Available online at www.sciencedirect.com

ScienceDirect

Transportation Research Procedia 1 (2014) 206 – 215

Transportation Research Procedia

www.elsevier.com/locate/procedia

41st European Transport Conference 2013, ETC 2013, 30 September – 2 October 2013, Frankfurt, Germany

Unlocking mineral resource potential in southern African countries: is rail infrastructure up to the challenge?

Priyanka Parida *

Ingerop South Africa (Pty) Ltd, Rivonia, Johannesburg, South Africa

Abstract

In recent years, there has been new coal, iron-ore and manganese discoveries in southern African countries, and increased trade with emerging economies. However, a key concern is market access and critical infrastructure challenges regarding railways and ports. These factors combine to hinder expansion of trade within Africa and globally. As a result of historic underinvestment in transport infrastructure, these countries are facing an "infrastructure gap". Most of the railway systems in southern Africa are not functioning as they should. Hence, economic development and regional integration in Southern African countries hinges on rehabilitation of existing rail infrastructure and on building new rail infrastructure. Following a review of corridors and railway projects, this paper identifies the strategic challenges with regard to rail infrastructure provision. In the policy context, the gauge and inter-operability issue i.e. Standard Gauge vs Cape Gauge, taking into account the requirements for interconnections with other regional railways is examined. Some of the other enablement issues are promotion of green technologies, and a robust institutional framework for providing clear guidelines on balanced regulation for ownership and operational structures, promotion of principle of multiple users, and access agreements. Moving forward, an overview of plans and programmes viz.; the Southern African Development Community (SADC) - Regional Infrastructure Development Master Plan, the forthcoming Programme of Infrastructure Development in Africa (PIDA) by the New Partnership for African Development (NEPAD), and the key to policy transfer are discussed.

Peer-review under responsibility of the Association for European Transport

Keywords: Mineral resource; Rail infrstructure; Infrastructure gap; Policies

* Corresponding author

E-mail address: priyanka_parida@rediffmail.com

Peer-review under responsibility of the Association for European Transport

doi:10.1016/j.trpro.2014.07.021

1. Introduction

Rapid economic growth in newly industrialized nations has fuelled a mineral "super cycle". Economic growth has stimulated demand for minerals, pushed commodity prices to record high levels and led to increase in global trade. In recent years, there has been new coal, iron-ore and manganese discovery in southern African countries. Of these minerals, world coal consumption is projected to increase by almost fifty percent, from the years 2006 to 20301.This is supplemented with fourty percent growth in international coal trade in the same time period (International Energy Outlook 2009, Energy Information Administration, the Government of United States, May 27 2009).Of the total demand for coal exports, it is expected that 10 percent to 13 percent (70 -100 million tonnes per annum) will be met by exports from southern African countries, which includes Botswana and Mozambique. Given the steady increase in demand for coal imports in Asia, the world coal trade forecast projects that by 2030, southern Africa will export over 50 million tonnes steam coal to Asia (CPCS Traffic Study Report, September 2010). This has led to development of new coal export corridors in southern Africa are illustrated in Fig. 1.

