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Detailed Scoping Study (DSS) – of Vision 2063 Africa Integrated High Speed Railway Network and Master Plan

Prepared for:

African Union Development Agency (AUDA-NEPAD)

Prepared by:

CPCS

In association with:

Aurecon AMEI Ltd
ILF Consulting Engineers

Solutions for growing economies

CPCS Ref: 16528
February 12, 2020

Quality Assurance

Detailed Scoping Study (DSS) – of Vision 2063 Africa Integrated High Speed Railway Network and Master Plan

CPCS Ref: 16528

Final Report and Master Plan

Version	Date	Responsible	Approval
1.0	February 12, 2020	George Kaulbeck (Team Leader)	Miho Ihara (Project Director)
2.0			
3.0			

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February 12, 2020

To: NEPAD Planning and Coordination Agency,
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Dear Sirs:

Re: Detailed Scoping Study (DSS) – of Vision 2063 Africa Integrated High Speed Railway Network and Master Plan (Procurement No: 005/RIIT/CEO/CS/QCBS/16)

Submission of Final Report

We are pleased to submit this final report for the above-referenced project. This report presents the AIHSRN Master Plan, technical options and recommendations, recommendations for transnational operations of railways, financing options, environmental and social impact management, and implementation roadmap, as well as detailed scoping of the two accelerated pilot projects.

Yours very truly,

CPCS Transcom Limited

George Kaulbeck

George Kaulbeck
Team Leader

Table of Contents

List of Figures

List of Tables

Acronyms/Abbreviations

AAR	Association of American Railroads
ABS	Automatic Block System
AC	Alternative Current
ADB	Asian Development Bank
AEI	Automatic Equipment Identification
AfDB	African Development Bank
AFTTR	World Bank's Africa Transport Unit
AIDA	Accelerated Industrial Development for Africa
AIDC	Africa Infrastructure Country Diagnostic
AIDS	Acquired Immunodeficiency Syndrome
AIHSRN	Africa Integrated High Speed Railway Network
AMV	African Mining Vision
AREMA	American Railway Engineering and Maintenance-of-Way Association
ATP	Automatic Train Protection
AU	African Union
AUC	African Union Commission
AUDA-NEPAD	African Union Development Agency
BCR	Benefit Cost Ratio
BIAT	Boosting of Intra-African Trade
BOT	Build-Operate-Transfer
CAADP	Comprehensive Africa Agricultural Development Programme
CAPEX	Capital Expenditure
CAR	Central African Republic
CBP	US Customs and Border Protection
CBTC	Communications-Based Train Control
CCTV	Closed Circuit Television
CDC	Compensation Determination Committee
CEN-SAD	Community of Sahel-Saharan States
CFTA	Continental Free Trade Area
CKGR	Central Kalahari Game Reserve

COMESA	Common Market for Eastern and Southern Africa
COTIF	Convention concerning International Carriage by Rail
CPCS	CPCS Transcom Limited
CTC	Centralized Traffic Control
CTP	Common Transport Policy
DB	Design-Build
DC	Direct Current
DFI	Development Finance Institution
DRC	Democratic Republic of Congo
DSS	Detailed Scoping Study
EAC	East African Community
EARMP	Eastern Africa Rail Master Plan
ECA	Export-Credit Agencies
ECCAS	Economic Community of Central African States
ECOWAS	Economic Community of West African States
EIRR	Evonomic Internal Rate of Return
ENPV	Economic Net Present Value
ERTMS	European Rail Traffic Management System
ESF	Environmental and Social Framework
ESIA	Environmental and Social Impact Assessment
ETCS	European Train Control System
EU	European Union
FIRR	Financial Internal Rate of Return
FNPV	Financial Net Present Value
FRMCS	Future Railway Mobile Communication System
GDP	Gross Domestic Product
GHG	Greenhouse Gas
GIF	Global Infrastructure Facility
GIS	Geographic Information System
DSCR	Debt Service Coverage Ratios
GSM-R	Global System for Mobile Communication - Railway Applications
HIV	Human Immunodeficiency Virus
HR	High Representative

HSGOC	Heads of State & Government Orientation Committee
HSR	High Speed Railway
Hz	Hertz
ICD	Inland Container Depot
ICT	Information and Communications Technology
IFC	International Finance Corporation
IFI	International Finance Institutions
IGAD	Intergovernmental Authority on Development
IMF	International Monetary Fund
IP	Internet Protocol
IRR	Internal Rate of Return
km	Kilometre
km/h	Kilometre per hour
KTFP	Kgalagadi Trans Frontier Park
kV	Kilovolt
LIBOR	London Inter-bank Offered Rate
m	Metre
MCA	Multi-Criteria Analysis
MIRR	Modified Internal Rate of Return
mm	Millimetre
MTPA	Million Tonnes Per Annum
NBIA	New Bugesera International Airport
NGO	Non-Governmental Organisation
NPV	Net Present Value
NRC	Nigerian Railway Corporation
NRZ	National Railways of Zimbabwe
OAU	Organization of African Unity
OD	Origin/Destination
OPEX	Operating Expenditure
OSBP	One-Stop Border Post
OSShD	Organization for Cooperation of Railways, or OSJD

OTIF	Organisation intergouvernementale pour les transports internationaux ferroviaires (Intergovernmental Organisation for International Carriage by Rail)
O&M	Operation and Maintenance
PAP	Priority Action Plan
PICI	Presidential Infrastructure Championing Initiative
PIDA	Programme for Infrastructure Development for Africa
POE	Points-of-Entry
PPF	Project Prioritization Framework
PPIAF	Public-Private Infrastructure Advisory Facility
PPP	Public-Private Partnership
PRA	Project Readiness Assessment
PRC	People's Republic of China
RAP	Resettlement Action Plan
REC	Regional Economic Community
RoW	Right of Way
SADC	Southern African Development Community
SCADA	Supervisory Control and Data Acquisition
SDR	Social Discount Rate
SGD	Sustainable Development Goal
SGR	Standard Gauge Railway
SIA	Socio-economic Impact Assessment / Social Impact Assessment
SSA	Sub-Saharan Africa
SSATP	Africa Transport Policy Programme
STC	Specialized Technical Committee
STD	Sexually Transmitted Disease
TAH	Trans African Highways
TAZARA	Tanzania-Zambia Railway Authority
TBD	To Be Determined
TENs	Trans-European Transport Networks
TETRA	Terrestrial Trunked Radio
TEU	Twenty-foot Equivalent Unit
tkm	Tonne-kilometre

TKR	Trans-Kalahari Railway
TOR	Terms of Reference
TRC	Tanzania Railways Corporation
TWR	Transboundary Water Resource
UHF	Ultra High Frequency
UIC	International Union of Railways
UMA	Arab Maghreb Union
UK	United Kingdom
UN	United Nations
UNESCO	United Nations Educational, Scientific and Cultural Organization
US	United States
USD	United States Dollar
US$	United States Dollar
VAT	Value-Added Tax
VHF	Very High Frequency
vkm	Vehicle-kilometre
WACC	Weighted Average Cost of Capital

1 Introduction

1.1 Authority for the Assignment

This Final Report was prepared under the authority of the contract signed between the African Union Development Agency (AUDA-NEPAD) and CPCS Transcom Limited (CPCS) in December 2018, to provide consultancy services for "Detailed Scoping Study (DSS) for Vision 2063 Africa Integrated High Speed Railway Network and Masterplan" (Procurement No. 005/RIIT/CEO/CS/QCBS/2016).

1.2 The Assignment

1.2.1 Project Background and Context

In May 2013, at the 50 years celebration of the founding of the Organization of African Unity (OAU), the African Union (AU) heads of state pledged to integrate the ideals of shared value and common purpose through the development of a Continental Agenda to the Year 2063 (i.e. "AU Agenda 2063"). The AU Agenda 2063 is a strategic framework for the socio-economic transformation of the continent over the next 50 years. It builds on, and seeks to accelerate the implementation of, past and existing continental initiatives for growth and sustainable development.[1]

Amongst the key enablers of this agenda is the Africa Integrated High Speed Railway Network (AIHSRN) of AUC. This initiative is aimed at interconnecting African capitals with each other, and with economic and industrial hubs and major tourism locations across the continent using appropriate high speed rail (HSR) technology and other complementary power, transboundary

[1] African Union, *Towards the Africa Integrated High Speed Rail Network (AIHSRN) Development.* https://au.int/sites/default/files/documents/32186-doc-towards_the_african_integrated_high_speed_railway_network_aihsrn_development-e.pdf

water, and ICT [Information and Communications Technology] broadband infrastructure and services.

The AIHSRN Initiative will complement the Programme for Infrastructure Development for Africa (PIDA) and enable the realisation of the African-wide frameworks such as: Boosting of Intra-African Trade (BIAT), the Continental Free Trade Area (CFTA), the Comprehensive Africa Agricultural Development Programme (CAADP), the Accelerated Industrial Development for Africa (AIDA), and the African Mining Vision (AMV). The AIHSRN Initiative of Agenda 2063 will be developed with a phased approach, with the first phase – from 2013 to 2023 – setting out an Implementation Plan for two regional HSR pilot projects.

Africa Integrated High Speed Railway Network (AIHSRN)

AIHSRN envisions an integrated, cross-border, high speed railway network for the African continent.

The network is to be formed by a set of "individual" links that are to be built by respective sovereign states, who wish to be part of the continental network, entering into multinational treaties / cooperation agreements.

While the links are to be developed by cooperative footprint states individually, they will be constructed with a vision for future integration. This will be done under a common/harmonised transnational legal and regulatory framework – deemed generally accepted best practice transnational policy frameworks, such as those adopted by AUC/AUDA-NEPAD and Regional Economic Communities (RECs) (e.g. Abidjan-Lagos Corridor) for the management of corridors, and using recommended technical options and standards.

This Assignment supports the preparation and development of AIHSRN by providing the future vision of the network through the development of a master plan and recommendations for technical standards for transnational railway operation and preparing draft multinational treaties / cooperation agreements, among others.

1.2.2 Assignment Objectives and Scope

The stated objective of the Agenda 2063 – AIHSRN is:

To facilitate economic and physical integration of the Continent, by Year 2063 – within the context of Agenda 2063 development framework, and other AU strategic frameworks – NEPAD, PIDA, CFTA, AIDA, etc.

To assist the AIHSRN Initiative to achieve the above-stated objective, the Consultant conducted the following:

1. Review of Agenda 2063 AIHSRN (4x6 Network), consistent with the development principles of the AIHSRN

2. Development of the AIHSRN Master Plan for 2033 and 2043
3. Review of rail technologies and development of recommendations for the technical options and standards for AIHSRN
4. Development of recommendations on the transnational operations of AIHSRN
5. Assessment of financing options and delivery mechanisms for the master plans
6. Identification of environmental and social impacts and development of a checklist for mitigation and monitoring plans
7. Development of an implementation roadmap, including a National Readiness Strategy
8. Selection of two accelerated pilot projects and an additional 10 pilot projects to be supported by AUC and AUDA-NEAPD
9. For the two accelerated pilot projects specifically:
    1. Detailed scoping
    2. Development of financing strategy
    3. Preparation of the TOR for the next step, i.e. feasibility study
    4. Preparation of a draft multinational treaty / cooperation agreement
10. Development of a promotion video for AIHSRN.

Scope for Two Accelerated Pilot Projects

Based on the results of the Project Prioritization Framework (PPF) (see Appendix A for details), the following are selected as "**accelerated pilot projects**":

- Rail Links 35 & L36 (in combination): **Walvis Bay-Windhoek-Gaborone** (Rank 4 and 38 based on PPF), plus L37 Gaborone- Johannesburg (Ranked 14)[2]; and
- Rail Link 34 **Kigali-Dar es Salaam** (Rank 43), combined with Rail Link 72: **Kampala-Bujumbura** (Rank 5).

Detailed scoping was undertaken for:

- Rail Links 35 & L36 (in combination): **Walvis Bay-Windhoek-Gaborone**[3] (Rank 4 and 38); and

[2] Gaborone-Johannesburg was later added to capture higher levels of freight and passenger traffic at the request of AUDA-NEPAD.
[3] Included an extension from Gaborone to Mmamabula to capture potential export coal traffic.

- Rail Link 34 **Kigali-Dar es Salaam** (Rank 43).[4]

The scope of the desktop scoping studies included traffic, revenue and operating costs projections; environmental, economic and financial analysis; route identification and capital cost estimates; and legal and institutional analysis. *Details of analysis and findings are presented in Appendix B and Appendix C.*

For these links, based on the scale of investment required and estimated financial and economic returns, a **financing strategy** was also prepared. *The financing strategy is presented in Appendix D.*

Terms of Reference (TOR) for the next step, i.e. full feasibility study, were prepared for

- Walvis Bay-Windhoek-Gaborone[5]-Johannesburg; and
- Kampala-Bujumbura.[6]

The TORs are included in Appendix E and Appendix F.

Elements of the feasibility studies to be conducted include:

- Projections of traffic and revenues as well as operating and capital costs 40 years of operations under three scenarios;
- Preliminary design of fixed infrastructure;
- Development of plans for railway operations and maintenance; as well as detailing of requirements of rolling stock and systems;
- Preparation of an Environmental and Social Impacts Assessment (ESIA) and Resettlement Action Plan (RAP);
- Project structuring for government and private sector participation including legal, regulatory and institutional analysis;
- Financial and economic feasibility assessment; and
- Preparation of a roadmap for project execution and tender documents for the next phases of the project.

In addition, we have prepared **multinational treaties / cooperation agreements** for all six countries involved in the two accelerated pilot projects (i.e. Botswana, Burundi, Namibia, Rwanda, South Africa and Uganda). *The draft treaties / agreements are provided in Appendix G and Appendix H.*

[4] The scoping was limited to the Kigali-Dar es Salaam section and excluded the Kampala-Bujumbura because the study was to be based on available previous studies.

[5] Also includes line from Gaborone to Mmamabula to capture potential export coal traffic.

