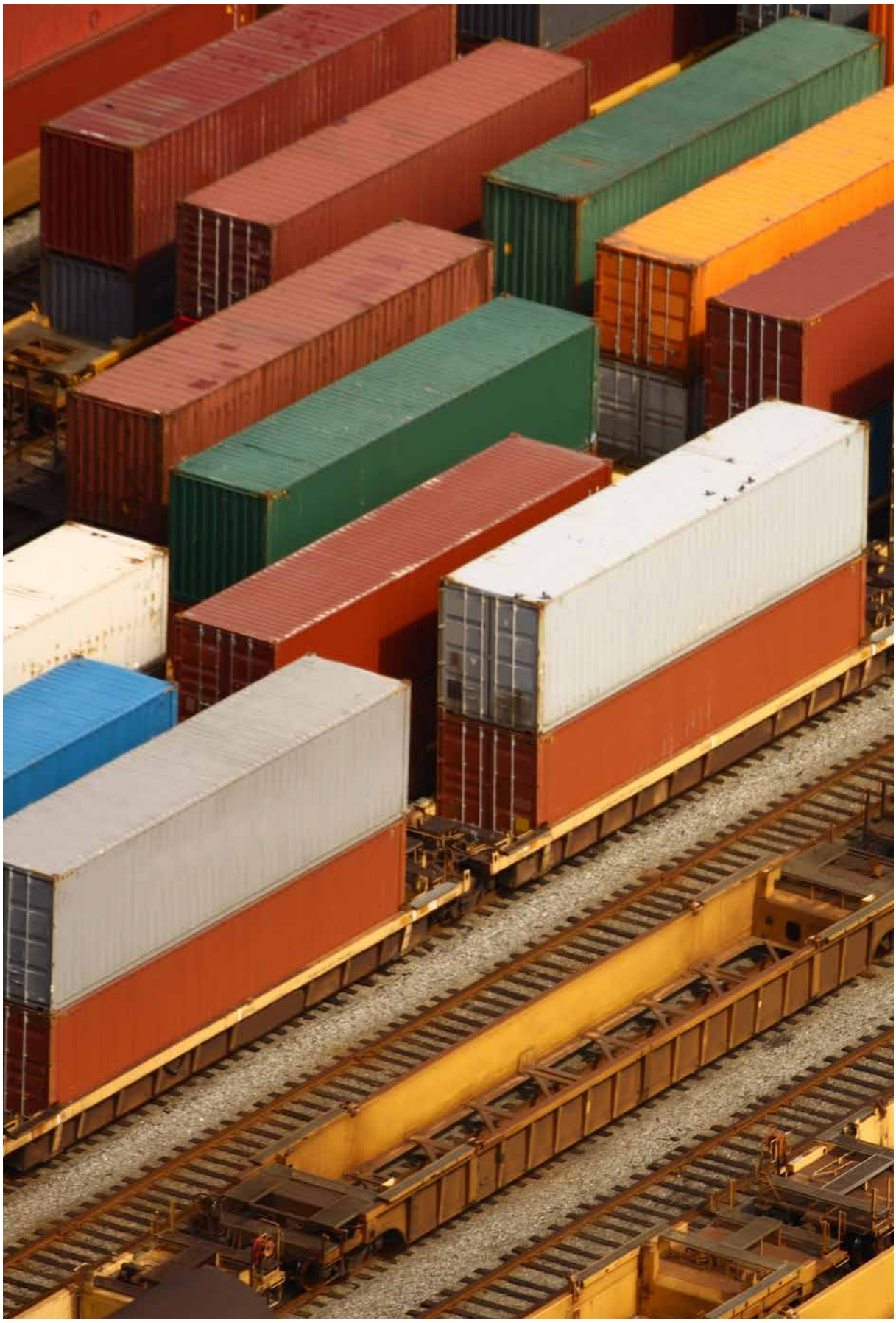


Source: Boston Consulting Group (2017): infrastructure financing in SSA: best practices from 10 years in the field

It is without a doubt that SSA has a long way to go, but governments are slowly making regulatory changes while building their own capacity to negotiate deals. Governments in SSA countries need to adapt the following:

- Establish solid legal and regulatory frameworks, that are transparent and enforce anti-corruption standards.
- Establish enabling and stable environments, with appropriate strategic subsidies (tax incentives, sovereign guarantees, or free land etc), to encourage private investments in infrastructure projects that are profitable without government subsidies.
- Adapt state-of-the-art public tendering and data disclosure practices to ensure transparency along the entire project chain from project origination to preparation to implementation.
- Strengthen regional collaboration by promoting regional free trade agreements, and encouraging multination projects.
- Formulating integrated infrastructure plans and creating a steady pipeline of new projects.
- Strengthen financial markets in domestic economies to capacitate banks to have the financial muscle required to finance large, transformative infrastructure projects.
- Compliance with international standards. Research, co-ordination and centres of excellence needs to be enhanced.
- Honing human capital by training people and building effective institutional capabilities.
- Facilitating provisions that promote dispute

14 Accessed at: https://bipartisanpolicy.org/wp-content/uploads/2015/12/BPC-P3-Enabling-Model-Legislation.pdf



9

FUNDING RAIL INFRASTRUCTURE

9. FUNDING RAIL INFRASTRUCTURE

settlements and licensing.

There are various methods of financing rail in Africa but the most common is sovereign financing, as government support is a key enabler to successful project completion. Project execution on budget and timeously requires a myriad of resources among them appropriate financing, technology delivered by experienced contractors, specifically for brown field projects.

Corporate financing is a challenge given the weak balance sheets of most rail companies, which are state-owned; while project finance tends to come at a higher cost, unless if there are strong sponsors supporting the project(s). There are various estimates based on different calculation methods with Africa's current infrastructure financing needs ranging from US$92 billion[15] to US$142 billion on an annual basis. These figures include the cost of raising funds for project implementation and creation. Africa's infrastructural investment needs for PIDA projects is estimated at US$360bn up to the year 2040[16]. Railways alone may need more than US$ 100 billion in infrastructure investment to update the existing infrastructure and to build new railway lines.

9.1 FUNDING MODELS

African infrastructure has been historically dependent on concessional financing from governments and multilateral Development Finance Institutions due to the weak internal revenue generation and tax collection. Financial markets in SSA are still small in terms of market capitalization with limited trading activities mainly dominated by local government bonds. Such markets may not be able to absorb the high risk, long tenors and sufficient hard currencies to fund major infrastructure projects. Mobilisation of resources from various sources, including multilaterals are key as returns from successful projects in SSA are likely to generate a higher return on investment than similar projects in other regions.[17]

Thanks to solid GDP growth and improvements in the regulatory and legal framework, the historical trend of infrastructure financing is changing across the continent. There are currently various ways in which funding can be mobilised for infrastructure development, namely; infrastructure bonds, PPPs, foreign investors, institutional investors among others. Below are examples from Africa and the respective funding options utilized.