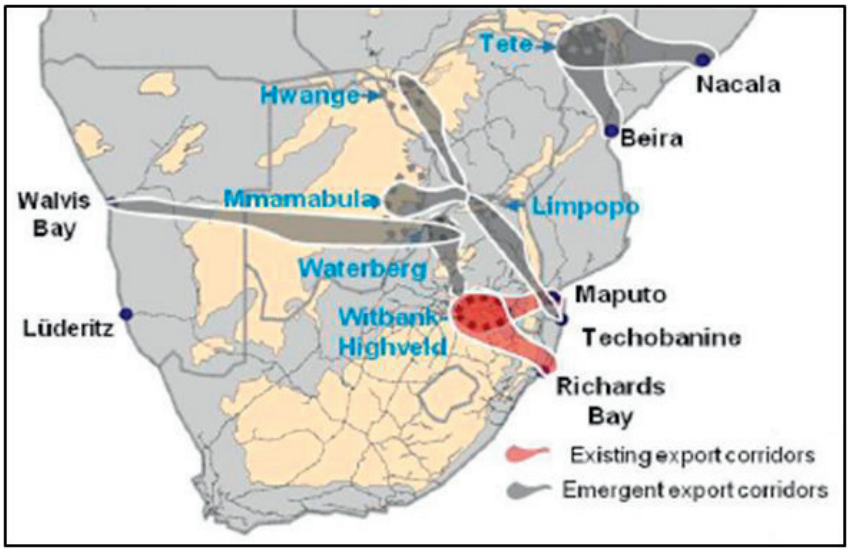

Fig. 1. Map of southern African emergent coal corridors, Source: RMB Southern African Coal June 2012

However, a key concern is market access and critical infrastructure challenges regarding railways and ports. These factors combine to hinder expansion of trade within Africa and globally. As a result of historic underinvestment in transport infrastructure, these countries are facing an "infrastructure gap". Most of the railway systems in southern African countries are not functioning as they should. Their operating costs are high and volumes of goods transported are low (Mark Pearson and Bo Giersing, 2012). Regional freight traffic projections for 2030 indicate that it will be very difficult to expand road services enough to accommodate demand. Thus, in spite of poor and declining performance of railway service over the past 25 years, there is an urgent need for revival and expansion of the same. Rail service has two competitive advantages over road service: lower unit variable operating costs (subject to a high degree of asset use) and lower rates of fuel consumption (about 25 percent of road fuel consumption). These aspects are discussed in the following sections by considering two study corridors in southern Africa.

2. Existing railways in southern Africa

Africa has about 80 000 km of railways, which is about 7 percent of the world's total railway length (National Transport Master Plan 2005-2050, Final Report, September 2010). About 85 percent of the total length is

represented by narrow gauge (NG) of the 1 000 and 1 067 mm varieties. The remaining 15 percent is 1435 mm standard gauge (SG) with majority of them situated north of the equator. The adjacent table and diagrams below provide a picture of the layout, gauge distribution and statistics (Railway Corporate Strategy, 2005 (Global Railway Industry Data Base, www.railcorpstrat.com, Hearsch, J. 2000 - Capabilities of Metre Gauge Railways. UIC Metre gauge Railway Group, Professional Conference on African Railways Systems Interconnection, Inter-operability and Complementarity; Africa Union: 20 – 21 November 2007, Johannesburg, South Africa).

Table 1. Gauge Distribution

Country/ Gauge(mm)	Narrow Gauge (*1000 mm*)	Narrow Gauge (1067 mm)	Standard Gauge (1435 mm)	Ranking
South Africa		22300 km		1
Egypt			5024 km	2
Tanzania	3000 km	1581 km		3
Sudan		4578 km		4
Algeria		1085 km	3138 km	5
Congo (Dem. Rep.)		3641 km		6
Nigeria		3505 km		7
Angola		3000 km		8
Mozambique		2974 km		9
Zimbabwe		2898 km		10
Namibia		2382 km		11
Tunisia	1762 km		496 km	12
Zambia		2232 km		13
Kenya	1918 km			14
Morocco			1907 km	15
Cote D'Ivoire & Burkina Faso	1260 km			16
Uganda	1241 km			17
Guinea	936 km		236 km	18
Cameroon	1016 km			19
11 other countries (less than 1000 km)	3222 km	3736 km	1353 km	20
Total	14355 km	53912 km	12514 km	

The narrow gauge railway lines in southern Africa are generally in poor condition. South Africa is an exception with two world class heavy haul lines and core lines in a fair to good condition (Rails in Africa 2008; Creamer Media's Research Channel) .However, South Africa's non -core and branch lines are also in a poor condition. Limited portions of the narrow gauge lines in Botswana, Mozambique, Namibia, Zambia, Malawi, Swaziland and Zimbabwe are in fair condition ((The SAICE Infrastructure Report Card for South Africa: 2006).