[6] The Kigali-Dar es Salaam section was studied at the full feasibility study level in 2019, thus excluded from the TOR for full feasibility study.

1.3 Structure of This Report

The remainder of the report is structured as follows:

- ***Chapter 2: AIHSRN Master Plan***, providing the Master Plans 2033 and 2043;
- ***Chapter 3: Technical Options and Recommendations***, which discusses the available technical options and recommendations for AIHSRN;
- ***Chapter 4: Transnational Operations of Railways***, which provides best practice on handling the key issues of transnational railways, such as contract of carriage, interoperability and border crossings from the legal perspective;
- ***Chapter 5: Financing Master Plan Implementation***, discussing available financing options that can be considered for AIHSRN;
- ***Chapter 6: Environmental and Social Impact Management***, which identifies at a high level the potential environmental and social impacts and provides a checklist for impact mitigation and monitoring;
- ***Chapter 7: Implementation Roadmap***, which provides implementation steps and national readiness strategy for involved countries to be prepared for AIHSRN development.
- ***Appendix A: Link Prioritisation Methodology, Its Results and Selection of Pilot Projects***, which describes the agreed project prioritisation framework (PPF) applied to rank AIHSRN links to select pilot projects and its results.
- ***Appendix B: Detailed Scoping of Accelerated Pilot Project: Gaborone-Walvis Bay***, providing detailed scoping for Gaborone-Walvis Bay.
- ***Appendix C: Detailed Scoping of Accelerated Pilot Project: Dar es Salaam-Kigali***, providing detailed scoping of Dar es Salaam-Kigali.
- ***Appendix D: Financing Strategy for Accelerated Pilot Projects***, which provides financing strategy for the two accelerated pilot projects.
- ***Appendix E: TOR for Feasibility Study for Johannesburg-Gaborone-Walvis Bay***, providing TOR for the next step, i.e. feasibility study for Gaborone-Walvis Bay.
- ***Appendix F: TOR for Feasibility Study for Kampala-Bujumbura***, providing TOR for the next step, i.e. feasibility study of Kampala-Bujumbura (as a feasibility study for Dar es Salaam-Kigali was conducted in 2019).
- ***Appendix G: Draft Multinational Treaty / Cooperation Agreement for Accelerated Pilot: Gaborone-Walvis Bay***, which provides a draft agreement for the countries involved in the development of Gaborone-Walvis Bay, i.e. Botswana and Namibia.
- ***Appendix H: Draft Multinational Treaty / Cooperation Agreement for Accelerated Pilot: Dar es Salaam-Kigali***, which provides a draft agreement for the countries involved

in the development of Dar es Salaam-Kigali and Kampala-Bujumbura, i.e. Burundi, Rwanda, Uganda and Tanzania.

- ***Appendix I: Narration of AIHSRN Promotion Video***, which provides the narrations used for the AIHSRN promotion video produced under this assignment.

2 AIHSRN Master Plan

2.1 Initial Vision for AIHSRN and Master Planning

At the beginning of the assignment, 74 links were identified from the initial vision of the 4x6 network to form Agenda 2063 Africa Integrated High Speed Rail Network (AIHSRN), to:

- Select two accelerated pilot projects and 11 additional pilot projects to be supported by AUC and AUDA-NEPAD; and
- Develop master plans for 2033 and 2043.[7]

Below provides the list of the links, immediately followed by a map. The geographic classification[8] is done in order to balance development across the region during the pilot project selection and when programming for the master plan.

Table 2-1: List of 74 Links

Link	Link Start and Finish	Length (km)	Geographic Classification
1	Alexandria, EGY - Benghazi, LBY	1,019	Northeastern and Northwestern & North Central

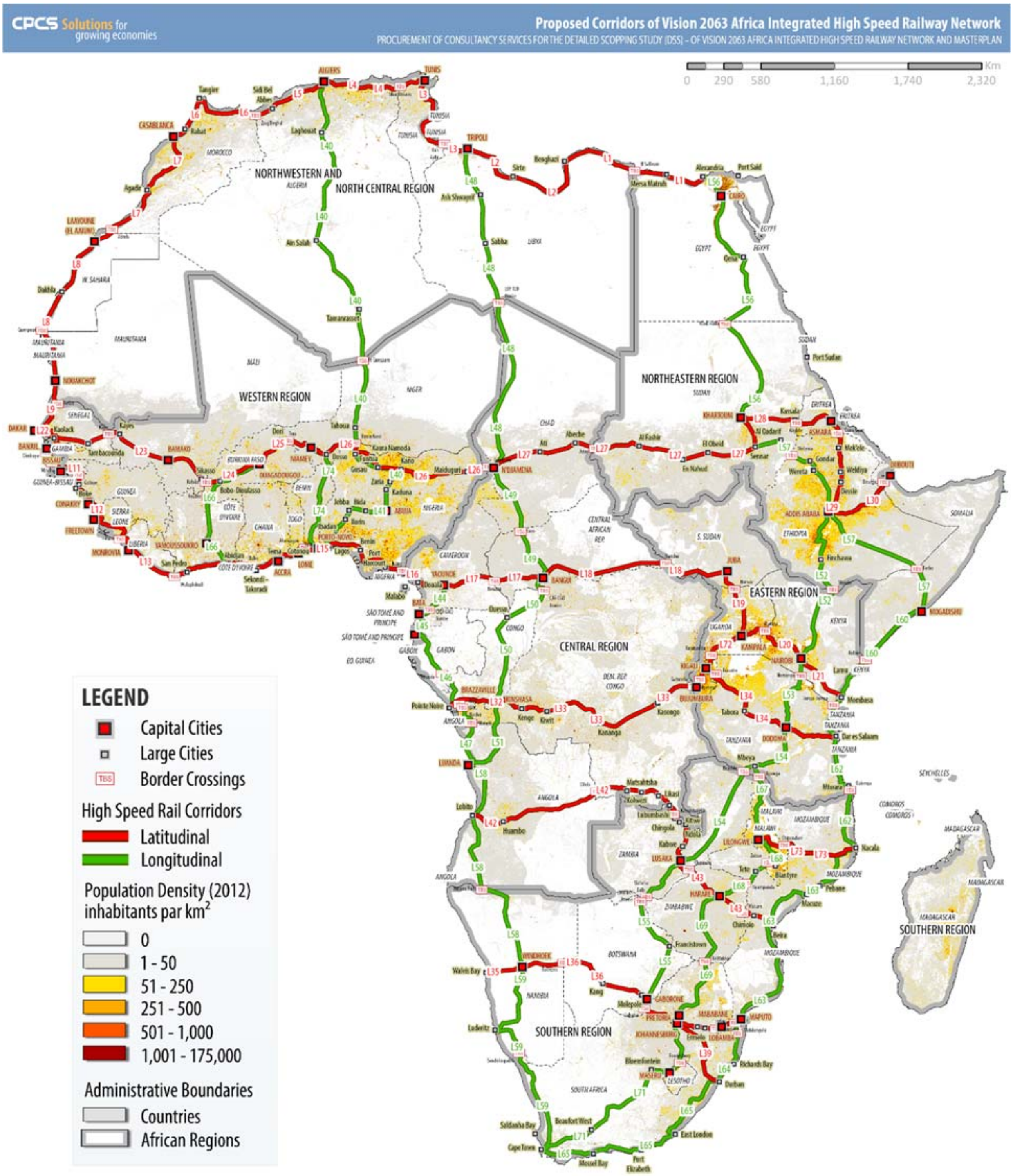
[7] The TOR for the assignment initially had a scope of programming in five 10-year phases up to 2063. However, it was agreed during the Draft Final Report Validation Workshop held in Johannesburg in April 2019 that the master plan be programmed for two 10-year phases up to 2043.
[8] The geographic classification groups African countries into six regions for the purpose of this study.

Link	Link Start and Finish	Length (km)	Geographic Classification
2	Benghazi, LBY - Tripoli, LBY	987	Northwestern & North Central
3	Tripoli, LBY - Tunis, TUN	764	Northwestern & North Central
4	Tunis, TUN - Algiers, DZA	700	Northwestern & North Central
5	Algiers, DZA - Sidi Bel Abbes, DZA	388	Northwestern & North Central
6	Sidi Bel Abbes, DZA - Casablanca, MOR	901	Northwestern & North Central
7	Casablanca, MOR - Laayoune (El Aaium), ESH	1,058	Northwestern & North Central
8	Laayoune (El Aaium), ESH - Nouakchot, MRT	1,152	Northwestern & North Central
9	Nouakchot, MRT - Dakar, SEN	523	Northwestern & North Central and Western
10	Dakar, SEN - Banjul, GMB	434	Western
11	Banjul, GMB - Conakry, GIN	753	Western
12	Conakry, GIN - Monrovia, LIB	796	Western
13	Monrovia, LIB - Abidjan, CIV	903	Western
14	Abidjan, CIV - Accra, GHA	508	Western
15	Accra, GHA - Lagos, NGA	534	Western
16	Lagos, NGA - Douala, CMR	934	Western and Central
17	Douala, CMR - Bangui, CAF	1,066	Central
18	Bangui, CAF - Juba, SSD	1,551	Central and Eastern
19	Juba, SSD - Kampala, UGD	672	Eastern
20	Kampala, UGD - Nairobi, KEN	627	Eastern
21	Nairobi, KEN - Mombasa, KEN	459	Eastern
22	Dakar, SEN - Tambacounda, SEN	447	Western
23	Tambacounda, SEN - Bamako, MLI	700	Western
24	Bamako, MLI - Ouagadougou, BFA	835	Western
25	Ouagadougou, BFA - Niamey, NER	523	Western
26	Niamey, NER - N'Djamena, TCD	1,630	Western and Central
27	N'Djamena, TCD - Khartoum, SDN	2,396	Central and Northeastern
28	Khartoum, SDN - Asmara, ERI	742	Northeastern
29	Asmara, ERI - Addis Ababa, ETH	771	Northeastern
30	Addis Ababa, ETH - Djibouti, DJI	637	Northeastern
31*	Pointe Noire, CGO - Brazzaville, CGO	398	Central
32*	Brazzaville, CGO - Kinshasa, DOC	19	Central
33+	Kinshasa, DOC - Bujumbura, BDI	1,338	Central and Eastern
34	Kigali, RWA - Dar es Salaam, TZA	1,476	Eastern
35	Walvis Bay, NMB - Windhoek, NMB	269	Southern
36	Windhoek, NAM - Gaborone, BOT	1,026	Southern
37	Gaborone, BOT - Johannesburg, SAF	348	Southern

Link	Link Start and Finish	Length (km)	Geographic Classification
38	Johannesburg, SAF - Maputo, MOZ	524	Southern
39	Pretoria, SAF - Durban, SAF	626	Southern
40	Algiers, DZA - Abuja, NGA	3,428	Northwestern & North Central and Western
41	Abuja, NGA - Lagos, NGA	683	Western
42	Lobito, AGO - Lusaka, ZMB	2,253	Central and Southern
43	Lusaka, ZMB - Beira, MOZ	818	Southern
44	Yaounde, CMR - Bata, GNQ	353	Central
45	Bata, GNQ - Libreville, GBN	241	Central
46	Libreville, GBN - Pointe Noire, CGO	764	Central
47	Pointe Noire, CGO - Luanda, AGO	694	Central
48	Tripoli, LBY - N'Djamena, TCD	2,437	Northwestern & North Central and Central
49	N'Djamena, TCD - Bangui, CAF	1,019	Central
50	Bangui, CAF - Brazzaville, CGO	536	Central
51	Brazzaville, CGO - Luanda, AGO	694	Central
52	Addis Ababa, ETH - Nairobi, KEN	1,416	Northeastern and Eastern
53	Nairobi, KEN - Dodoma, TZA	623	Eastern
54	Dodoma, TZA - Lusaka, ZMB	1,464	Eastern and Southern
55	Lusaka, ZMB - Gaborone, BOT	1,309	Southern
56	Alexandria, EGY - Khartoum, SDN	2,196	Northeastern
57	Khartoum, SDN - Mogadishu, SOM	2,336	Northeastern
58	Luanda, AGO - Windhoek, NAM	1,882	Central and Southern
59	Windhoek, NAM - Cape Town, SAF	1,632	Southern
60	Mogadishu, SOM - Mombasa, KEN	970	Northeastern and Eastern
61	Mombasa, KEN - Dar es Salaam, TZA	370	Eastern
62	Dar es Salaam, TZA - Nacala, MOZ	986	Eastern and Southern
63	Nacala, MOZ - Maputo, MOZ	1,993	Southern
64	Maputo, MOZ - Durban, SAF	526	Southern
65	Durban, SAF - Cape Town, SAF	1,582	Southern
66	Ouagadougou, BFA - Abidjan, CIV	1,120	Western
67	Mbeya, TZA - Lilongwe, MLI	631	Eastern and Southern
68	Lilongwe, MLI - Harare, ZIM	851	Southern
69	Harare, ZIM - Johannesburg, SAF	1,221	Southern
70	Johannesburg, SAF - Maseru, LSO	412	Southern
71	Maseru, LSO - Cape Town, SAF	1,135	Southern
72+	Kampala, UGD - Bujumbura, BDI	596	Eastern
73	Lilongwe, MLI - Nacala, MOZ	814	Southern
74	Niamey, NER - Cotonou, BEN	955	Western

*Links 31 and 32 will be treated as a single link in our analysis.
+ Link 33 was originally Kinshasa-Kigali, and Link 72 was Kampala-Kigali during Step 1 of this assignment. The links have been adjusted as shown in the table above based on the consultations with the client to better link Burundi to the network.
Source: CPCS, based on Agenda 2063 Africa Integrated High Speed Network (AIHSRN) 4x6 network concept.

Figure 2-1: Initial Vision of Africa Integrated High Speed Railway Network



Source: CPCS.