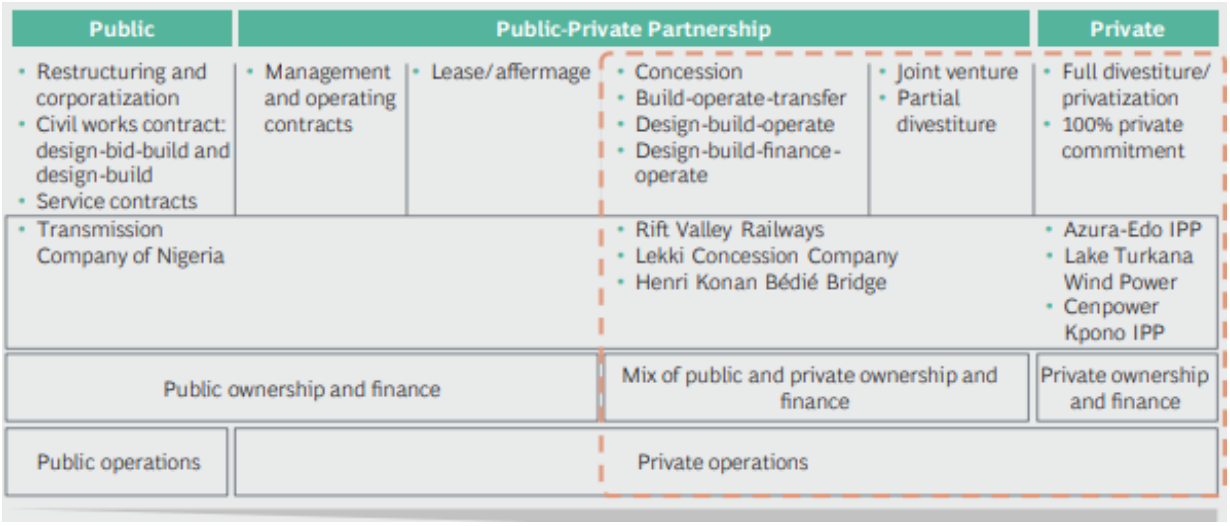
9.1.1 PUBLIC-PRIVATE PARTNERSHIPS

Public-private partnerships can best be described as the future of infrastructure projects. PPPs can provide a solution to financing problems without sacrificing government finances and provide technical capacity for planned projects. Through PPPs, African countries can gain from job creation for its people and economic gains for the region as a whole. According to AfDB, 70 per cent of railways in SSA are managed under a PPP, however public railways are still dominant in some countries, predominantly in South Africa and North Africa[18].

There are various ways in which PPPs can been executed in rail infrastructure development, namely; Management and operating contracts, Leases, Concessions, Joint Ventures, Partial divestiture, Build-Operate-Transfer (BOT), Design-Build-Operate (DBO) and Design-Build-Finance-Operate (DBFO).

15 World Bank: Africa Pulse Report (2017). World Bank. Washington D.C.
16 Ibid
17 Boston Consulting Group-Africa Finance Corporation (AFC). 2017. op. cit
18 AfDB (2017): Rail infrastructure in Africa. Financing Policy Options

Figure 15: Public-Private Partnership models



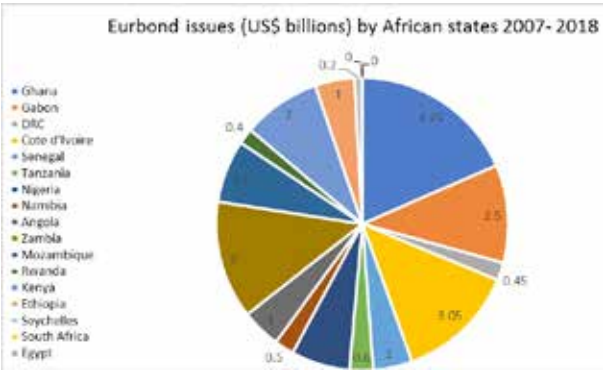
Source: Boston Consulting Group-Africa Finance Corporation (AFC), 2017

9.1.2 INTERNATIONAL BOND MARKETS

Debt forgiveness under the auspices of the Highly Indebted Poor Countries Initiative opened new funding sources for African governments. Higher commodity prices, sound economic policies and improved governance enhanced some African countries' eligibility to raise money by issuing Eurobonds. It became a trend to sell Eurobonds in Africa as an attractive alternative for getting money at historically low interest rates to finance infrastructure unsecured, i.e. without conditions attached to the funding.

The increase in sovereign bond issuance for SSA surged since the global financial crisis of 2007/8 with strong levels of issuances from 2013 to 2015. The drivers included the slump in the global economy which ignited a strong appetite among investors for higher yielding debt outside the traditional markets in the advanced economies. Most bond issuances were largely oversubscribed, a testimony of investors' appetite for risk in the frontier markets.

Figure 16: Eurobond issues by African countries (US$ billions) 2007 -2018



Source: IMF 2016, Bloomberg 2018. NB Eurobond issues up to March 2018*

Several countries have issued sovereign bonds to finance infrastructure including Angola, Côte d'Ivoire, Ethiopia, Gabon, Ghana, Kenya, Namibia, Nigeria, Rwanda, Senegal, Seychelles, Tanzania and Zambia. Nigerian states and South Africa's parastatals, among others, have issued bonds to raise finance. In South Africa, parastatals such as South African National

Roads Agency issue bonds to raise finance for projects.

This new source of funding comes with its own challenges in the face of stagnant commodity prices, poor fiscal revenue collection, lack of transparency and shortage in hard currency reserves. It has also turned into a financial burden as interest payable on issued bonds continues to increase, with investors demanding higher returns for perceived risks. This has resulted in a number of African countries appealing to the IMF for assistance in restructuring their public debts, among them Ghana and Zambia.

9.1.3 FOREIGN INVESTORS

Foreign investors are also another option to growing Africa's infrastructure at a speedier pace. Currently, China is one of the biggest foreign investors in African infrastructure, and invests about US$14 billion annually. Most of the foreign investors have mapped plans in terms of funding projects on the continent such as the Japanese Africa economic corridor. Foreign investors also provide flexible financing terms with long grace periods, tenor and low interest rates.

It should be noted that foreign funding may come with its own procurement rules in terms of content requirements and supporting their own industries. Local know-how for projects which require high capacity remains a challenge, with such contracts expected to be dominated by international contractors. However, there are smaller subsectors in South Africa identified under IPAP, where local companies in various sub-sectors can grow.

9.1.4 INSTITUTIONAL INVESTORS

Rich countries have excess savings, and Africa can tap into pension funds and sovereign wealth funds (SWFs) worth trillion of dollars. South Africa's Government Employees Pension Fund (GEPF) is Africa's largest pension fund with assets worth over R1,6 trillion. However, for infrastructure projects that attract such institutional investors, reforms will be required, along with appropriate financial instruments. Mandates from some institutional investors have restrictions in terms of allocations to investment grade assets.

Given that most countries in the continent are sub-investment grade, their creditworthiness allows them only to use multilateral and regional development finance institutions such as the World Bank and African Development Bank (AfDB) for their lower interest rates. The credit ratings for various African countries are shown in the table 4.