In majority of the cases, the threshold traffic volumes required for sustainable operations decreased. Budget and performance indicators illustrate that income was first spent on salaries and fuel, and the residual income was set aside for maintenance, repair of infrastructure and equipment. Poor management and lack of investment in railways, combined with increasing importance of the road sector, has been cited in many studies as the reasons for decline of railways. The attempts to concession certain railway lines in Malawi, Mozambique, Zambia and Zimbabwe, in lines with the World Bank model did not result in efficient operations. It can be inferred that traffic and income levels would have to increase three to four times, to achieve financial viability and sustainability in operations.

3. Overview of plans and programs

A number of significant initiatives that are underway on various levels are described in this section. Southern African Development Community (SADC), an inter-governmental organization has identified eighteen major regional transport corridors in southern Africa, which serve as the major framework for regional transport infrastructure and socio-economic development of the ten member counties. These corridors are illustrated in Fig. 2.

Fig. 2. Southern Africa transport corridors and major ports, Source: Preparatory Survey for Southern Africa Integrated Transport Program, March 2010

In the same lines, Program for Infrastructure Development in Africa (PIDA), a scheme dedicated to facilitating continental integration in Africa, through improved regional infrastructure was developed. Designed to support implementation of the African Union Abuja Treaty, and the creation of the African Economic Community, PIDA is a joint initiative of the African Union Commission (AUC), the New Partnership for Africa's Development Planning and Coordination Agency (NPCA), and the African Development Bank (AfDB). The study focused on the African Regional Transport Infrastructure Network (ARTIN), which consists of the trans-African highways and 40 key corridors carrying 40 percent of Africa's international trade. The study also covered 19 ports handling 70 percent of the continent's international trade, and 53 airports handling 90 percent of the continent's air traffic respectively. An implementation strategy and processes for the Priority Action Plan (PAP), 2012–2010 was also developed.

4. Background of case study corridors

A number of new railway lines are currently being planned in southern Africa. The purpose of the study of two corridors is to identify the strategic challenges with regard to rail infrastructure provision and suggest a way forward.

4.1. Trans-Kalahari Corridor

The Trans-Kalahari corridor (TKC) was jointly built by the Namibian and Botswana governments with an initial investment of N$850 million [US$127 million] and was officially opened in 1998. It is a tarred road, stretching over 1900 km from the Port of Walvis Bay, through Botswana into Johannesburg. Together with the Maputo Corridor, it provides the much needed east west connection across four countries i.e. Namibia, Botswana, South Africa and Mozambique. The railway line along the corridor runs from the Port of Walvis Bay to Gobabis (via Windhoek), and continues from Lobatse in Botswana (Refer Fig. 3). Presently, the cargo from the Port of Walvis Bay is mainly transported by road from the Port of Walvis Bay to Gaborone and Gauteng. Cargo can also be transported by rail from the port of Walvis Bay to Gobabis and then offloaded from the train onto a truck, with the remainder of the journey done by road to Gaborone or Gauteng, as the rail link ends in Gobabis. However, this intermodal system is hardly utilized. Okahandja, Gobabis, Karibib, Usakos, Walvis Bay and Swakopmund are some of the towns located along the Trans-Kalahari Corridor.

Fig. 3. Trans-Kalahari Corridor, Source: Walvis Bay Corridor Group

4.2. Beira- Harare Corridor

Mozambique serves as an international trade gateway for the landlocked countries of Zimbabwe, Zambia, the DRC, Malawi and Botswana, providing the shortest distance to the regional sea ports of Beira, Nacala and Maputo respectively. However, the main transit corridors and ports in Mozambique were severely disrupted during the 15 year civil war between 1977 and 1992, which resulted in the shift of international trade with the land locked countries to other regional corridors and ports, mainly Dar es Salaam and Durban. The Beira –Harare Corridor was historically the main route into Zimbabwe, while serving some Zambian traffic. Freight flows through the Beira port are now being dominated by coal exports, which accounted for up to 6 million tonnes per annum (MTPA) during 2013 (Beira Corridor: Diagnostic and Options Study , Draft Report, 20 January 2013).