From the initial 4x6 network, the links that meet the agreed objectives discussed below have been selected (with some adjustments and additional links based on the reality on the ground based on the recommendations from AUDA-NEPAD and technical validation workshops) to form the Master Plans 2033 and 2043.

2.2 AIHSRN Agreed Objectives

The long-term mandate of AIHSRN is to facilitate economic and physical integration of the continent. Thus, there are four main objectives that the AIHSRN should endeavour to fulfil in the long term,[9] as follows:

1. Connect landlocked countries to sea ports;
2. Provide interconnections between different regions/parts of African continent;
3. Establish “Trans-Africa beltways”, similar to Trans African Highways (TAH), while also filling transport infrastructure gaps in key transport corridors; and
4. Connect all political and economic capitals.

Each of the objectives is explained below.

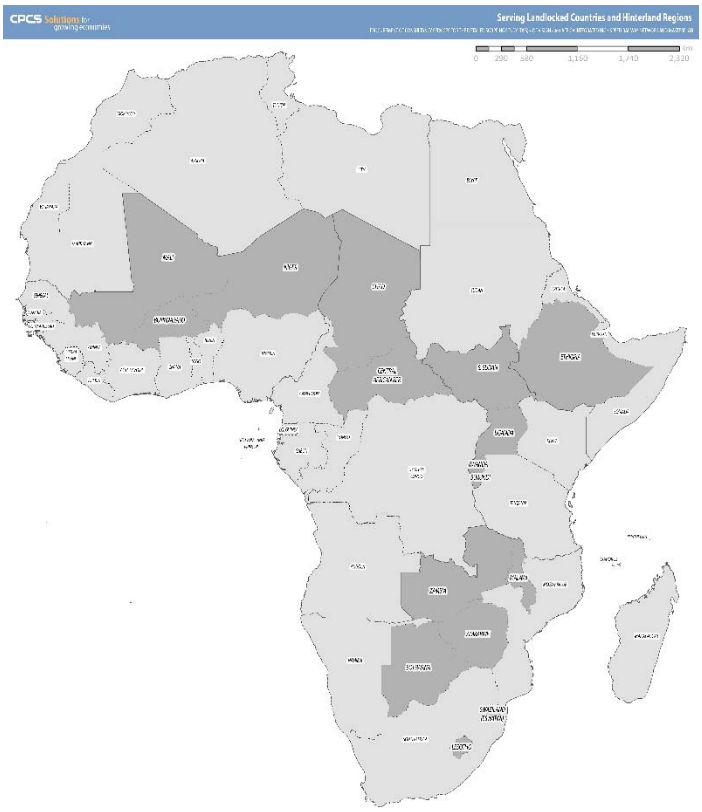
2.2.1 Connecting Landlocked Countries to Sea Ports

Railways in Africa were largely built by colonial powers for the extraction of resources from the hinterlands. The politics and economics that determined the railway routes also determined the country borders that are in place today. There are 16 landlocked countries in Africa as shown in the map on the right.

To provide landlocked countries with rail access to the sea, multi-country initiatives and investments are needed.

The following presents the list of links that will provide access between landlocked countries without existing rail service and sea ports.

Figure 2-2: Landlocked Countries



Source: CPCS

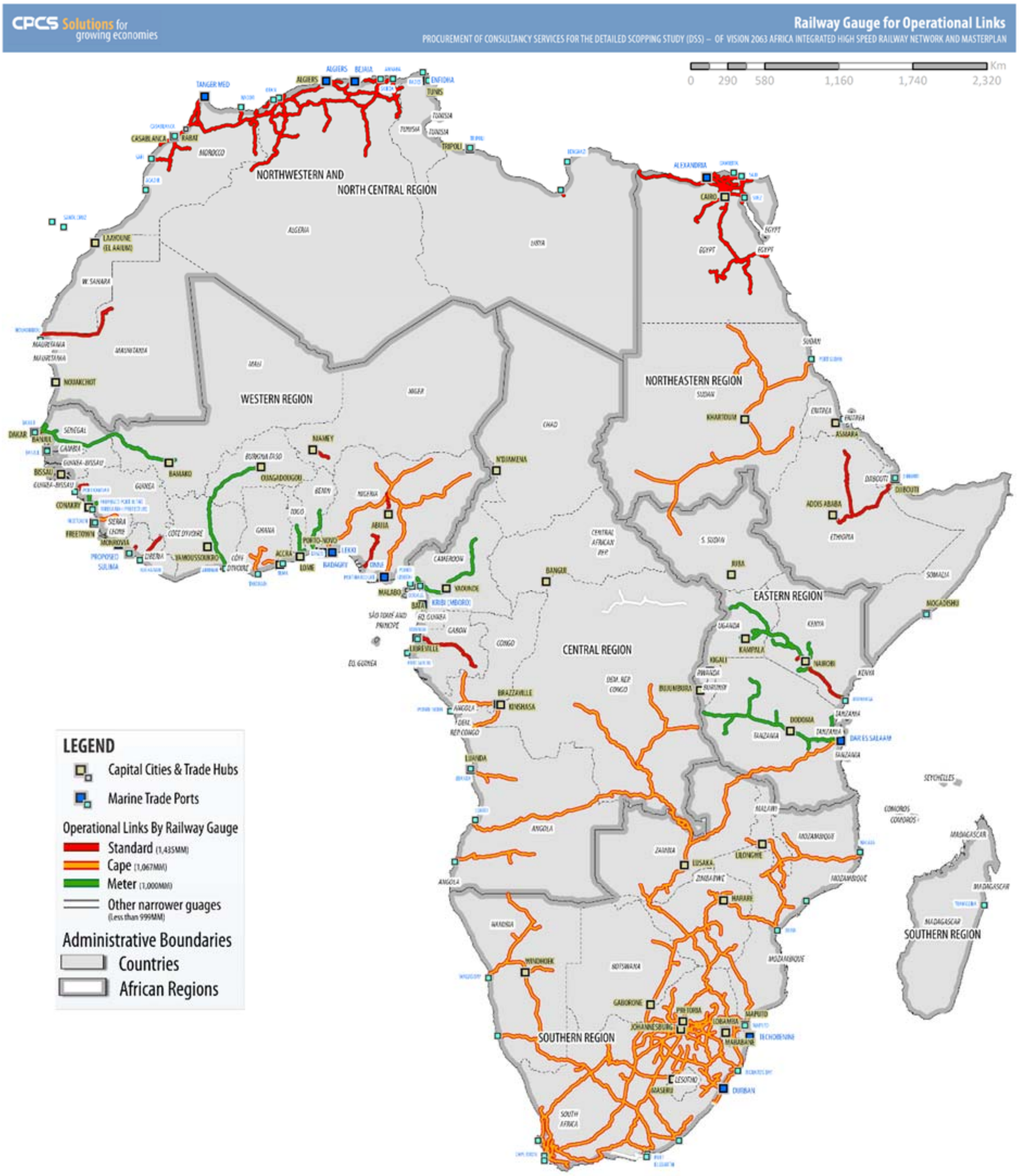
[9] These objectives of AIHSRN have been discussed and agreed upon during the Draft Final Report Validation Workshop held in Johannesburg in April 2019.

2.2.2 Connecting Regions

Many regions of Africa have existing railway networks with active or past connectivity between countries. However, no existing rail lines are fully operational connecting different regions of Africa.

For continent-wide integration of railways to be a reality, there is a need for connecting the different regions of Africa.

Figure 2-3: Existing Railway Network of Africa



Source: CPCS

2.2.3 Establishing Trans-Africa Beltways ("Land Bridges")

A rail "land bridge" by definition is rail transport of freight traffic between ports on either side of a land mass, for the traffic to go from sea to a land bridge, then back to sea by cutting through the land in the middle (thus the railway is the infrastructure bridging the two ports). Such a land bridge can be optimised as a multi-modal railway/ road/ pipeline and fibre connectivity.

However, with today's marine shipping, which is substantially cheaper than land transport for freight for long distances, it is unlikely that a lot of cargoes would travel from sea, land on a port on one side of the continent, travel on railways to a port on the other side of the continent, then continue their journey on sea.

There are, nevertheless, benefits in looking at these east-west and north-south "land bridges" in this master planning because they:

- Largely conform to the routes of the Trans-African Highways and other recognised trade and transport corridors of the continent, such as Trans-Kalahari Corridor and Central Corridor; thus they will also help fill the missing infrastructure gaps in the key corridors.
- Are already widely recognised corridors and reconfirming them as the key transport corridors of the continent will help guide rail infrastructure development activities at the regional and country levels going forward.
- Will provide landlocked countries with multiple access to sea (alternative routes for imports and exports), reducing landlocked countries' dependency on a single corridor.
- Will connect different regions of the continent through major sea ports, opening up the possibility of cargo landing at a port in one region to travel to another region (e.g. cargo landing in Mombasa to travel to N'Djamena) when it is more efficient in terms of time and cost (this will depend on what may be going on with other route options).
- Will help facilitate broader intra-regional trade on the continent.
- Will provide more corridor routing options to countries, potentially encouraging more competition among the corridors and gateway ports.
- Will open up the continent's hinterland to more development opportunities.

Filling Gaps in Continental Corridors

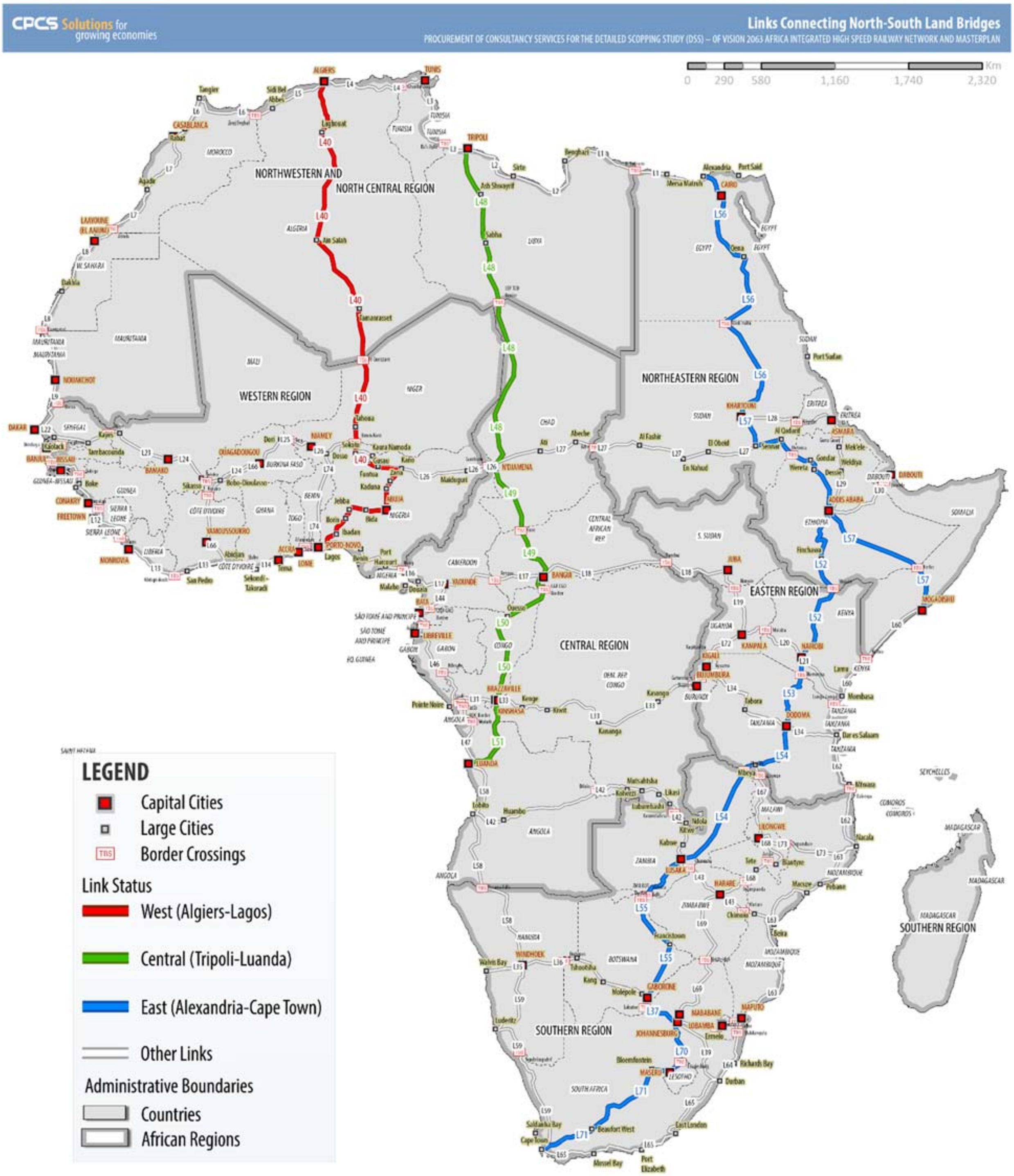
One of our mandates in Step 1 was to identify links that had higher chances of success. As such, links within existing transport corridors with functioning infrastructure would score better than those within corridors with little or no road infrastructure capacity or no rail infrastructure.

The East-West and North-South land bridges presented in this section largely conform to the key transport and trade corridors of the continent, and developing these links would fill the gaps in the continental corridors.

Figure 2-4: Links that Create East-West Land Bridges

Source: CPCS

Figure 2-5: Links that Create North-South Land Bridges



Source: CPCS

2.2.4 Connecting Political and Economic Capitals

Economic and physical integration of the continent can only be achieved if the network serves all political and economic nodes, and the network is developed in a geographically balanced manner.

2.3 Operating SGR and SGR at Advanced Stage as Building Blocks

The plan is to meet the first three objectives by 2033, and then to connect all capitals by 2043. A map is included on the following pages. It is envisaged that many lines will be developed before then and afterward that will be part of the AIHSRN. The map on the page that follows indicates what the network could look like with full development.