While institutional investors are seen as notable absentees in the African infrastructure sector, some development partners are making efforts to find a way in for them. AfDB is engaged in the task of developing financial instruments to attract this class of investor by deploying capcital to fund sustainable businesses. Several development partners are looking at ways to guarantee or mitigate risks in projects to attract institutional investment in some projects. African sovereign wealth funds are estimated at 2.1% (US$154 billion) of the global figure, giving an alternative source of funding. Countries such as Nigeria, Kenya and Ghana have mandates to priorities domestic infrastructure and industrial investments.

Remittances were estimated at US$430 billion in 2016, which triple the amount of global aid. Zimbabwe is one country tapping into this option through the Diaspora Infrastructure Development Group (DIDG) which is looking at raising US$1 billion to support infrastructure development in the country. DIDG/ Transnet Consortium is looking at recapitalizing National Railways of Zimbabwe in a US$400 million deal which is expected to be concluded in 2018 and will include supply of locomotives, wagons, passenger coaches, supply of signaling equipment as well as repairs[19]

19 https://www.theindependent.co.zw/2018/02/02/new-trains-nrz-deal-

Table 4: African Countries Sovereign Risk ratings

Country	Fitch	Moody's	S&P
Angola	B	B3	B-
Botswana		A2	A-
Burkina Faso	-	-	B
Cabo Verde	B	-	B
Cameroon	B	B2	B
Congo	-	B3	CCC+
Cote d'Ivoire	B+	Ba3	-
DRC	-	B3	-
Egypt	B	B3	B
Ethiopia	B	B1	B
Gabon	B	B3	
Ghana	B	B3	B-
Kenya	B+	B2	B+
Lesotho	B+		
Mauritius	-	Baa1	-
Morocco	BBB-	Ba1	BBB-
Mozambique		Caa3	B-
Namibia	BB+	Ba1	-
Nigeria	B+	B2	B
Rwanda	B+	B2	B
Senegal	-	Ba3	B+
Seychelles	BB+	-	BB+
South Africa	BB+	Baa3	BB
Tunisia	B+	B2	n/a
Uganda	B+	B2	B
Zambia	B	B3	B

Source: Ratings as at May, 2018.

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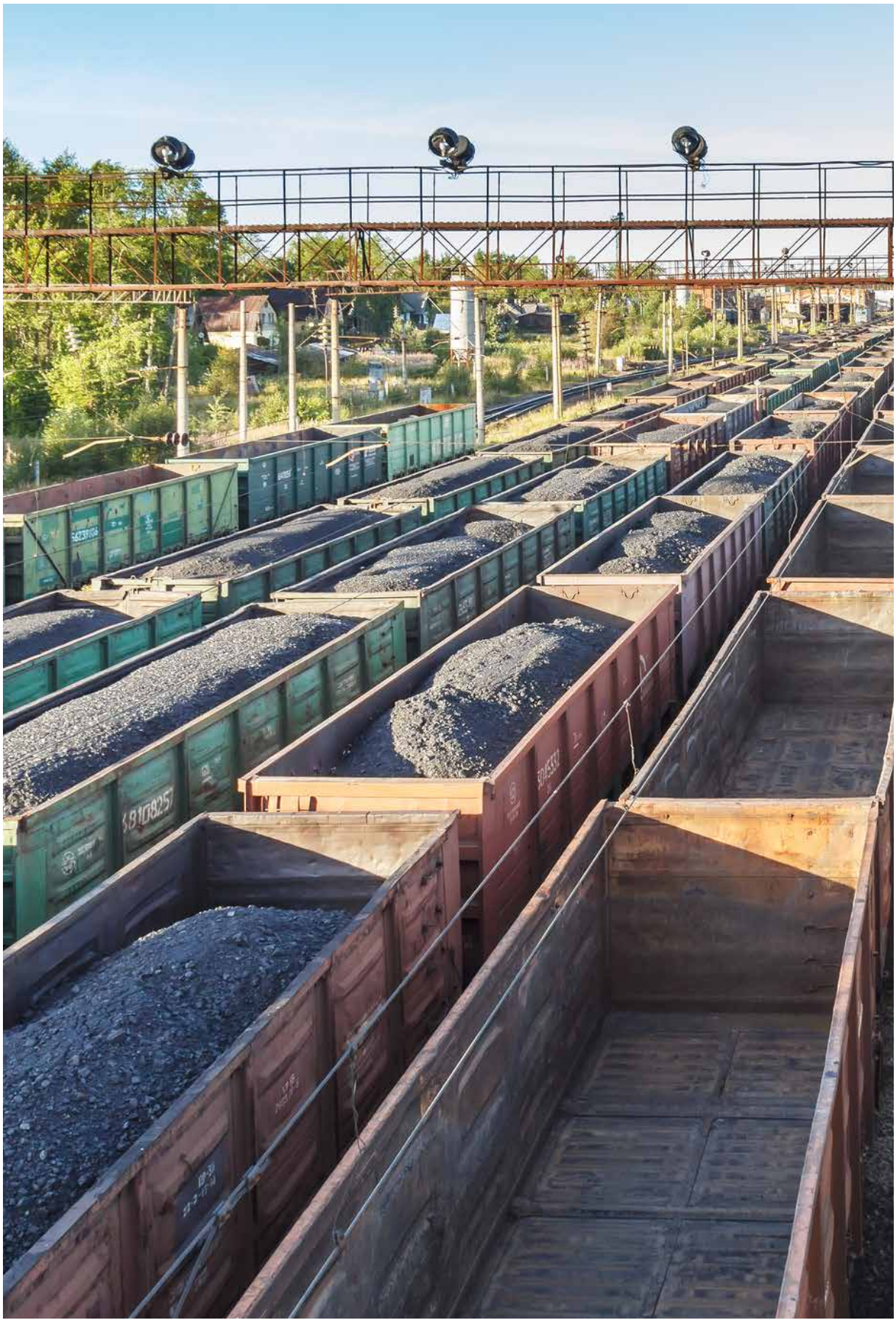
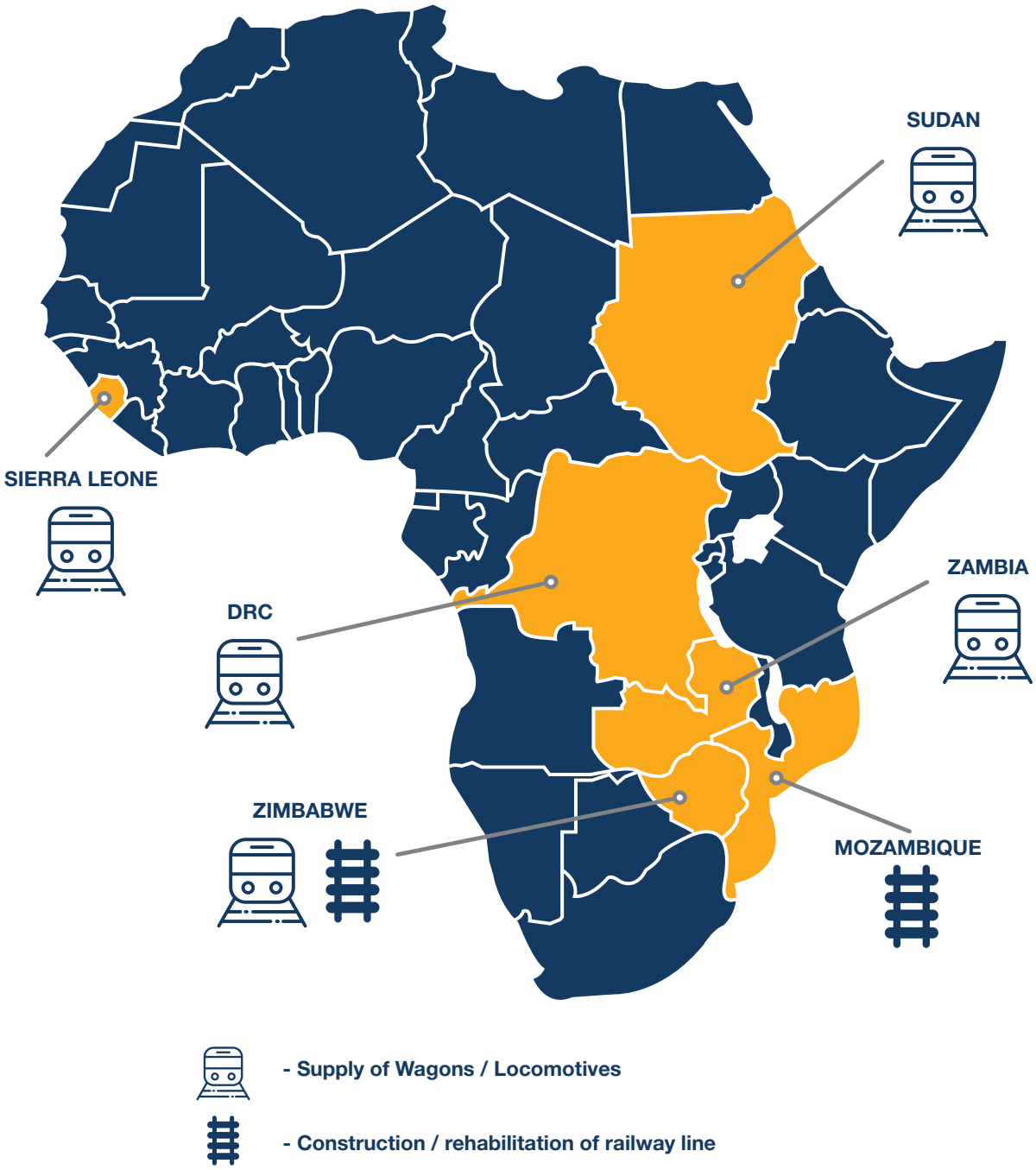