5. Rail Infrastructure- The Missing Middle

This section examines the condition of rail infrastructure in the case study corridors. While the road conditions along the Trans-Kalahari Corridor are relatively good, a missing portion of the railway line to Walvis Bay Port has

become a bottleneck. The railway along this corridor mainly serves coal exports from Botswana. TransNamib, a parastatal enterprise, is in charge of operation of the railway network in Namibia, consisting of 2,883 km, which includes the sections from Walvis Bay to Gobabis via Windhoek along the Trans-Kalahari Corridor. This section was built with an initial design capacity of 4 MTPA. The transportation of mineral resources mined and/or smelted in the region heavily depends on road transport, leading to repetitive maintenance requirements. The railway line from Walvis Bay to Gobabis is presently underutilized due to poor track conditions, shortage of (freight) wagons and locomotives. A proposed Trans-Kalahari Railway Project, which would connect Walvis Bay Port and Lobatse in Botswana over a distance of about 700 km, is now under consideration.

In case of Beira – Harare corridor, the Sena railway line (575 km) is the only existing export corridor linking the town of Moatize to the Port of Beira, with an initial design capacity of 6 MTPA. 2 locomotives and 42 wagon trains with at an estimated capacity of 2 MTPA presently ply on the line. It is operated by CFM (Mozambican Ports and Railways), using locomotives and wagons on an access fee basis (US Cents 2.3 per tonne km). Access to the stock yard and port is hindered due to the poor condition of the railway track between Beira and Dondo, leading to single line speed restriction of 20 km/hour. An expansion of the Sena – Beira line is planned for 2014 / 2016 up to 20 MTPA capacity. Not only is the planned expansion insufficient, but will have to be done simultaneously with ongoing operations due to prior commercial commitments.

A new railroad corridor is being planned by Vale, to be built from the town of Moatize to connect Nacala, which is located around 905 kms from the Moatize Basin. The railroad will cross the neighbouring country of Malawi. The project involves both rehabilitating existing railroads and constructing a new stretch. Given the limited capacity of the Sena Railway line and Beira Port's new coal terminal (max. 6 million tonnes of coal a year), it is urgent to find and develop other export routes for the Mozambican coal. Moatize coal export projects involve 25 MTPA to 50 MTPA of exports and substantial import of equipment, consumables and fuel, utilising both the Beira and Nacala transport corridors. In the past few years, the Machipanda line within the Harare-Beira corridor has had a transit time of up to 10 days over a distance of 615 km, utilising 25 wagon trains at a cost of US$ 1700 per 40 feet container. By comparison, the road tariff is US$ 2200 for imports and US$ 1200 for exports with a 2 day transit time.

Another challenge, often overlooked, is the use of the existing infrastructure to import goods, consumables and specialized inputs. These mining inputs include, but are not limited to minerals, machinery, equipment, plant, maintenance spares and fuel. Most of these goods are not locally produced. They are imported via transport routes already overloaded with exports of minerals. The current situation, likely to persist in the medium term, is characterized by inadequacy of the infrastructure for export and import both in terms of rail and port facilities - a major hold on development of the mining industry.

6. Window of opportunity

The Trans-Kalahari railway is seen as having great potential for Botswana in terms of possible coal exports to Namibia as well as for export through Walvis Bay. Botswana's extensive coal resources at c.212Bt (currently unexploited) makes it possibly one of the most coal-rich countries in Africa. Majority of Botswana's coal lies within the Kalahari Karoo Basin. It also has a number of base metal (copper and nickel) projects nearing the development stage, most of which would benefit from a rail link to Namibia. With an uranium industry already present in Namibia, Walvis Bay is well equipped for the shipping of radioactive products, with such materials being brought by road from as far away as northern Mozambique (e.g. from the Marropino Tantalum Mine). There is increasing exploration for uranium in Zambia, as well as base metal projects in the south of Zambia. After consideration of the long port delays at east African ports, most of the traffic is being routed through South Africa, primarily by road.