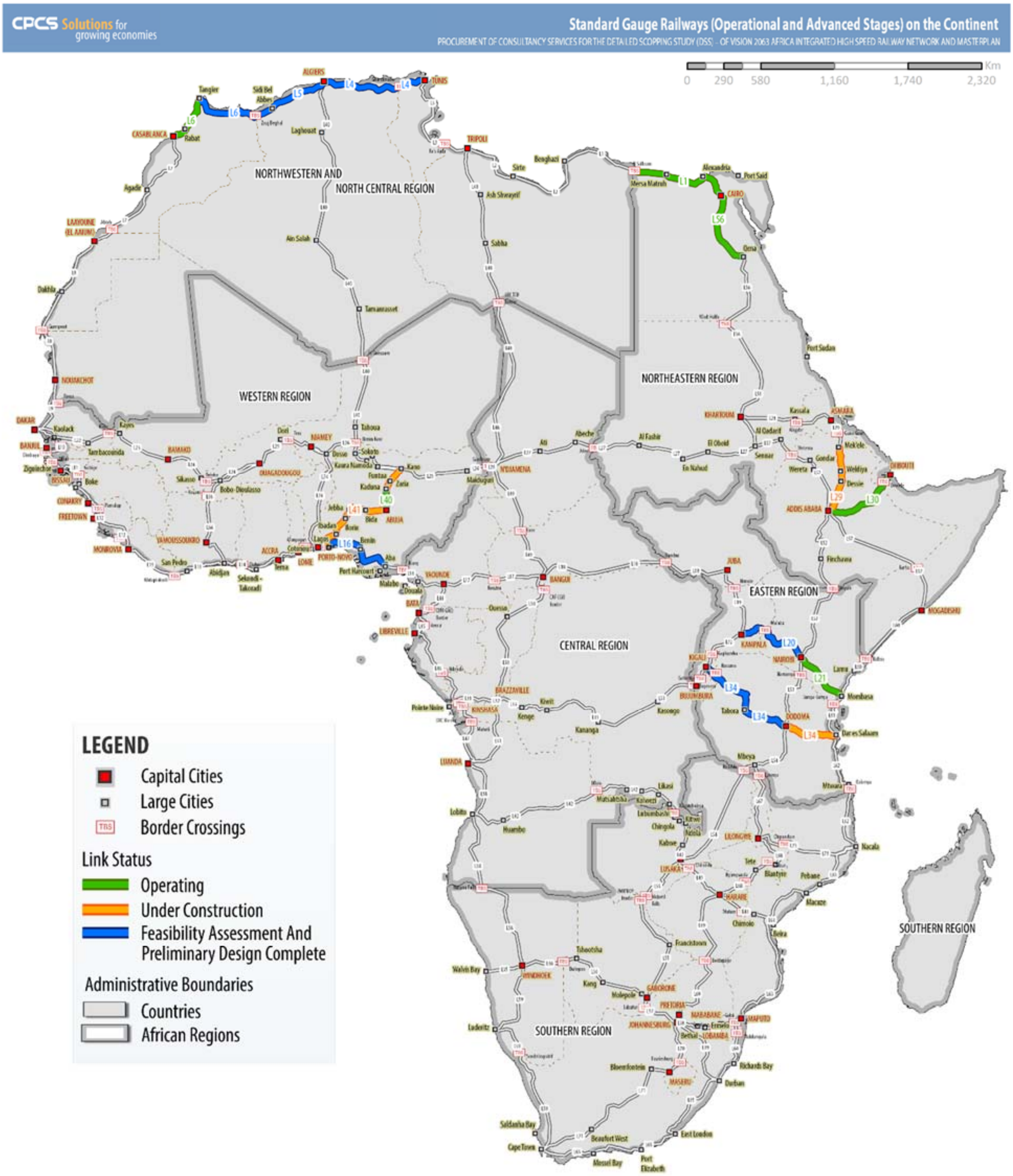
It should be noted that some of the links are currently operational or are in an advanced stage of development. These include the following links, and **they will be the building blocks of AIHSRN.**

Table 2-2: Standard Gauge Railways on Continent – Both Operating and In Advanced Stages of Development That Can Be Part of AIHSRN

Links	Region	Comment
Rail Link 1Alexandria, EGY - Benghazi, LBY (Alexandria-Mursa Matruh Section)	Northeastern Region	Part (Alexandria-Mursa Matruh section) operating
Rail Link 6 Sidi Bel Abbes, DZA - Casablanca, MOR (Tangier-Casablanca Section)	Northwestern & North Central Region	Operating
Rail Link 20 Kampala, UGD - Nairobi, KEN	Eastern Region	Feasibility assessment and preliminary design complete
Rail Link 21 Nairobi, KEN - Mombasa, KEN	Eastern Region	Operating
Rail Link 29 Asmara, ERI - Addis Ababa, ETH (Mikelle-Addis Ababa Section)	Northeastern Region	Part (Mikelle-Addis Ababa section) under construction
Rail Link 30 Addis Ababa, ETH - Djibouti, DJI	Northeastern Region	Operating
Rail Link 34 Kigali, RWA - Dar es Salaam, TZA	Eastern Region	Part (Dar es Salaam-Makutupora section) under construction; feasibility study and preliminary design complete for Makutupora-Isaka section; SELECTED PILOT
Rail Link 40 Algiers, DZA - Abuja, NGA (Abuja-Kano Section)	Western Region	Part (Kaduna-Abuja section) operating; Part (Kano-Kaduna section) under construction
Rail Link 41 Abuja, NGA - Lagos, NGA	Western Region	Under construction
Rail Link 56 Alexandria, EGY - Khartoum, SDN (Alexandria-Qena Section)	Northeastern Region	Part (Alexandria-Qena section) operating

Source: CPCS analysis.

Figure 2-6: Standard Gauge Railways on Continent – Both Operating and In Advanced Stages of Development That Can Be Part of AIHSRN



Source: CPCS

2.4 AIHSRN Master Plan for 2033 and 2043

2.4.1 Master Plan 2033 and Pilot Projects

The Master Plan 2033 aims to meet the first three objectives:

1. Connect landlocked countries to sea ports;
2. Provide interconnections between different regions/parts of African continent; and
3. Establish "Trans-Africa beltways", similar to TAH, while also filling transport infrastructure gaps in key transport corridors.

In addition, some of the SGR links that are currently operational or are in an advanced stage of development are incorporated in the master plan.

Of the links selected for the Master Plan 2033, two are selected as accelerated pilot projects and 11 as additional pilot projects as presented below.

Table 2-3: Accelerated Pilot Projects and Additional Pilot Projects

No.	Pilot Projects	Country	REC Ownership	Comment
Accelerated Pilots				
1.	Rail Link 34 Kigali, RWA - Dar es Salaam, TZA (Eastern Region, MCA Rank 43) Rail Link 72: Kampala, UGD - Bujumbura, BDI* (Eastern Region, MCA Rank 5)	Burundi, Rwanda, Tanzania, Uganda	COMESA, EAC, ECCAS, IGAD, SADC	Selected based on PPF**
2.	Rail Link 36 Windhoek, NAM - Gaborone, BOT (Southern Region, MCA Rank 4) Rail Link 35 Walvis Bay, NMB - Windhoek, NMB (Southern Region, MCA Rank 38) Rail Link 37 Gaborone, BOT - Johannesburg, SAF (Southern Region, MCA Rank 14)	Botswana, Namibia, South Africa	SADC	Selected based on PPF; "Trans-Kalahari" L37 added to capture higher levels traffic at the request of AUDA-NEPAD.
Additional Pilots				
1.	Rail Link 20 Kampala, UGD - Nairobi, KEN (Eastern Region, MCA Rank 1)	Uganda, Kenya	COMESA, EAC, IGAD	Selected based on PPF
2.	Rail Link 66 Ouagadougou, BFA - Abidjan, CIV (Western Region, MCA Rank 6)	Burkina Faso; Ivory Coast	CEN-SAD, ECOWAS	Selected based on PPF

No.	Pilot Projects	Country	REC Ownership	Comment
3.	Rail Link 4 Tunis, TUN - Algiers, DZA (Northwestern & North Central Regions, MCA Rank 8) Rail Link 5: Algiers, DZA - Sidi Bel Abbes, DZA (Northwestern & North Central Regions, MCA Rank 53) Rail Link 6: Sidi Bel Abbes, DZA - Casablanca, MOR (Northwestern & North Central Regions, MCA Rank 20)	Algeria, Morocco, Tunisia	UMA, COMESA, CEN-SAD	Selected based on PPF; also promoted by UMA as "Trans-Maghreb"
4.	Rail Link 74 Niamey, NER - Cotonou, BEN (Western Region, MCA Rank 18)	Benin, Niger	CEN-SAD, ECOWAS	Selected based on PPF
5.	Rail Link 56 Alexandria, EGY - Khartoum, SDN (Northeastern Region, MCA Rank 41)	Egypt, Sudan	COMESA, CEN-SAD, IGAD	Selected based on PPF; also promoted by IGAD
6.	Rail Link 29 Asmara, ERI - Addis Ababa, ETH (Northeastern Region, MCA Rank 47)	Eretria, Ethiopia	COMESA, CEN-SAD, IGAD	Selected based on PPF
7.	Rail Link 43 Lusaka, ZMB - Beira, MOZ (Southern Region, MCA Rank 52)	Mozambique, Zambia, Zimbabwe	COMESA, SADC	Selected based on PPF
8.	Rail Link 17 Douala, CMR - Bangui, CAF (Central Region, MCA Rank 66)	Cameroon, Central African Republic	CEN-SAD, ECCS	Selected based on PPF
9.	Rail Link 49 N'Djamena, TCD - Bangui, CAF (Central Region, MCA Rank 67)	Chad, Central African Republic	CEN-SAD, ECCS	Selected based on PPF
10.	Rail Link 22 Dakar, SEN - Tambacounda, SEN (Western Region, MCA Rank 68) Rail Link 23 Tambacounda, SEN - Bamako, MLI (Western Region, MCA Rank 21)	Mali, Senegal	CEN-SAD, ECOWAS	Promoted by ECOWAS as "Dakar-Bamako"
11.	Rail Link 75 Lamu, KEN - Juba, SSD	Kenya, South Sudan	COMESA, EAC, IGAD	Added after Draft Final Report Validation Workshop held in Johannesburg in April 2019;

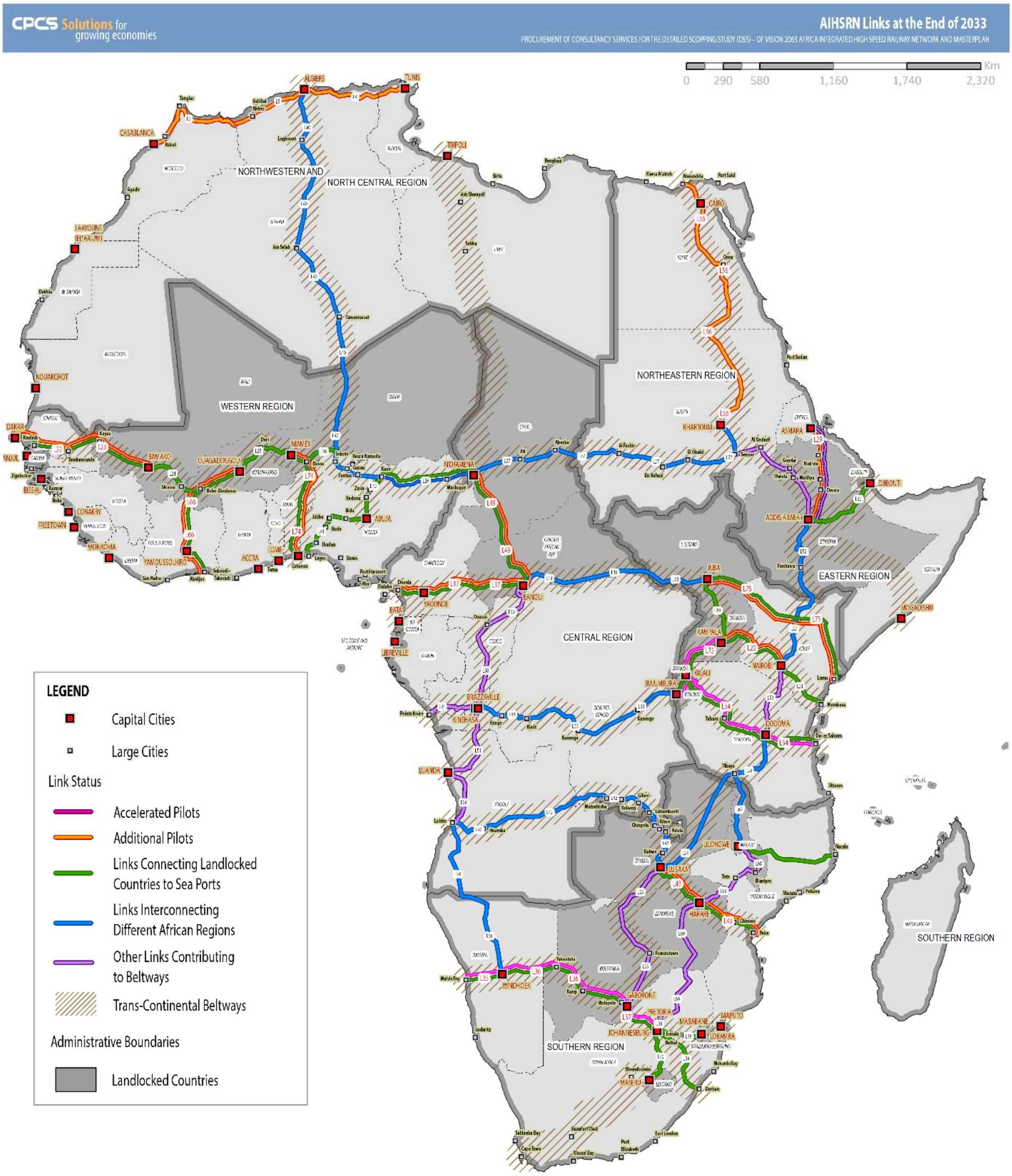
No.	Pilot Projects	Country	REC Ownership	Comment
				Promoted by IGAD

*Link 72 was Kampala-Kigali during Step 1 of this assignment. The links have been adjusted as shown in the table above based on the consultations with the client to better link Burundi to the network.
** The Project Prioritization Framework (PPF) and Multi-Criteria Analysis (MCA) conducted during Step 1 of this assignment are provided in Appendix A.
Source: CPCS

These links are to be supported by AUC / NEPAD-AUDA to be rapidly advanced.