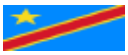
10

ECIC SUPPORTED PROJECTS AND PRODUCT OFFERING

10. ECIC SUPPORTED PROJECTS AND PRODUCT OFFERING

10.1. ECIC SUPPORTED PROJECTS ACROSS AFRICA



Country		Description of Project
	Zambia	Upgrading of railway systems of Zambia
	Zimbabwe	Construction of Railway line. The manufacturing and supply of 6 mainline diesel-electric locomotives
	Sudan	The Supply and Delivery of 50 wagons, 100 container wagons and 600 bogies and locomotives spare parts.
	Sierra Leone	Manufacturing and supply of 20 locomotives.
	DRC	Refurbishment, supply & maintenance of 11 locomotives
	Mozambique	Construction and refurbishment of railway line.

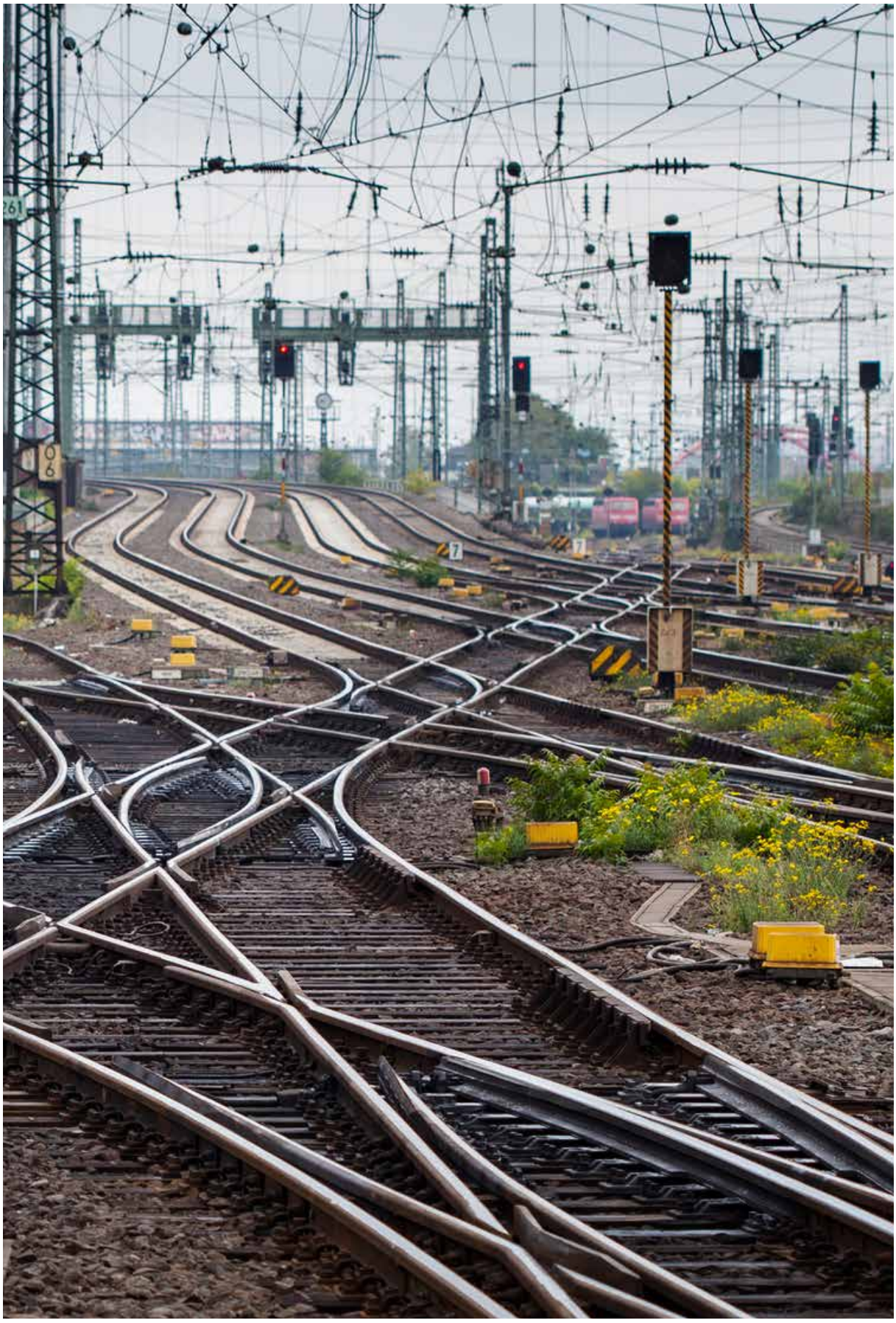
10.2 ECIC PRODUCT OFFERING TO THE RAIL SECTOR

The ECIC has much experience spanning over a number years in working with financial institutions and SA rail equipment suppliers to facilitate the export of rail equipment across the continent (see figure above). Recently, the ECIC has been involved in one of the largest African infrastructure project financing projects, the Nacala transport corridor which entailed the construction and operation of 912 km railway line through Malawi to the Nacala port in Mozambique.