There has been limited coal production (not exceeding 0.1 MTPA) in Mozambique during the past 20 years. Minas Moatize was the only operating mine in Mozambique, recently having been joined by other majors like Vale, Jindal and Rio's Benga. The proven and indicated reserves of coal in the Moatize area have significantly increased and additional exploration carried out has resulted in the Moatize region being hailed as the largest unexploited coal field in the world. The yield of coking coal within the seams has also been higher than initially expected. A major expansion in production from Mozambique over the next decade has been planned resulting in Mozambique becoming a significant sea-borne coal exporter. It is estimated that all of Mozambique's coal will be produced in the

Tete Province and will be sourced from the Moatize and Lower Zambezi Basins. With more mines in Moatize starting production, it is estimated that there will be an increase in Mozambique's coal production from 0.1 million tonnes in 2010 to 33.5 million tonnes in 2015(refer Table 2).

Table 2. Coal production estimates in Tete province in Mozambique (Source: Trade Mark South Africa (TMSA), Mineral Scan Report 2011)

Mine Prospect	Estimated Production *(Million Tonnes)*				
	2015	2020	2025	2030	2035
Moatize	11	11	11	11	6
Zambeze	8	15	15	15	15
Benga	10	10	10	10	10
Ncondezi	3	10	10	10	10
Minas Moatize	2	2	2	2	2
Total	34	48	48	48	43

Minimum traffic volumes are estimated to be greater than 10 MTPA for new railways, and greater than 20 MTPA for high-speed heavy haul lines. Apart from the movement of coal, both the railway lines will cater for other commodities such as container traffic, copper, nickel, zinc, cement salt, soda ash, grain and other agricultural products within the region. However, the volumes associated with these commodities cannot sustain the railway line as an economically viable investment. Assuming that the proposed resource-based projects are realized by 2030, the base case for rail is estimated at 56 MTPA. Hence, there is a time window to capture the coal export opportunity. The upgrade of the existing railway line, in case of Beira –Harare corridor as suggested below will prepare them for expanding railways, or building new systems will enable Trans-Kalahari Corridor to meet future demand for competitive rail service.

7. Enablement issues

In the policy context, the gauge and inter-operability issue i.e. Standard Gauge vis-à-vis Cape Gauge, taking into account the requirements for interconnections with other regional railways is important. The current railway network in southern Africa is built with Cape Gauge or 1 067mm Narrow Gauge railways with thus no break of gauge with southern Africa. Synergistically, this serves the purpose of immediate inter- regional connectivity, although, rendering itself unsuitable for transportation of minerals, which provides the threshold traffic volumes for financial viability.

In November 2007 the African Union (AU) held a Conference on Rail Interoperability in South Africa and resolved "To this end and to facilitate interoperability of rail transport networks in Africa, standard 1 435 mm gauges should be adopted and retained for construction of new rail lines in the Continent"(Rail Development in Africa: Stakes and Prospects, Objectives and Missions of the African Rail Union (ARU); 10 – 14 April 2006, Brazzaville, Republic of Congo). It was concluded that " The conversion to standard gauge (1 435 mm) for new railway lines should enable African railways to benefit further from the wide range of material and equipment at global level, and will contribute significantly to resolving the problem of interoperability in the future Pan-African railway network." Ten Corridors and three Radials feature in the vision of the Union of African railways and member states are encouraged to keep these in mind for future integration whenever new lines are considered (Refer Fig. 4).

Thus, this is also likely to be a stakeholder decision as "Adoption of Standard Gauge for new railway constructions" was adopted by African Union (AU) as one of the strategic orientations for the development and management of railway transport in Africa (African railways – Vision 2025; Stanley Mkoko, 4 June 2008, Rail Africa 2008). Some countries with existing narrow gauge railway network have decided to follow the AU resolution on standard gauge, irrespective of the cost-effectiveness of gauge choice in the short or long term. Therefore, if the countries are to follow the AU resolution, then the case study rail lines should be standard gauge. This could create

inter-connectivity issues in the immediate term, until the rest of the regional network is built with standard gauge. Many studies have recommended that existing tracks could be upgraded to standard-gauge specifications in respect of track formation, structures, track ballast and sleepers; allow a third rail to be installed in a progressive manner; and possibly permit the simultaneous operation of both the narrow and standard-gauge systems. However, the standard-gauge specifications of higher speeds and axle loads will require a new track to be realigned in areas of difficult topography for both the case study railway lines, and it could be viable to build the whole line on a new alignment.