The map below presents the Master Plan 2033, including two accelerated pilot projects and 11 additional pilot projects.

Figure 2-7: AIHSRN Master Plan 2033

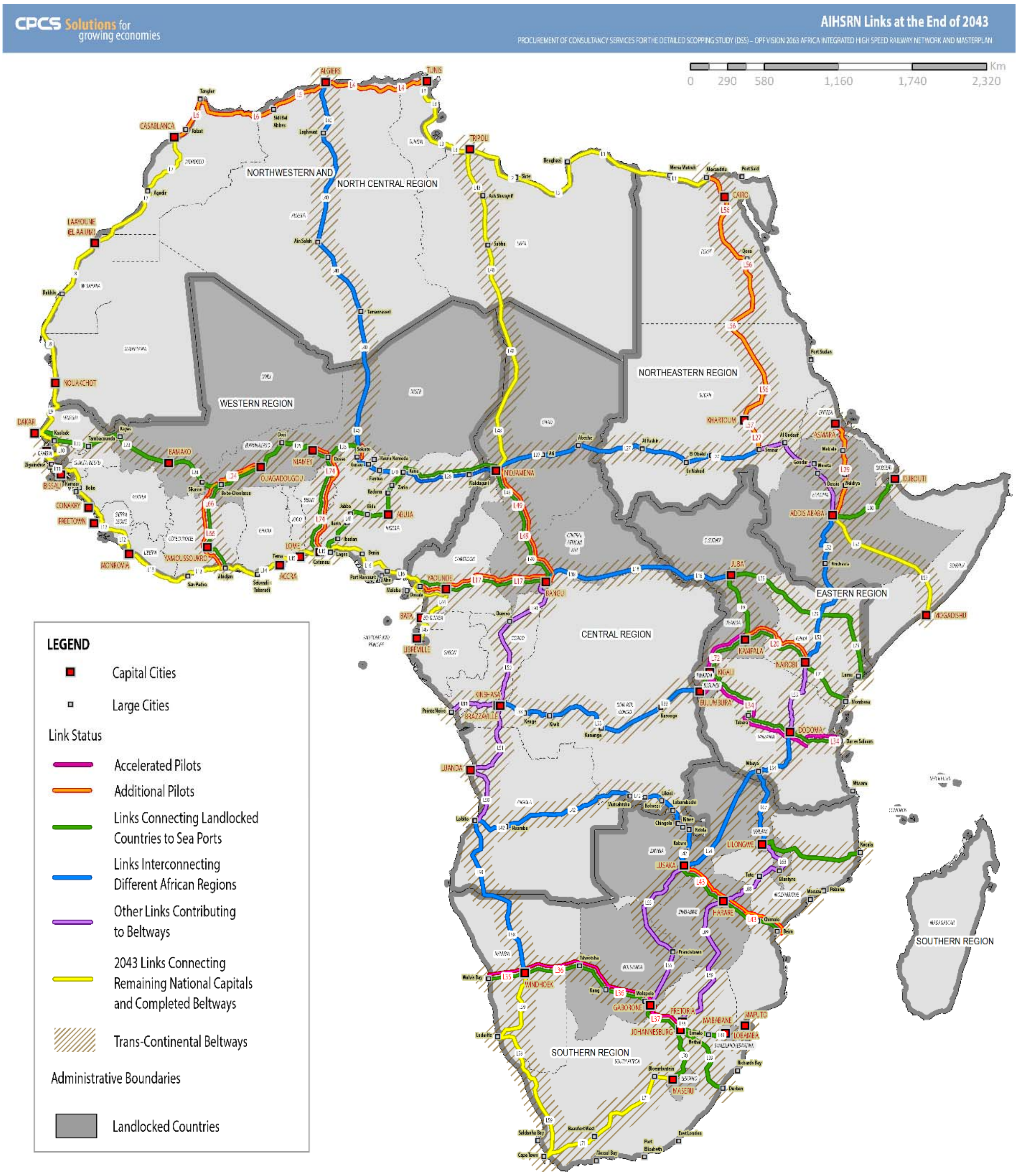


Source: CPCS

2.4.2 Master Plan 2043

The Master Plan 2043 aims to meet the fourth objective, which is to connect all political and economic capitals.

Figure 2-8: AIHSRN Master Plan 2043



Source: CPCS

2.4.3 Master Plan Link Summary

The table below provides the links included in the master plans.

Table 2-4: Master Plan Links

Link	Link Start and Finish	Length (km)	Comment
1	Alexandria, EGY - Benghazi, LBY	1,019	2043 Master Plan
2	Benghazi, LBY - Tripoli, LBY	987	2043 Master Plan
3	Tripoli, LBY - Tunis, TUN	764	2043 Master Plan
4	Tunis, TUN - Algiers, DZA	700	2033 Master Plan; one of the 11 additional pilot projects, combined with L5 and L6
5	Algiers, DZA - Sidi Bel Abbes, DZA	388	2033 Master Plan; one of the 11 additional pilot projects, combined with L4 and L6
6	Sidi Bel Abbes, DZA - Casablanca, MOR	901	2033 Master Plan; one of the 11 additional pilot projects, combined with L4 and L5
7	Casablanca, MOR - Laayoune (El Aaium), ESH	1,058	2043 Master Plan
8	Laayoune (El Aaium), ESH - Nouakchot, MRT	1,152	2043 Master Plan
9	Nouakchot, MRT - Dakar, SEN	523	2043 Master Plan
10	Dakar, SEN - Banjul, GMB	434	2043 Master Plan
11	Banjul, GMB - Conakry, GIN	753	2043 Master Plan
12	Conakry, GIN - Monrovia, LIB	796	2043 Master Plan
13	Monrovia, LIB - Abidjan, CIV	903	2043 Master Plan
14	Abidjan, CIV - Accra, GHA	508	2043 Master Plan
15	Accra, GHA - Lagos, NGA	534	2043 Master Plan
16	Lagos, NGA - Douala, CMR	934	2043 Master Plan
17	Douala, CMR - Bangui, CAF	1,066	2033 Master Plan; one of the 11 additional pilot projects
18	Bangui, CAF - Juba, SSD	1,551	2033 Master Plan
19	Juba, SSD - Kampala, UGD	672	2033 Master Plan
20	Kampala, UGD - Nairobi, KEN	627	2033 Master Plan; one of the 11 additional pilot projects
21	Nairobi, KEN - Mombasa, KEN	459	2033 Master Plan
22	Dakar, SEN - Tambacounda, SEN	447	2033 Master Plan; one of the 11 additional pilot projects, combined with L23
23	Tambacounda, SEN - Bamako, MLI	700	2033 Master Plan; one of the 11 additional pilot projects, combined with L22
24	Bamako, MLI - Ouagadougou, BFA	835	2033 Master Plan
25	Ouagadougou, BFA - Niamey, NER	523	2033 Master Plan
26	Niamey, NER - N'Djamena, TCD	1,630	2033 Master Plan
27	N'Djamena, TCD - Khartoum, SDN	2,396	2033 Master Plan
29	Asmara, ERI - Addis Ababa, ETH	771	2033 Master Plan; one of the 11 additional pilot projects

Link	Link Start and Finish	Length (km)	Comment
30	Addis Ababa, ETH - Djibouti, DJI	637	2033 Master Plan
31*	Pointe Noire, CGO - Brazzaville, CGO	398	2033 Master Plan
32*	Brazzaville, CGO - Kinshasa, DOC	19	2033 Master Plan
33+	Kinshasa, DOC - Bujumbura, BDI	1,338	2033 Master Plan
34	Kigali, RWA - Dar es Salaam, TZA	1,476	2033 Master Plan; one of the 2 accelerated pilot projects, combined with L72
35	Walvis Bay, NMB - Windhoek, NMB	269	2033 Master Plan; one of the 2 accelerated pilot projects, combined with L36 and L37
36	Windhoek, NAM - Gaborone, BOT	1,026	2033 Master Plan; one of the 2 accelerated pilot projects, combined with L35 and L37
37	Gaborone, BOT - Johannesburg, SAF	348	2033 Master Plan; one of the 2 accelerated pilot projects, combined with L35 and L36
38	Johannesburg, SAF - Maputo, MOZ	524	2033 Master Plan
39	Pretoria, SAF - Durban, SAF	626	2033 Master Plan
40	Algiers, DZA - Abuja, NGA	3,428	2033 Master Plan
41	Abuja, NGA - Lagos, NGA	683	2033 Master Plan
42	Lobito, AGO - Lusaka, ZMB	2,253	2033 Master Plan
43	Lusaka, ZMB - Beira, MOZ	818	2033 Master Plan; one of the 11 additional pilot projects
44	Yaounde, CMR - Bata, GNQ	353	2043 Master Plan
45	Bata, GNQ - Libreville, GBN	241	2043 Master Plan
48	Tripoli, LBY - N'Djamena, TCD	2,437	2043 Master Plan
49	N'Djamena, TCD - Bangui, CAF	1,019	2033 Master Plan; one of the 11 additional pilot projects
50	Bangui, CAF - Brazzaville, CGO	536	2033 Master Plan
51	Brazzaville, CGO - Luanda, AGO	694	2033 Master Plan
52	Addis Ababa, ETH - Nairobi, KEN	1,416	2033 Master Plan
53	Nairobi, KEN - Dodoma, TZA	623	2033 Master Plan
54	Dodoma, TZA - Lusaka, ZMB	1,464	2033 Master Plan
55	Lusaka, ZMB - Gaborone, BOT	1,309	2033 Master Plan
56	Alexandria, EGY - Khartoum, SDN	2,196	2033 Master Plan; one of the 11 additional pilot projects
57	Khartoum, SDN - Mogadishu, SOM	2,336	2033 Master Plan (Khartoum-Addis Ababa Section); and 2043 Master Plan (Addis Ababa-Mogadishu Section)
58	Luanda, AGO - Windhoek, NAM	1,882	2033 Master Plan
59	Windhoek, NAM - Cape Town, SAF	1,632	2043 Master Plan
66	Ouagadougou, BFA - Abidjan, CIV	1,120	2033 Master Plan; one of the 11 additional pilot projects
67	Mbeya, TZA - Lilongwe, MLI	631	2033 Master Plan
68	Lilongwe, MLI - Harare, ZIM	851	2033 Master Plan

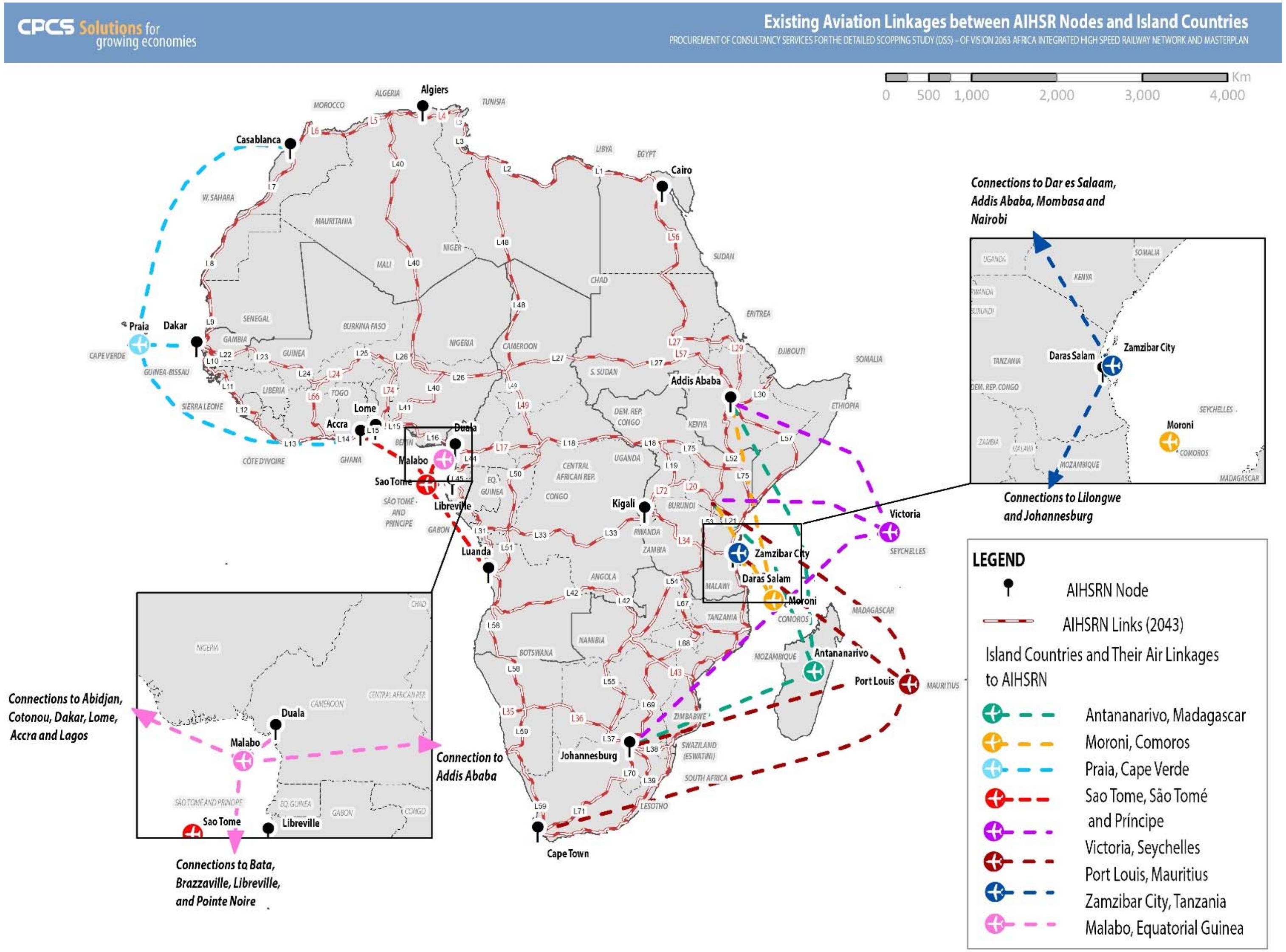
Link	Link Start and Finish	Length (km)	Comment
69	Harare, ZIM - Johannesburg, SAF	1,221	2033 Master Plan
70	Johannesburg, SAF - Maseru, LSO	412	2033 Master Plan
71	Maseru, LSO - Cape Town, SAF	1,135	2043 Master Plan
72+	Kampala, UGD - Bujumbura, BDI	596	2033 Master Plan; one of the 2 accelerated pilot projects, combined with L34
73	Lilongwe, MLI - Nacala, MOZ	814	2033 Master Plan
74	Niamey, NER - Cotonou, BEN	955	2033 Master Plan; one of the 11 additional pilot projects
75	Lamu, KEN - Juba, SSD	1,547	2033 Master Plan; added based on the discussion during the Draft Final Report Validation Workshop held in Johannesburg in April 2019

*Links 31 and 32 will be treated as a single link in our analysis.
+ Link 33 was originally Kinshasa-Kigali, and Link 72 was Kampala-Kigali during Step 1 of this assignment. The links have been adjusted as shown in the table above based on the consultations with the client to better link Burundi to the network.
Source: CPCS, based on Agenda 2063 Africa Integrated High Speed Network (AIHSRN) 4x6 network concept.