The ECIC offers a comprehensive suite of products to the South African rail industry which will support and enable the South African rail industry to export their products and services to the rest of the continent. One such product is the Bond Insurance scheme (Bid, Performance, Advance Payment, retention) where ECIC works together with financial institutions which issue bond facilities for rail export contractors, allowing for an expansion of the capacity of the South African rail market.

The frequently utilized Export Credit Insurance comprises of a range of products which supports both the financial institutions and South African rail exporters to extend credit to the importers of SA rail equipment from the rest of the continent. Given that African rail operators have limited capabilities to meet considerable rolling stock investments, the leasing market has become an attractive solution in the rail industry. In aligning with market needs, ECIC provides the lease (operating/ financial) and return of equipment insurance cover to the South African rail market.

For further information on ECIC products, please refer to our website www.ecic.co.za.



11

TYPICAL RISKS ASSOCIATED WITH RAIL INFRASTRUCTURE PROJECTS

11. TYPICAL RISKS ASSOCIATED WITH RAIL INFRASTRUCTURE PROJECTS

Table 5: Rail Risk Matrix

Risk Categories	Description	Mitigation
Regulatory risks	All risks, which depend on legislation and regulations i.e. ➢ compliance with environmental and security requirements ➢ compliance with changes in legislation applicable to the project ➢ change in Government policy	➢ Communication with national and regional level bodies to monitor the proposed changes in the legislation. ➢ Establish intergovernmental agreements ➢ Acquire knowledge on procurement documentation preparation. Allow appropriate contingency in the schedule for potential disputes
Financial risks	All risks, which relate to the financing of the project i.e. ➢ insufficient financing ➢ incorrect cash flow projections ➢ underestimated investment costs ➢ change in exchange rate/ inflation	➢ Ensure appropriate contingency reserve. ➢ optimizing the CAPEX or staging the project ➢ Currency matching/Derivative instruments
Strategic risks	All risks, which depend on the strategic consideration of the project, market dynamics i.e. ➢ freight flows ➢ changes in demand ➢ business model	➢ Conduct sensitivity analysis on macroeconomic changes; changes in demand; changes in freight flows, changes in tariffs.
Operational risks	All risks, which relate to the operations of the project i.e. ➢ rolling stock and infrastructure maintenance ➢ labor as well as processes & procedures possibly causing delays i.e. ➢ cross-border coordination of documentation	➢ Conduct infrastructure maintenance study, emphasis on the first years of operation that are the most sensitive to such risks ➢ External supervision
Technical and Construction risks	All risks, associated with the construction process i.e. ➢ lack of construction capacity ➢ Quality & time ➢ Defect Design/ changes in design ➢ Technology & obsolescence (unproven/outdated technology) Location (adverse climatic conditions)	➢ Seek expertise to assist with construction & technical design. ➢ Conduct material sourcing studies, emphasis on equipment that is expected to be most complex in terms of material requirement and access to construction site

Source: Rail Baltica Global Cost Benefit Analysis (2017)

12

DEVELOPMENTS SHAPING THE FUTURE OF THE SECTOR

12. DEVELOPMENTS SHAPING THE FUTURE OF THE SECTOR

Powering tomorrow's trains

Today, it is rare to see Africa's locomotives using coal as a fuel of choice. Instead, it is likely to be diesel or electric engines pulling the continent's freight trains from one destination to another. The share between diesel and electrification fuelling, with the former fuel powering 80% of the continent's freight locomotives, is likely to continue into the foreseeable future, given Africa's limited ability to roll-out more advanced technologies such as battery, hydrogen, and liquid natural gas (LNG) powered locomotives, and as suppliers of diesel locomotives, such as General Electric (GE), develop more fuel efficient and "greener" diesel locomotives.

Diesel powered locomotives

Diesel is the most popular fuel choice for powering freight locomotives in African countries, especially where electric power supplies are unreliable, in countries such as Nigeria and Zambia. Diesel locomotives are ideal for moving bulky raw materials such as coal, iron ore and other commodities. In fact, teams of diesel locomotives operate one of the world's longest freight trains in Mauritania. This 2.5 km long train moves iron ore from the Mauritanian iron centre of Zouerate to the Atlantic port of Nouadhibou, across 704-km of Saharan Desert. In response to the growth in demand for diesel locomotives, GE has set up a plant near Pretoria in South Africa. Here, GE is assembling kits imported from the United States for its African customers. New diesel locomotives offer African clients a range of benefits including being more fuel-efficient and having lower emissions than conventional diesel-electric locomotives. Also, the new line of diesel locomotives will be the first in the sub-Saharan region to meet International Union of Railways UIC 2 emission standards. As a result, GE has received orders for 233 locomotives from freight operators in South Africa, 100 from Angola and 120 from Mozambique, indicating that demand for diesel locomotives remains flush.

Electric powered locomotives

In countries with stable power supplies, such as Ethiopia, Morocco and South Africa, electric rail networks are being expanded. Increasingly, many African rail operators are opting for electric locomotives, due to their environmental credentials and lower operating costs when compared with diesel. However, electrification of the rail sector is fairly far-off from diesel locomotive penetration, which stands at more than 80% of the sector. Nonetheless, evidence suggests that electric trains are greener than diesel, producing 20% to 30% less carbon monoxide. In addition, electric trains are lighter on track wear and tear and so less expensive than diesel. However, electrified services experience higher capital costs than diesel, which make them impractical on lightly trafficked routes, a concern for freight rail as the network moves cargo at a slower rate than a passenger rail network. In addition, there is the need to operate on electrified tracks despite a lack of stable power supplies in many African countries.

New energies in powering Africa's freight locomotives

While diesel plays a major part on many rail-way routes in many countries on the African continent, and looks to continue dominating the fuel mix for African locomotives, the global rail sector is experimenting with new forms of power, such as hydrogen fuel cells and battery powered locomotives. For Africa, these technologies are out of reach, given that they require large amounts of monetary investment in developing intellectual knowledge on the subject, as well as that infrastructure in supporting these technologies does not exist at all. Therefore, it would be a burdensome cost to undertake implementing such technology while cheaper alternatives with larger current benefit exist.