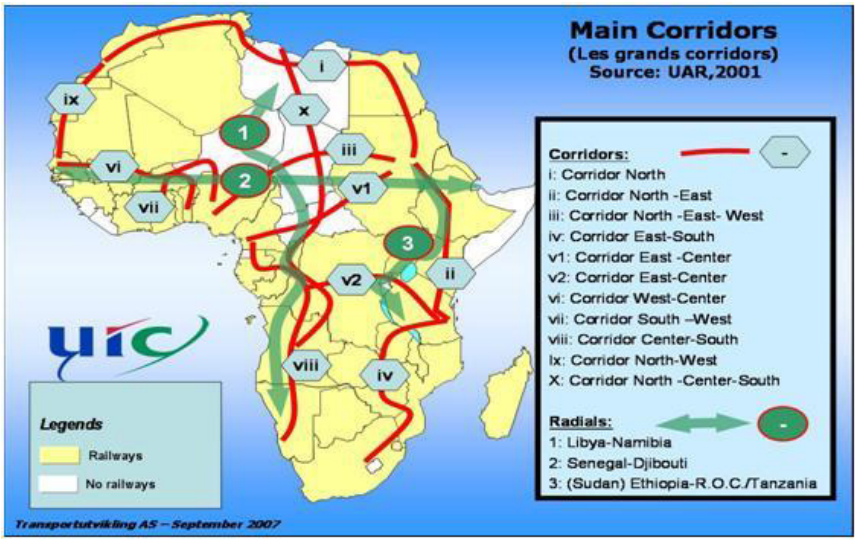

Fig. 4: Main Corridors and Radials, Source: Rail Development in Africa: Stakes and Prospects, Objectives and Missions of the African Rail Union (ARU); 10 – 14 April 2006, Brazzaville, Republic of Congo

The fixed costs for railway operations generally vary between 60 percent and 80 percent, mostly depending on the freight volumes and related asset utilization. For road services, fixed costs make up about 40 percent of operating costs. Hence, it is important for rail to achieve a very high level of infrastructure and equipment utilization. Transnet Freight Rail (TFR), the largest business unit in the state-owned freight and logistics group of South Africa, is presently investigating new and innovative methods with which to expand rail capacity in South Africa. The first such test train, comprising of 18 diesel locomotives, 4 test coaches and 208 loaded CR wagons carrying manganese completed the run within twenty hours. The total length of the train was 2,23km. The Tshipi test train also witnessed the first 208 wagon manganese train, as opposed to standard 104 wagon trains. Similarly, the intermodal railway service between Johannesburg and Durban, over a distance of 700km, has recently been expanded to handle 20 trains per day of 50 wagons (100 TEUs) with a rail transit time of about 16 hours (700000 TEUs pa) and a cost of US$ 900 per 40 feet container. The freight volume on the coal line in South Africa is about 60 MTPA, the train turnaround time is about two days and the tariff is about US$0.015 per ton-km. This operation is very profitable. Using the above operational parameters, the Trans – Kalahari Line can achieve turnaround times of 48 hours. Reducing handling times would allow for higher reliability which will equate to improved sustainability and service predictability. The key motivation for upgrade of CFM Rail Section, and expansion of Dondo - Beira rail service, is to provide lower cost, more reliable, environment friendly, and financially sustainable regional transport corridor for international trade, taking advantage of the geographical position of Beira.

Another complex issue is corridor access and multi-client /user infrastructure. The first mover mining company wants priority access as “founder”, which includes potential future use for expansion of mine and prefers that third-party access must not cause operational inefficiencies, issues with project lenders, and environmental , health and safety issues. Whilst, the subsequent movers want government to provide “effective access rights”, clear and