2.4.4 Integration of Island Countries to AIHSRN

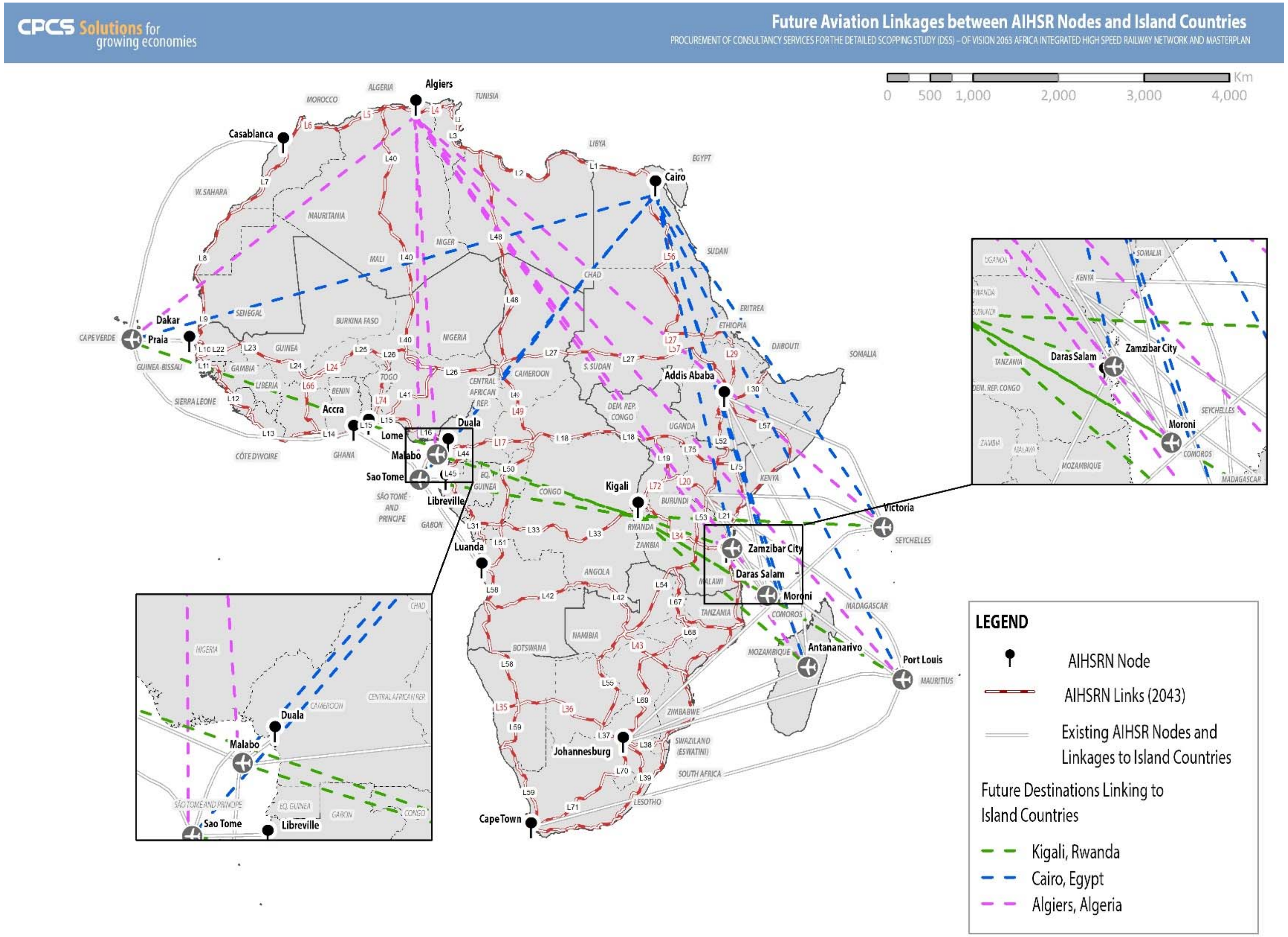
For the integration of Africa, it is also important that the island countries are connected. Based on the existing aviation routes, the following maps provide how the island countries' national capitals are and will be also integrated into AIHSRN.

Figure 2-9: Aviation Linkages between AIHSRN Nodes and Island Countries – Existing Linkages



Source: CPCS

Figure 2-10: Aviation Linkages between AIHSRN Nodes and Island Countries – Future Potential Linkages



Source: CPCS

3 Technical Options and Recommendations

3.1 Rail Transportation Options

3.1.1 AIHSRN Requirements

The objective of AIHSRN is to provide a network of rail links across the entire continent. To fulfill this, AIHSRN will need to satisfy a number of key requirements as presented below, which in turn will determine the preferred technology options for AIHSRN.

- Technologies and design criteria should fully sustain AIHSRN's objective to facilitate physical and economic integration of the continent.
- AIHSRN should satisfy all or a reasonable maximum share of transport demands that are likely to arise, particularly passenger traffic and freight transport over longer distances.
- Transit times for passenger travel from origin to destination should be competitive with air transport, at least across a typical range of travel distances.
- Freight transport should be competitive with road haulage, at least for a substantial share of market segments.
- Passenger fares and freight tariffs should be bearable and competitive, under varying market conditions across the continent. Investment, operation and maintenance are accordingly required to be cost effective.
- AIHSRN's network and technical configuration, as well as the market shares that AIHSRN will be able to gain, should constantly sustain its financial and economic feasibility.

- AIHSRN's network should ideally be interoperable, but should as a minimum enable uninterrupted transportation of goods across the entire continent.
- AIHSRN should at least enable proper interfaces with existing railway lines and should ideally be fully interoperable with existing railway lines where this is technically possible.
- AIHSRN should not start with an untested new technology but should use sufficiently proven systems.
- AIHSRN should not be based on proprietary technologies that are obtainable from only one or a small number of suppliers.
- AIHSRN's technologies and design criteria should enable incremental implementation.
- AIHSRN's technologies should remain available and upgradable also in the far future, and enable introduction of subsequent equipment generations without substantial reconfiguration.
- AIHSRN's technologies should not enforce unnecessary investments that are solely driven by technical properties (such as grade separation where not required); rather, investments should be driven by operational requirements or topographic constraints.
- AIHSRN should be attractive for donors of different origins, and thus its technologies should not be limited to those that are supported by only one or a small number of countries.
- AIHSRN's infrastructure should be constructible, its operation manageable and its equipment maintainable in countries with different skills levels and cultural environments.
- AIHSRN shall be environmentally friendly and on the other hand be able to sustain challenging climatic conditions of different types.

A range of technology options together with their merits and demerits is presented in the following section.

3.1.2 Technology Options

The following technologies have been considered for AIHSRN:

1. High speed rail
2. Semi-high speed rail
3. Conventional rail
4. High speed monorail systems
    a. Maglev
    b. Transrapid
5. Hyperloop

Each of them are discussed below.

1. High Speed Rail

High speed rail is the advanced development of conventional rail technology with standard gauge to maximum operating speeds of up to 350 km/h. Such speed levels are only achievable on new lines with extremely high standards for design and safety.

High speed lines are dependent on generous curve radii, which limits their adaptability to topography. High speed lines in other than flat terrain often comprise large amounts of viaducts, cuttings, bridges and tunnels, as required to accommodate the larger radii.

High speed lines are typically limited to passenger transport. Freight transport is normally not feasible with the potential exception of high-value, low-weight parcel and postal transport.

High speed rail requires generous curve radii whereas heavy freight rather limits gradients. A combination of both (almost tangent and almost flat) would obviously generate extraordinarily high construction costs, particularly in hilly terrains or where obstacles need to be bypassed.

High speed rail requires higher maintenance standards than conventional rail, with finer tolerances for rail profiles, more frequent inspections, etc. Higher-weight freight degrades rail systems quicker, but needs less precise tolerance for gauge, etc.

High speed lines with passenger service only typically use gradients of up to 35 ‰. A reasonable limit for freight train operation is rather around 12.5 ‰. Steeper gradients would theoretically be also possible for freight, but traction power, adhesion weight and energy consumption of locomotives, as well as tension forces on couplers, would become unreasonably high.

Another effect arises from their different speed profiles, and acceleration and deceleration properties. For any type of railway, the highest capacity can be achieved when trains have uniform speed profiles (e.g. all trains are slow freight trains or all trains are high speed trains). Mixing speed profiles has a highly negative effect on capacity – the larger the differences the less capacity is utilised. Larger speed differences between passenger and freight trains typically extend time slots for train operation, with negative effects on line capacity.

These effects together exclude in fact freight trains from high speed lines. As a consequence, most countries use their high speed lines only for passenger transport and refer freight to the existing, potentially upgraded, network.

High speed and conventional rail lines and rolling stock are principally compatible.

- Conventional rolling stock is generally able to use high speed lines despite limitations that may arise from different signalling technologies, axle loads and the like. It is, however, uncommon to operate slower passenger and freight trains on high speed lines due to the above reasons.
- Vice-versa, high speed rolling stock is typically compatible with existing networks, as long as the same track gauge is used. It is quite common that high speed trains enter conventional lines in order to reach destinations that are not (yet) part of the high speed rail network, as well as existing depots, stabling yards and maintenance workshops.

High speed rail is technically mature and is proven in many transport corridors in Europe, Asia and North Africa (Morocco), with many reference cases and numerous suppliers providing rolling stock and equipment. Both expansion of existing high speed rail networks and implementation of entirely new lines are under way.

High speed rail is built at standard gauge throughout the world, and road crossings are systematically grade separated. Further development may allow even speeds of up to 400 km/h.

In essence, most features of high speed rail would make it usable for AIHSRN. However, heavier freight transport would be excluded from high speed rail lines, and significant opportunities to connect Africa commercially and to generate freight revenue would be lost. High speed rail is therefore not suitable to become the standard system for AIHSRN. It may, however, be appropriate for a limited number of corridors where it is justifiable despite being limited to passenger transport.

2. Semi-High Speed Rail

Semi-high speed rail is also based on the adaptation of conventional rail, albeit up to operating speeds of around 240 km/h. This does not necessarily require new lines and is also achievable by upgrading of existing lines.

Below provides a number of examples of semi-high speed rail lines.

Table 3-1: Examples of Semi-High Speed Rail Lines

Line/location	Length (km)	Operating speed (km/h)
Northeast Corridor (Washington-Boston), USA	734	200 and 220 with short sections at 240
Berlin-Hamburg, Germany	384	230
Cologne-Aachen, Germany	70	250 / suburban 120
Gautrain (Johannesburg-Pretoria), South Africa	80	160

Source: CPCS

With the exception of Gautrain, the lines above are used by both passenger and freight trains and can also be shared by suburban passenger services (Gautrain is exclusively suburban passenger service).

Combining passenger and freight traffic is a typical feature of semi-high speed lines. The limited spread of train speeds (passenger trains with typical speeds as above and freight trains with 100-120 km/h) allows the lines to be built in a technically and economically feasible manner. Alignment design can typically be done in a way that avoids unreasonable restrictions and unreasonably high cost. In the case of greenfield, we recommend selecting an alignment that would not preclude conversion to high speed operation in the future.

As for semi-high speed rail, consecutive train runs of faster passenger and slower freight trains would still require extended time slots to avoid conflicts; it still has negative effects on line capacity but to a much smaller extent than high speed rail. A common principle for operation is therefore to separate passenger and freight trains time-wise, with passenger trains primarily at day time and freight trains primarily at night time.

Modest speed differences between passenger and freight trains would also allow balancing superelevation in curves and limiting wear and tear of rail and wheels.

Superelevation is the height of the top of the outer rail in a curve relative to that of the inner rail. It is intended to balance lateral acceleration in curves, and ideally reduce lateral acceleration of a train to zero. Lateral forces between rails and wheels – which generate wear on wheels and rails – would also be zero. This would however only be achievable for exactly one speed. If both faster (passenger) and slower (freight) trains use the same line, a compromise has to be found. The smaller the speed difference is, the lower the unbalanced lateral acceleration and, accordingly, less wear will result. In addition, heavier axle loads of freight trains have to be considered in order to find an optimum. This is realistically achievable under the conditions of semi-high speed rail.