Leveraging LNG supply for cleaner railways

While dismissing hydrogen and battery power energy for powering the rail sector in Africa in years to come, there is a cleaner, more efficient option available, in the form of LNG. LNG is being used in the rail industry as an option for dual-fuel locomotives. In 2016, Russian

Railways, Gazprom, Transmashholding and Sinara Group signed an agreement to develop the necessary infrastructure to support the use of LNG to power locomotives, given Russia's large endowment of LNG. While fresh infrastructure costs will be a point of contention in using LNG to power freight locomotives, some African countries, such as Nigeria, Egypt, and in the near-term, Mozambique, will be able to leverage off their large supplies of LNG as an alternative fuel source in powering freight rail, and more broadly, each country's rail network. Adding to this, and creating an easier transition to LNG powered locomotives, GE transportation runs a natural gas retrofit kit, which it claims can convert its Evolution diesel series locomotives to operate on as much as 80% natural gas, helping reduce costs and the need to purchase dedicated LNG fuelled locomotives.

Application of technology and data

Railways were synonymous with modernization when they were built over a hundred years ago. Initially, they were constructed by mining companies to provide cheap and reliable transport links directly to ports, but quickly developed into networks for passengers as well as freight. At the time, railways seemed cheaper and quicker to build than paved roads and provided a much quicker and cheaper transport than other options available such as waterways and trucks. As other modes of transport expanded quickly, railways began a slow but sturdy decline as other modes were quicker to incorporate new technologies (as it happened in in the automobile and aircraft industries) than the railway industry. Fortunately, the railways industry is starting to adapt more advanced technological processes allowing it to become more efficient, economic and environmentally friendly than other transport modes such as road or air. In saying that, in the modern age, digitalisation is the largest push in terms of technological adaption in the sector, with both hardware and software available to better optimise the sector.

Digitalisation

Digitalisation is the integration of digital technologies into the way things are done (i.e. in the workplace or even everyday life), but the rail sector is taking this one step further and entering into the Internet of things (IOT) territory by merging operational technology and information technology and managing the process using software and powerful analytics in order to streamline processes*. The main driver behind the digitalisation drive is to add value in terms of safety, productivity and maintenance.

The rail sector isn't one that you'd traditionally associate with digitalisation, but it's slowly becoming more prevalent internationally, and more specifically, in Africa**. However, the transport industry within Africa presents digital maturity below average when compared to other industries assessed on the continent, such as mining, according to Siemen's Africa Digitalisation report, 2017. A lot still has to be done to unlock value generation from digitalisation, especially as the African rail sector slowly begins to unlock the benefits of digital transformation. Current applications, for example, are the use of a hot bearing detector, expected to be implemented across Ethiopia's freight rail network in 2018, which provides information about the pairing of the locomotive's wheel and the track, and sends an alarm to a software program should a bearing overheat. A hot bearing can create a stuck wheel, which could in turn result in a derailment and loss of cargo. The software referred to above is an integrated conditioning and monitoring system that integrates all the sensors into a single dashboard. The information that's supplied to the rail operator is aligned with what the threshold of each specific sensor would be. Currently, rail operators work on time-based maintenance programs, which mean that wagons require maintenance over a fixed cycle period. But using this data, operators can provide condition-based maintenance solutions, enabling performance measurement of the asset, preventing a failure ahead of time.

Additionally, augmented and virtual reality (AR and VR) technology are already being used to teach train drivers in Southern Africa - the next step in digitalisation, using AR and VR to assist maintenance teams with the real-time inspection of systems. If train equipment has failed, an AR display could potentially be used to indicate exactly which wheel on a freight train comprising 200 wagons requires working attention.

* Smart Rail World, 2017
** Freight Rail, Transnet 2017

Smart Data

A technological development with real potential for the rail freight industry in Africa is smart data: data created naturally and collected from the operations of railway activity and used to improve the operational efficiency of the railway road network from which it originates from. The harvesting of smart data has two major areas of potential for freight rail. Smarter train communication through wireless signalling enables operators to constantly receive data from trains and more effectively monitor performance and secondly, smart data highlights potential problems or maintenance requirements on the rail network. This can diminish the time freight trains are out of service and limit logistical inefficiencies.

The rail freight industry in Africa is slowly rolling out stand-alone sensors to garner information about things like train driver behaviour, distance travelled as well as stationary periods (while the train is loading commodities, for instance). The resulting data can help rail operators understand where bottlenecks and congestion are, whether extra capacity is required, and give general insight that will allow them to improve operational performance.

The other key potential area for smart data in the African rail sector is through the maintenance and security of rail infrastructure, which includes the rail itself, the overhead track equipment and the transmission lines as well as the buildings that are used to protect signalling systems and distribution points. Attacks on any of these can cause prolonged interruption. Because of this, rail operators are starting to deploy camera systems at key sites, although in some of the more remote areas - a particular problem in Africa - a lack of network access can hinder this type of implementation. Nonetheless, having eyes on the ground can help track illegal activities such as rail infrastructure theft or vandalism. These systems can also be used to monitor operational activity, such as counting the number of maintenance workers at a specific site so that the rail operator can better understand and plan maintenance team deployments.

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CONCLUDING REMARKS

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Despite the difficulties faced so far and the state of decline of rail in most regions, railways in Africa still have great potential to support the economic and social development of the continent. The need to sustain current economic growth momentum, sluggish intra-regional trade, cost of doing business and prospects for increased international trade call for huge investments in rail infrastructure. Although road transport generally has much more flexibility than rail, some African corridors are conducive to freight transport, especially for the transport of bulk goods such as hydrocarbons, mining products or agricultural products.

The continent provides ample opportunities for prospective exporters and investors, especially in the following:

- ✓ Sale and lease of rolling stock
- ✓ Maintenance and repair of rail tracks
- ✓ Construction of rail tracks
- ✓ Rehabilitation of existing rail tracks
- ✓ Exports of rail equipment