reasonable conditions of access to avoid the "Pilbara scenario" and address any conflict of interest. In case of "haulage" model, the subsequent movers want service provider to take responsibility/liability. The local businesses along the railway line, want access to be allocated on basis of national development goals, reasonable financial obligation imposed on non-mining users. In most of the cases, public sector's role is limited. The role for public sector can extend back to infrastructure financing, once first movers projects have been successfully implemented, and have created the "fiscal space" in support of public financing. Thus, there are a limited number of financing solutions available for structuring Greenfield multi-use projects like the Trans –Kalahari and Harare –Beira railway line. Transport tariffs also need to be related to future market prices (in this case the price of coal). Securing long-term transport contracts with tariffs having acceptable operating margins (typically in the order of twenty to twenty five percent) is essential. Moreover, the aspect of tariff setting flexibility i.e. acknowledgement of foundations rights of anchor or first mover client, who pays less than the other clients has to be considered. Thus, there is need to agree on a method of determining freight tariffs made up of an infrastructure access component. The infrastructure access component can be split into a fee per tonne km and a fee per train slot. 'Take or pay' contracts where customers pay for slots whether they use them or not, but only pay for tonne km actually utilized also addresses private lenders risk requirements in exchange for secured capacity.

8. Moving towards a seamless freight railway service

Focusing on removing barriers to the success of this — missing middle is the key to developing a vibrant mining economy. Regional governments need to facilitate an independent regulator to control safety, including technical and operational interfaces, and ensure an equitable commercial environment via a regional multilateral agreement. Agreements need to be made between national railway systems, so that a train operator can operate a train without having to change either the locomotive or the wagons at a national border. A consistent transit time of one to two days will have to be guaranteed for rail to be competitive vis-à-vis road, which can be achieved if both the rail freight services are operated as a seamless service, with no stops for locomotive switches, train inspections, customs or immigration. Trains must be operated as scheduled block trains, a principle also now being adopted for general freight in South Africa (TFR). This will require National Railways of Zimbabwe (NRZ), CFM, Botswana Railway and Trans Namib to grant reciprocal track access to each other on agreed trains and access tariffs. Preliminary analysis has indicated that it should be possible to operate a service of 0.8 MTPA (0.5 in and 0.3 out) with a total tariff of less than US$ 40/t – (which is significantly cheaper than road), and with an attractive operating margin for both infrastructure and operations (Mark Pearson and Bo Giersing, 2012).

Ensuring increased operating speed only may not necessarily lead to shorter turnaround time. The current transit time on Rift Valley Railways (RVR) from Mombasa to Kampala is about 10 days and sometimes higher. The actual train travelling time at 20 km/hour average speed, is 2.5 days. Thus, the train is effectively standing still for 7.5 days due to poor scheduling, breakdowns, and derailments. If a 2.5 day guaranteed transit time is offered with a competitive tariff, then RVR would capture considerable road traffic. The first priority for the railways is therefore to make operations safe for a given speed, say 20 or 30km/hour and to avoid equipment breakdown.

Private sector participation may be the best way to leverage opportunities for both the rail lines. A greenfield shared-use Public Private Partnership (PPP) will have to rely on an anchor mine, and mining majors are best equipped to support greenfield shared-use PPP models. Needs and pressures have to be anticipated and acknowledged upfront within the PPP's contractual arrangements. There is need to find equilibrium between protecting the private investors while enabling third party access for both the railway lines. Additional transport capacity needs to be anticipated and incentivized, yet it cannot override basic principle of providing anchor mining with foundations rights related to preferential tariffs and preferential access (i.e. secured capacity).

Two distinct access models which can be considered are the access regime, where the concessionaire provides access to the infrastructure (e.g., tracks) to other users who use their own equipment to transport their own goods or a haulage regime, where the principal operator acts as the sole transport service provider for other mines or clients. The company in charge of the track may operate on a take-or-pay scheduled service level agreement (SLA). The precedent has been set in Mozambique with Vale and Rio Tinto. In this model, major customers/freight owners (or their private train operator service providers) manage the operation and maintenance of their own trains, only paying the infrastructure owners (NRZ and CFM) for access to the track, and where relevant, leasing of maintenance

facilities (which are managed and resourced by the private company). This model allows the private sector to identify specific rail freight transport demand and to operate and maintain their ring-fenced rolling stock fleet optimally to meet this specific rail freight transport demand. Railways really become preferable when single bulk commodities are loaded, transported and off-loaded with dedicated resources on a fixed and predictable schedule.