Semi-high speed rail is technically mature. It is used on all continents and is globally on the rise. Equipment is obtainable from a large number of suppliers, both global players and smaller firms with local origins and focus. Semi-high speed rail is built throughout the world both as new lines and as improvements of existing conventional lines.

Semi-high speed rail suits both passenger and freight transport, and due to its lower cost and greater market share it promises a much better cost benefit ratio than high speed rail. It complies accordingly much better with the requirements of AIHSRN and has much greater potential to become its standard technology.

3. Conventional Rail

State-of-the-art conventional rail is not more and not less than a modern and cost-effective version of the traditional key technologies of railways. Conventional rail is used for speeds of up to 160 km/h for passenger and up to 120 km/h for freight trains. It provides fairly great flexibility of alignment design (curvature and gradients). Track is relatively easy to build and maintain, conventional signalling systems can be used, and road crossings can typically be at level.

The suitability of conventional rail to AIHSRN is limited by its low speeds. There may, however, be cases where conventional rail can as an exception become part of AIHSRN, e.g. where passenger demand and travel time expectations are low (e.g. in sparsely populated areas), where freight is dominating and passenger traffic is marginal, or where extraordinary topographic challenges would otherwise create unreasonably high cost.

Conventional rail is used worldwide. Expansion and upgrading of existing and implementation of new lines are ongoing in many places. Equipment is obtainable from a large number of suppliers, both global players and smaller firms with local origins and focus. Conventional rail is built throughout the world in many different gauges, from metre (1,000 mm) and cape gauge (1,067 mm) to Iberian (1,668 mm) and Indian (1,676 mm) broad gauge. Road crossings can generally be level.

Conventional rail is fully mature and is the technical basis for all systems with semi-high speeds. It would satisfy the majority of AIHSRN requirements. Its maximum speed would, however, not comply with long-term expectations of travel time for passenger services, and therefore compromise the objective of connecting the continent. Conventional rail may nevertheless be used in certain corridors where heavy cargo dominates (such as links between mines and harbours through less populated areas) or under other exceptional circumstances.

4. High Speed Monorail Systems

Monorail systems use a single metal or concrete beam instead of tracks and, for semi-high speeds, levitation instead of wheels. To overcome the limitations of the wheel/rail interface, air cushion suspension and magnetic levitation had originally been investigated. Air cushion suspension was tested up to 430 km/h, but no commercial system was developed. Magnetic levitation was developed to "**Maglev**" and "**Transrapid**" systems with a limited number of applications.

Such monorail systems:

- Enable speeds beyond high speed rail;
- Were exclusively developed for high speed passenger transport over longer distances;
- Are primarily intended for point-to-point connections in single corridors, rather than for complex networks;
- Were never intended for freight or short-distance passenger transport;
- Do not enable freight transport due to its larger weight and the accordingly much higher dynamic forces;
- Are not compatible with railways;
- Allow for small gradients, require high radii of curvature and grade separation throughout; and
- Are obtainable only from a very limited number of suppliers.

High speed monorail systems, therefore, do not satisfy a number of key requirements of AIHSRN.

Maglev

Maglev (derived from magnetic levitation) is proprietary technology which uses magnetically repelling forces between coils on board and in the guideway. Maglev systems are under construction in Japan including a dedicated passenger high speed connection in the extremely busy Tokyo-Osaka corridor. Operational speeds will be up to 500 km/h. A track section is available for real size tests which will later become part of the line.

Maglev is obtainable only from a very limited number of suppliers. It is only suited for fast passenger (and parcels) transport. Thus, it would not satisfy a number of key requirements of AIHSRN and is therefore not considered suitable for AIHSRN.

Transrapid

Transrapid is proprietary technology, which uses magnetically attracting forces between coils on board and steel slabs in the guideway. Transrapid is in revenue operation in China including operations between Shanghai and its main airport over a distance of about 40 km at 250 km/h.

It was tested up to 450 km/h. There are currently activities for further development towards 600 km/h in China.

Transrapid is obtainable only from a very limited number of suppliers. It is only suited for fast passenger (and parcels) transport. Thus it would not satisfy a number of key requirements of AIHSRN and is therefore not considered suitable for AIHSRN.

5. Hyperloop

Hyperloop is a concept for passenger transport at extremely high speeds. In its present configuration, passenger cabins (28 passengers, larger cabins for cars are considered) are moved through evacuated steel tubes (1/1,000 of atmospheric pressure), propelled by linear motors and guided and levitated by combined effects of air cushions and aerodynamic lift. Prospective speeds are estimated at up to 1,200 km/h. The present width of passenger cabins is approximately 1.35m.

Hyperloop is currently in the proof-of-concept phase, using reduced-scale models. Proposed applications include high speed links between Nevada and Los Angeles and between San Francisco and Los Angeles, among others.

Hyperloop may become an interesting concept for land-based passenger transport with very high speed potential, at least equivalent to subsonic air transport. However, up to now no full-scale demonstrator is under construction.

Hyperloop would, similar to the systems with magnetic levitation, require grade separation throughout, would not enable heavier freight transport (maximum size considered is passenger automobiles), is in an early conceptual phase and would only be obtainable from a very limited number of suppliers. It would, therefore, not satisfy a number of key requirements of AIHSRN and is not considered suitable for AIHSRN.

Technology Options Overview and Conclusions

A compilation of key criteria and their fulfilment is given in the table below.

Table 3-2: Comparison of Technology Options for AIHSRN

Criteria	High Speed Rail	Semi-High Speed Rail	Conventional Rail	Maglev / Transrapid	Hyperloop
Technically mature	++	++	++	-	-
Competitive speed	++	+	-	++	++
Combining passenger and freight traffic*	no	yes	yes	no	no
Interoperable with existing railways	yes 1)	yes 1)	yes 1)	no	no
Proven technology*	yes	yes	yes	limited	no
Not proprietary technology	yes	yes	yes	no	no
Incremental expansion possible	yes	yes	yes	yes	yes
Technology available in the long term	yes	yes	yes	unknown	unknown

Criteria	High Speed Rail	Semi-High Speed Rail	Conventional Rail	Maglev / Transrapid	Hyperloop
Competitive cost level	+	++	++	-	-
Fully interoperable network possible	**yes**	**yes**	**yes**	**yes**	**yes**
Attractive for donor countries	**yes** (several supply countries)	**yes** (many supply countries)	**yes** (many supply countries)	**limited** (few supply countries)	**limited** (few supply countries)
Locally manageable	**limited**	**yes**	**yes**	**no**	**no**
Climatically robust	**yes**	**yes**	**yes**	**unknown**	**unknown**

Source: CPCS

The system that fulfils the largest number of criteria is semi-high speed rail. Only rail systems have the potential to accommodate freight traffic, which is an essential requirement for AIHSRN. They also enable 'downgrading' for local distribution, connection of harbours, industrial sidings and the like, and enable door-to-door connections for freight transport.

We recommend **semi-high speed rail** as the preferred and basic standard system for AIHSRN, potentially with local applications of high speed or conventional rail, where driven by specific local or economic requirements.

3.2 Interoperability

3.2.1 Operating Requirements

The main objective of AIHSRN will be to facilitate economic and physical integration of the continent. This will include passenger and freight traffic unless they are technically or economically not feasible in certain corridors or regions.

Three key categories of traffic may therefore become target markets for AIHSRN, namely:

- High speed passenger traffic;
- Long-distance container traffic; and
- Long-distance conventional freight traffic.

They are addressed separately where appropriate.

Design speed of semi-high speed rail for AIHSRN is anticipated at up to 240 km/h. It might be varied in specific cases according to local conditions, both towards higher and lower levels. Semi-high speeds would respond to a combination of:

- Substantial passenger demand of time-sensitive nature and potential to afford correspondingly high fare levels, and
- Fewer demands for freight transport.

Variation of design speed should in no case compromise the integrity and interoperability of AIHSRN.

3.2.2 Standardisation and Interoperability

Operation of AIHSRN should be unconstrained across the entire continent without any national or technical barriers. It should, where reasonably possible, also be compatible with existing railway networks and thus be able to extend its area of influence.

It will, therefore, be necessary to develop a minimum set of common standards that are essential for interoperability across the entire network and to be applied on all lines without any modification.

The great diversity of its railway corridors may, however, not enable AIHSRN to be built and operated with fully identical standards across the entire continent. Adjustments of single parameters (such as design speeds, axle loads and train lengths) may be needed in exceptional cases, in order to reflect:

- Different transport markets;
- Different population densities;
- Different ambient and climatic conditions;
- Different topographic constraints;
- Different technical and economic capabilities of participating countries; and/or
- Different preferences for technologies and approaches.

Any adjustment or tailoring must not compromise interoperability across AIHSRN.

The following sections address the provisions for unlimited operation within the entire AIHSRN and interoperation with existing railway as far as they influence AIHSRN operational and technical criteria.

Criteria in the following are determined on a general, network-wide basis. They may later be adjusted and refined and will be applied to the HSR Pilot Projects once they are chosen.

Interoperability and Standardisation within AIHSRN

Although a train run 'Cape to Cairo' will be a very rare event, operability within the entire network should be unlimited in order to enable train runs across overlapping sections without change of technology.

Interoperability requires standardisation of certain design parameters across the entire AIHSRN.

The set of minimum standards for the network shall accordingly ensure a free flow of locomotives, trainsets, multiple units, coaches and wagons across the entire AIHSRN and avoid interchange or transhipment within the network. This, however, does not exclude the change of traction units at boundaries between electrified and non-electrified lines. A brief overview of standardisation requirements within AIHSRN is given in the table below. Further detail is, where appropriate, described in the system descriptions.

Table 3-3: AIHSRN Standardisation Requirements

System	Impact Where Not Interoperable	Importance to System Interoperability
Track gauge	Rolling stock cannot pass between lines	Critical
Axle load	Possibility that locomotives and loaded freight wagons cannot pass onto a line with lower permissible axle loads	Moderate
Structure gauge/ kinematic envelope	Possibility that locomotives and double-stacked wagons, and passenger coaches cannot pass onto a line with more restrictive structure gauge	Moderate
Signalling	Possibility that locomotives and operating employees (unless trained on both systems) cannot pass between lines	Moderate
Control & communication systems	Possibility that locomotives and operating employees (unless trained on both systems) cannot pass between lines	Moderate
Traction/Electrification	Locomotives from an electrified line will not be able to pass onto a line that is not electrified	Moderate
Overhead line and pantograph	Locomotives cannot pass between lines with different overhead and pantograph systems	Moderate
Couplers	Rolling stock cannot pass between lines with different coupler systems unless a transition wagon (wagon with different couplers at each end) is used.	High
Brakes	Rolling stock cannot pass between lines with different braking systems.	High

Source: CPCS

Track gauge is the only parameter that must in no case be deviated from. The other parameters are theoretically modifiable. Their modification, however, should be supported by a technical rationale.

Interoperability with Existing Railways

Interoperability of AIHSRN with the existing railway systems is seriously constrained by track gauge, as most of the current railway systems are of metre or cape gauges. Break-of-gauge has the least impact on passenger rail transport and has the most significant impact on bulk rail transport as explained below:

- Unlike freight traffic, passengers generally can easily move on their own at a station or international border. As such, the impact of a break-of-gauge rail passenger transport is quite manageable although it negatively impacts service quality and operating costs.
- For container transport, transhipment is possible with limited effort. It requires, however, special purpose yards and equipment where containers are transferred between trains, with corresponding costs. Containerisation is often chosen for safety and security (including protection against theft) reasons but also for reasons of transport time. The latter would obviously be affected by transhipment.
- For transport of bulk goods, transhipment or gauge change of rolling stock requires greater effort to move the freight from rail wagons of one line to the same or similar wagons of another. Transloading tends to be labour-intensive and typically requires

specialised handling equipment, not to mention two wagon fleets to move the goods from origin to destination.

Transloading of containers or bulk goods at a break-of-gauge is financially viable typically only with very long transit distances and when there is a large and regular flow of traffic (to justify the investment in rail wagons). It is unlikely that this will be the case with container traffic in Africa, and almost certainly not viable with bulk cargo.

3.2.3 Recent African Rail Projects

In general, most design parameters and standards used on recent rail projects have been the same, as indicated in the following table. In all cases, standard gauge was used. On two lines, design standards were Chinese as they were the primary funders and constructors of the line. Where Chinese standards were not used, the standards tended to be of an equal or higher standard.