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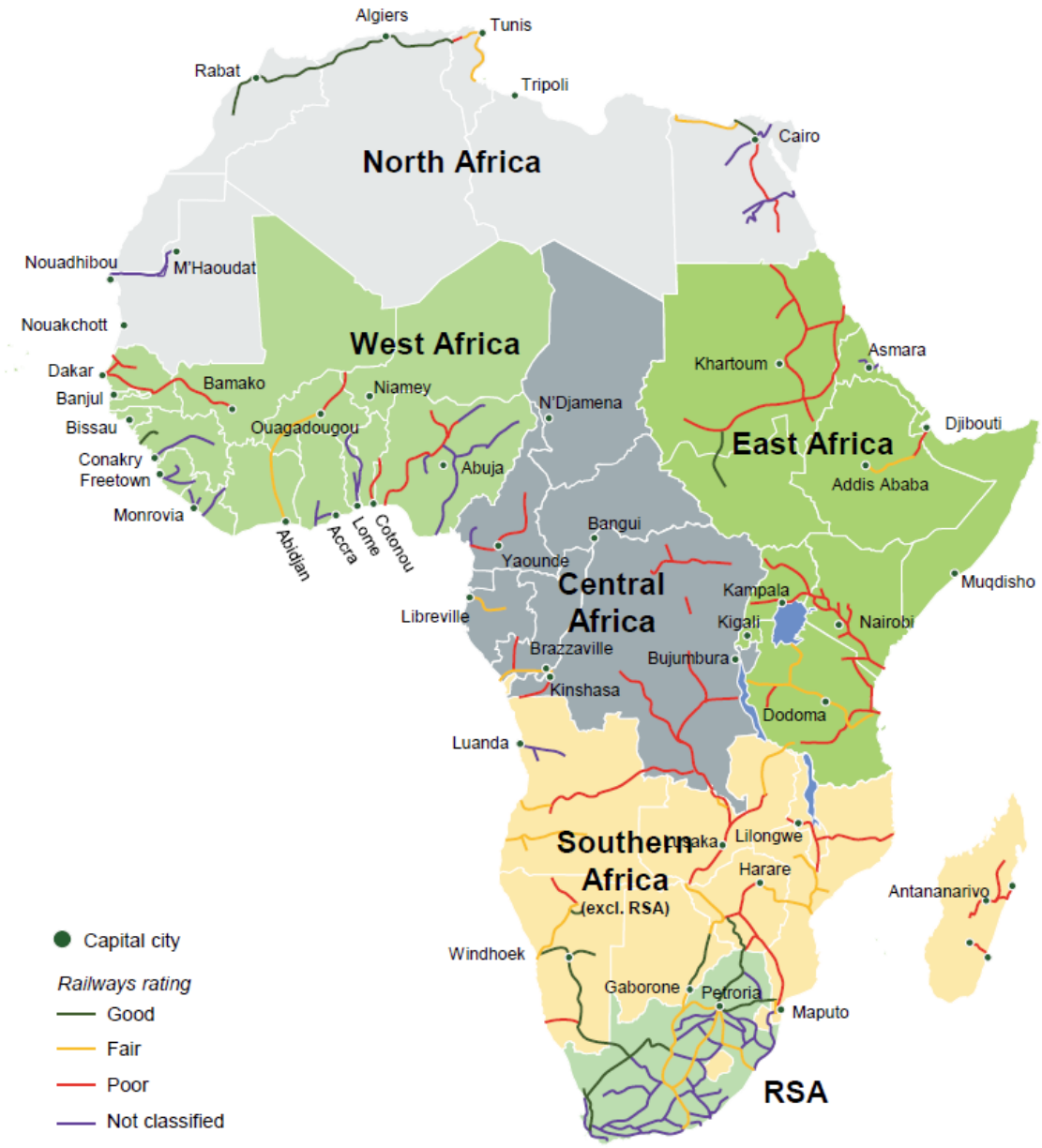
ANNEXURES