Another motivating factor for construction and upgrade of the two railway lines, is the fact that diesel-powered rail transportation accounts for about 25%–30% of the diesel fuel used by road transportation (per net ton-km). If fuel prices double relative to other operational costs, railway costs would increase by about 15%, whereas road costs would increase by about 40%. Rail transportation could thus become more profitable and can attract private sector investment.

Construction and upgrade of the two railway lines, i.e. Trans –Kalahari and Beira –Harare is essential for economic growth. It is clear that the volumes of freight that will need to be moved will increase significantly in the short to medium term, leading to additional strain on the existing transport system. The successes of the coal and manganese lines in South Africa, while significant, have provided only a glimpse of the potential railways hold. With the right mix of governance, stakeholder will and policy support, these railway lines have the potential to spur regional market development in southern Africa and unlock the potential for a dynamic mining sector. Now, with the new focus within southern Africa, there is a very real possibility of harnessing the new surge of resource-based investment for resource-led growth and other socio-economic benefits, making the construction and upgrade of the two railway lines, timelier than ever.

References

Adzigbey Y., Kunaka C., Mitiku T.N. (2007) Institutional Arrangements for Transport Corridor Management in Sub-Saharan Africa, Sub-Saharan Transport Policy Program (SSATP), SSATP Working Paper No. 86.

Africa Department, JICA (2008) Study Report on One Stop Border Post Assistance for Chirundu on Zambian–Zimbabwean Border.

African Development Bank and United Nations Economic Commission for Africa (2003) Review of the Implementation Status of the Trans African Highways and the Missing Links,Vol.1, Main Report

Africon, (2007) Implementation of Harmonized Road User Charges System in the SADC Region, prepared for the SADC Secretariat.

Central Intelligence Agency, The World Fact Book

COMESA/SADC/EAC (2009) North–South Corridor. Progress Report and Way Forward Paper Prepared for the North-South Corridor Meeting of Ministers, Lusaka, Zambia

Consilium Legis (Pty) Ltd. (2003) Transport and Trade Facilitation: East and Southern Africa – Review of Present Problems and Reform Initiatives - Vol. 1.

Buyonge C. and Kireeva I. (2008) Trade Facilitation in Africa: Challenges and Possible Solutions. World Customs Journal, Volume 2, Number 1

DBSA (2010) Doing Business in Post-Conflict/Fragile States: Challenge and Risks (third draft).

Eskom (2009) Annual Report

Harmon L.M., Simataa B., and Van der Merwe A. (2009) Implementing Facilitation on Trade and Transport Corridors, 28th Annual Southern African Transport Conference, Pretoria.

Japan Bank for International Cooperation (JBIC)-Mitsubishi UFJ Research & Consulting (2008) The Preliminary Study for Master Plan Formulation on Nacala Special Economic Zone (ZEEN), Final Report

Jourdan P. (2008) A Resource-based African Development Strategy RADS, presentation material at WMMF Toronto, March 2008

Kita Y. (2009) South Africa: Political and Economic Trends in Mining – Rare Metals and PGM Supply after the Economic Crisis", JOGMEC Metal Resources Report.

Nin Pratt A., Diao W. and Bahta Y. (2009) How Important is Regional Free Trade Area for Southern Africa? Potential Impacts and Structural Constraints, IFPRI Discussion Paper 00888

Pedersen P.O. (2002) The Logistical Revolution and the Changing Structure of Agriculturally Based Commodity Chains in Africa. CDR [Centre for Development Change] Working Paper 2.12.

Pedersen P.O. (2007) The Role of Freight Transport in Economic Development: An Analysis of the Interaction between Global Value Chains and Their Associated Transport Chains. DIIS Working Paper No. 2007/12

Pedro A.M. (2004) Mainstreaming Mineral Wealth in Growth and Poverty Reduction Strategies, Economic Commission for Africa, ECA Policy Paper No.1

Phipps L. (2009) Review of Railway – Concessions in the SADC Region, Southern Africa Global Competitiveness Hub

Portugal-Perez A. and Wilson J.S. (2008) Trade Costs in Africa: Barriers and Opportunities for Reform, World Bank Policy Research Working Paper 4619

World Bank (2007) Doing Business Project