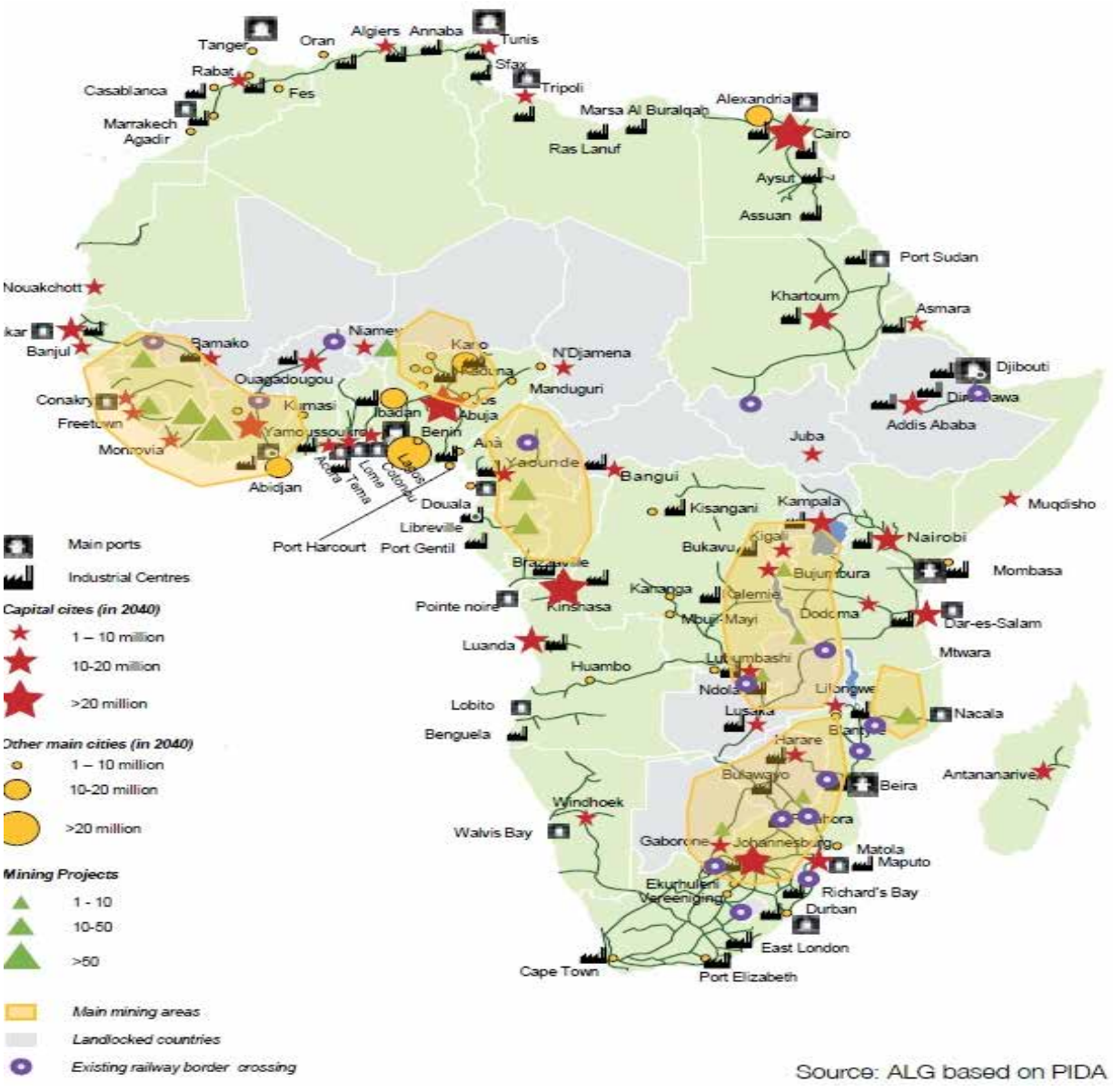
14. ANNEXURES

ANNEXURE 1: AFRICAN RAIL NETWORK

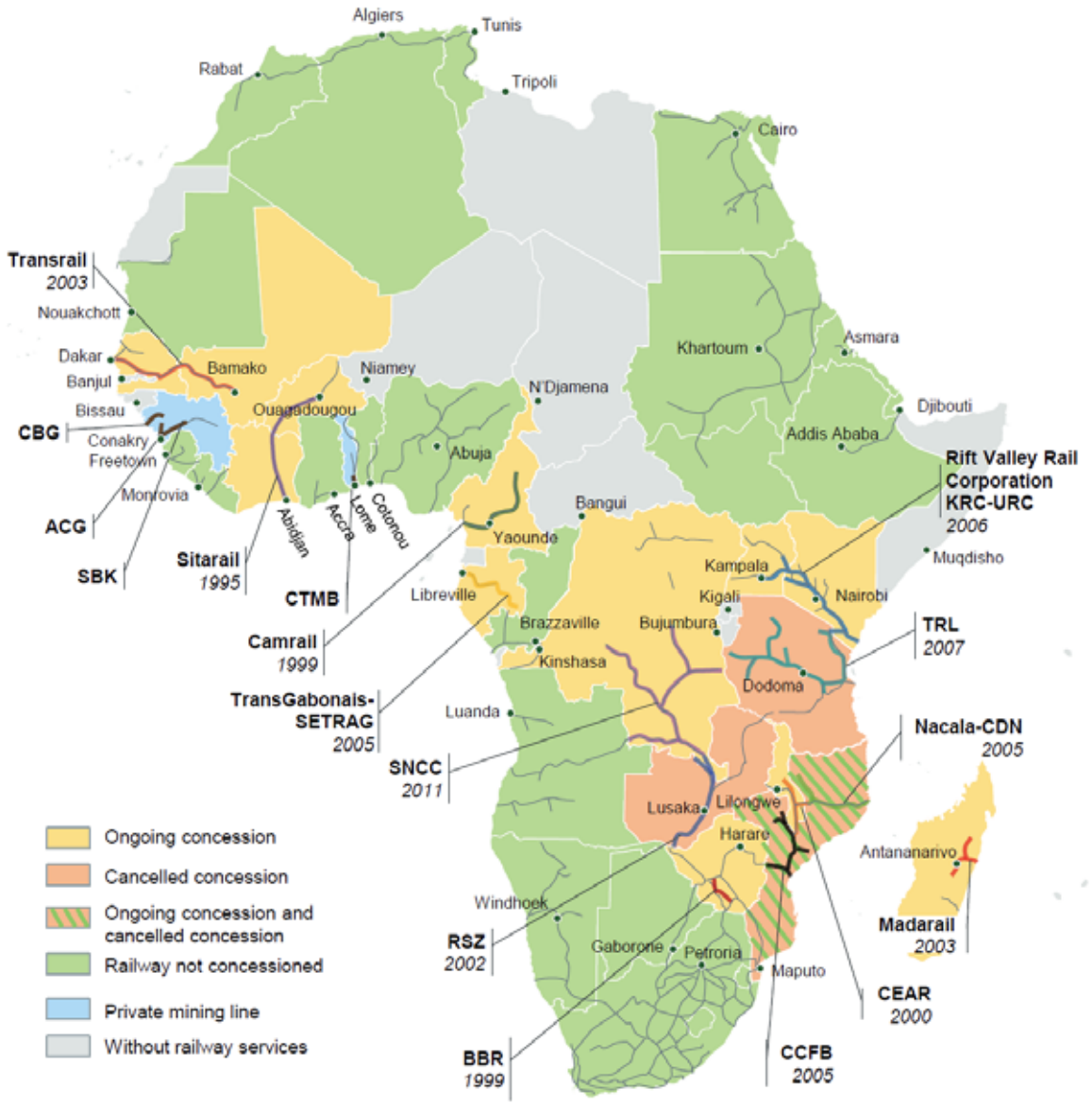


Source: AfDB (2015). Rail Infrastructure in Africa – Financing Policy Options. AfDB. Abidjan

ANNEXURE 2: PIDA PROPOSED RAIL PROJECTS



ANNEXURE 3: RAILWAY CONCESSIONS IN AFRICA



Source: AfDB (2015). Rail Infrastructure in Africa – Financing Policy Options. AfDB. Abidjan

ANNEXURE 4: SOVEREIGN CREDIT RATINGS

A credit rating provides an insight into the level of risk associated with investing in a particular country and gauges the ability of a country or sovereign entity to meet its financial obligations. The rating covers the global spectrum of corporate, sovereign (including supranational and sub-national), financial, bank, insurance, municipal and other public finance entities and the securities or other obligations they issue, as well as structured finance securities backed by receivables or other financial assets.

Credit ratings are opinions and not statements of current or historical fact. They do not constitute recommendations to buy, sell or hold any security, or provide investment or financial advice, for example regarding the suitability of an investment or adequacy of market price. It is our expectation that each investor will make its own study and evaluation of each security or issuer that is under consideration.

Grade	Moody's	S&P	Fitch	Definitions
Prime	Aaa	AAA	AAA	Highest credit quality. The risk factors are extremely low
High grade	Aa1	AA+	AA+	Very high credit quality. Protection factors are very strong. Adverse changes in business, economic or financial conditions would increase investment risk although not significantly.
	Aa2	AA	AA	
	Aa3	AA-	AA-	
Upper medium grade	A1	A+	A+	High credit quality. Protection factors are good. However, risk factors are more variable and greater in periods of economic stress.
	A2	A	A	
	A3	A-	A-	
Lower medium grade	Baa1	BBB+	BBB+	Adequate protection factors and considered sufficient for prudent investment. However, there is considerable variability in risk during economic cycles
	Baa2	BBB	BBB	
	Baa3	BBB-	BBB-	
Non-investment grade speculative	Ba1	BB+	BB+	Below investment grade but capacity for timely repayment exists. Present or prospective financial protection factors fluctuate per industry conditions or company fortunes. Overall quality may move up or down frequently within this category
	Ba2	BB	BB	
	Ba3	BB-	BB-	
Highly speculative	B1	B+	B+	Below investment grade and possessing risk that obligations will not be met when due. Financial protection factors will fluctuate widely according to economic cycles, industry conditions and/or company fortunes.
	B2	B	B	
	B3	B-	B-	
Substantial risks	Caa1	CCC+	CCC+	Well below investment grade securities. Considerable uncertainty exists as to timely payment of principal or interest. Protection factors are narrow and risk can be substantial with unfavourable economic/industry conditions, and/or with unfavourable company developments.
	Caa2	CCC	CCC	
	Caa3	CCC-	CCC-	
Extremely speculative	Ca	CC	CC	
			C	
In default with little prospect for recovery		SD	RD	Defaulted on one or more of its obligations, failing to meet scheduled principal and/or Interest payments
In default	C	D	D	Defaulted on all obligations, or is likely to default on all or substantially all of its obligations as they fall due, thus failing to meet all or substantially all scheduled principal and/or Interest payments
			DD	
			DDD	
Not rated	WR	NR		

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