Table 3-4: Standards of Recent Rail Projects in Africa

Railway	Dar es Salaam-Kigali (Tanzania to Rwanda)	Mombasa-Nairobi (Kenya)	Addis Ababa-Djibouti (Ethiopia to Djibouti)	Benin City-Obudu (Nigeria)
Stage	Partial - under construction; Partial - feasibility assessment complete	Operational	Operational	Feasibility assessment complete
Track gauge	Standard	Standard	Standard	Standard
Passenger Design (or maximum operating) speed (Km/h)	160	120	120	120
Freight Design (or maximum operating) speed (km/h)	120	80	80	80
Permissible (design) axle load (tonnes)	35	25	25	25
Kinematic envelope to permit double-stacked containers	yes	yes	yes	yes
Traction	Electric - Overhead 2x25 kV AC Auto-transformer	Diesel-electric with provisions for future electrification	Electric - Overhead 25 kV AC / 50 Hz	Diesel-electric
Signalling	Centralized Traffic Control (CTC) with ETCS/ERTMS based systems	Automatic Block System (ABS)	Semi-automatic and Automatic Block and ETCS Level 2	"Colour Light" Signalling System
Control & Communications	Railway (GSM-R) base stations and signalling system with continuous fibre optic system	Microwave backbone	Fibre optic based; fixed line and mobile telephones.	Microwave backbone system with on-board computer system
Crossing loops length / Design length of trains (m)	2,000	880	880	2,500
Couplers	Janney (AAR)	Janney (AAR)	Janney (AAR)	Janney (AAR)
Freight Train Brakes	Compressed Air	Compressed Air	Compressed Air	Compressed Air
Design standards	AREMA	National standards for PRC; China Railway Class I	National standards for PRC; China Railway Class II	TBD

Source: CPCS

3.3 Recommended Parameters and Standards

3.3.1 Recommendations Parameters and Standards

We recommend the following operating parameters and standards:

Table 3-5: Recommended Parameters and Standards

Parameter	Recommendation	Exception or further consideration
Gauge	Standard	With the possibility of dual gauge track on some lines
Design (and permissible) axle load	30 tonnes	Could be greater on lines where there is expected to be high levels of bulk traffic that is contained on the line
Passenger Train Length	600 metres	With significant flexibility permitted
Freight Train Length	2,000 metres	With significant flexibility permitted
Design Standards	AREMA or UIC	With consideration given to China Railway Class I
Structure Gauge	AAR plate C	Alternatively, a new standard that would meet or exceed the minimums of AAR (plate C), UIC, and GB/T standards
Diesel versus Electrification	Case-by-case basis	If a decision is made to opt for diesel operation from the outset, certain provisions should be made to implement electrification in the future
Electrification Traction Voltage	25 kV 50 Hz AC	In the event there is a decision to opt for electrification
Signalling & Control System	ETCS with the level determined by the specific operating requirements and environment	Alternative CBTC systems could also be considered. Flexibility needed to assure the most suitable technologies and to take advantage of future innovations and developments.
Communications System	GSM-R complemented by fibre-optic, VHF or UHF radio and microwave systems	Flexibility needed to assure the most suitable technologies and to take advantage of future innovations and developments.
Couplers (Freight trains)	Janney (AAR) couplers	-
Train Brakes (Freight trains)	Compressed Air	-

Source: CPCS

Each is discussed in the following sections.

3.3.2 Operating Parameters

Gauge

Standard gauge is the clear recommendation for AIHSRN. The only possible exception is rail lines in the Southern African Development Community (SADC) region given the scale and performance of the cape gauge network in the region. In the event that an exception is made in SADC, it should made with the stipulations that newly construction lines be:

- Operated as cape gauge only temporarily with the ultimate goal being operation as standard gauge; and/or

- The line be built as dual gauge track for operation of both metre and standard gauge trains.

In the case of temporary cape gauge operation, we recommend that the track be constructed as gauge convertible.

Axle Load

We recommend that the design (and permissible) axle load be set at no less than 30 tonnes/axle. Lines exclusively or largely for freight traffic could be designed for heavier axle loads.

Train Speed

Design (or maximum operating) speeds should be set in accordance with the intended purpose of the links as well as the terrain that it traverses. We recommend classifying links according to the intended purpose and setting design speeds accordingly, as follows:

- **Category A** – High speed, passenger trains only
  - Speed up to 320 km/h (or 330 km/h)
  - Gradient maximum 35 ‰, Radius minimum 10,000 m
- **Category B** – Semi-high speed, mix of passenger and freight trains
  - Speed up to 240 km/h for passenger service and up to 120 km/h for freight
  - Gradient maximum 12.5 ‰, radius minimum 5,000 m
- **Category C** – mainly or only freight trains
  - Speed up to 120 km/h
  - Gradient maximum 12.5 ‰, Radius depending on speed and terrain

There should be a fair amount of latitude for setting design speeds based on the specifics of the link.

Train Length

Design for train lengths of 750 m for freight and 400 m for passenger trains is current practice in Europe and may be used as a starting point. Freight train lengths tend to be significantly longer in North America, Australia and China. Longer freight trains can significantly improve the financial performance of a railway especially when labour is expensive or in limited supply. In addition, as longer trains will require fewer trains for the same amount of traffic, fewer (but longer) passing loops are required. The costs of extending passing loops and yard track for longer trains is higher once the rail line is operational. As such, we recommend that new railways be designed for freight train and passing loops lengths of 2,000 m. However, there is reason to permit flexibility based on the mix and make-up of freight and passenger traffic.

Passenger train length will determine the length of station platforms. We recommend a standard of 600 m with significant flexibility permitted on a case-by-case basis. In addition, we recommend platform heights of 550 mm above the top of rail.

Alignment Design Standards

The recommended standards for the design of fixed infrastructure is AREMA [American Railway Engineering and Maintenance-of-Way Association] or UIC [International Union of Railways]. The standard will dictate design parameters for horizontal curvature, vertical gradient, superelevation and other geometry elements based on the design speeds for the line.

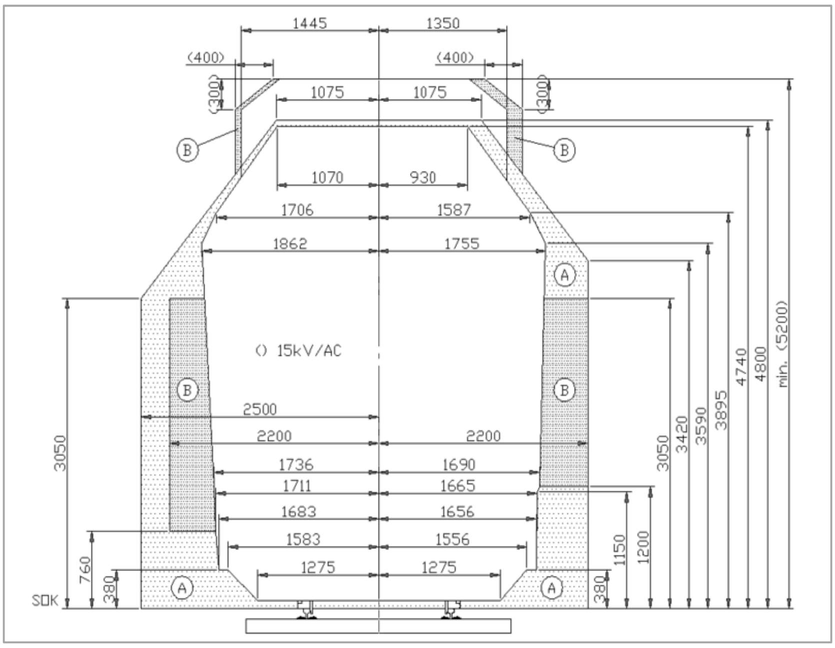
Structure Gauge

The structure gauge determines the cross section area that must not be infringed by buildings, any other constriction or equipment (such as signal heads). It is determined by:

- The maximum permissible kinematic envelope of trains, comprising their static contour and dynamic movements; and
- A certain clearance, as a tolerance between the kinematic envelope and the structure gauge.

The image below shows a typical structure gauge (outer contour) with the maximum kinematic envelope (inner contour) and the clearances as the differences between both.

Figure 3-1: Example of Kinematic Envelope and Structure Gauge



A standard structure gauge for AIHSRN needs to be defined to ensure interoperability of rolling stock. Its key parameters should originate from what is typically used in the railway industry and internationally common, with dimensions that promise best possible interoperability with existing standard gauge lines (both conventional and new).

A limited number of structure gauges are common in certain regions or continents. Typical examples are according to:

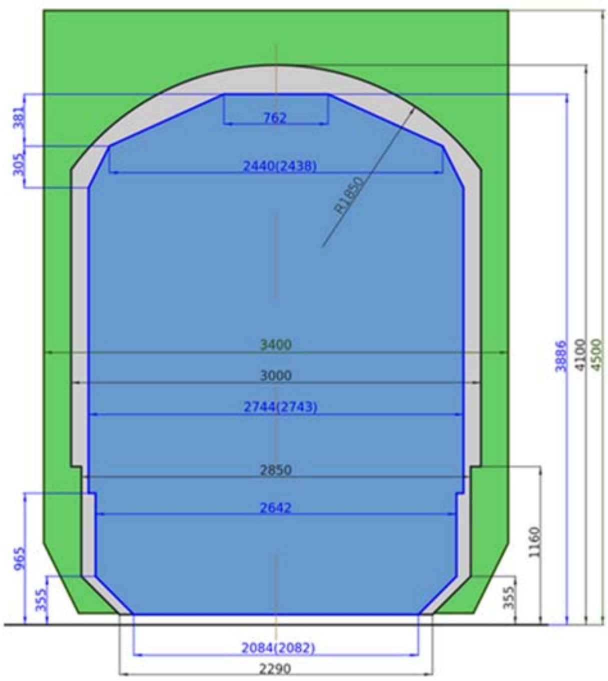
- UIC, used in Western and Eastern Europe, with local variation;

- OSShD [Organization for Cooperation of Railways, or OSJD], originating from the former Soviet Union and used in its successor countries and Finland;
- AAR [Association of American Railroads], used in North America; and
- GB/T, used in China, some neighbour countries and new investments built according to Chinese standards.

The lines between Addis Ababa and Djibouti and between Nairobi and Mombasa fall under the latter category with Chinese standards.

The three most commonly used structure gauges are shown below. The fourth, formerly Soviet one, is less common, particularly in terms of height (5.30 m), is much more demanding and is not used for lines outside its area of influence.

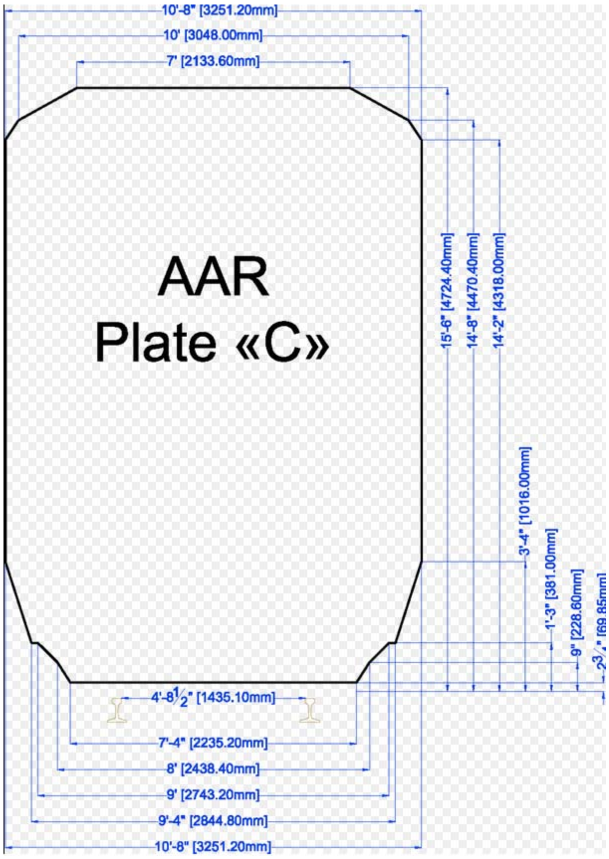
Figure 3-2: Most Commonly Used Structure Gauge



China

Structure gauge

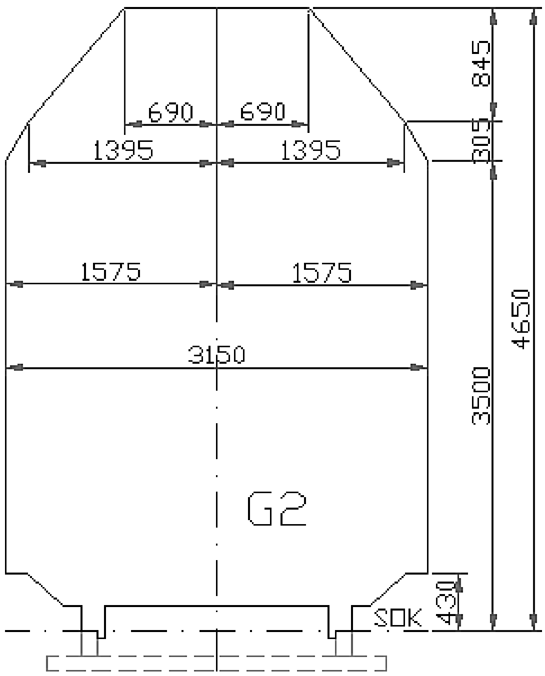
- height: 4.50 / 4.80 m
- width: 3.40 m



North America

Structure gauge

- height: 4.724 m
- width: 3.251 m



Europe

Structure gauge

- height: 4.65 m
- width: 3.15 m

The standard structure gauge for AIHSRN will need to be selected with great diligence. It will be necessary to study all existing lines, both conventional and new, with which AIHSRN may once interoperate, together with their operating conditions, typical rolling stock, kinematic envelopes and structure gauges. This will be required to ensure interoperability; even a small difference of a few centimetres can compromise interoperability

Considerations made and values given below are, therefore, provisional. They need to be scrutinised by further study as mentioned above, but should provide a provisional, robust order of magnitude.

- The standard width of AIHSRN's structure gauge may provisionally be set at 3.40 m as this is the largest value out of the above. It should also accommodate rolling stock, which was built with Chinese standards. Space for evacuation walkways is to be added where required.
- The greatest height out of the above is set by China at 4.80 m above top of rail. UIC and AAR (plate C) are similar at 4.65 m and 4.72 m, respectively. Rolling stock will in most cases be imported from countries outside Africa, and tunnel diameters are typically driven by height rather than width. It may be recommendable to provide sufficient space for double deck passenger trains, for which the European (UIC) structure gauge does not provide sufficient height. It may therefore be recommendable to use 4.80 m as a starting point.

Double stacking of containers, such as on the Nairobi-Mombasa line, should be foreseen as a standard feature. A matching structure gauge in the United States has a height of 6.15 m. The effect on tunnel diameters is more than obvious, and it would also make electrification more complicated (additional space is required, overhead line will be at least at 6.50 m above top of rail, and lateral movements of pantographs increase with height above top of rail). It is mainly for cost reasons that we do not recommended the entire AIHSRN to be designed for double stack container trains; we recommend that this be limited to the lines that require such capacity or where such operations (greater capacity trains and smaller number of trains to be run) is more economical. These will mostly be point-to-point connections.

3.3.3 Electrification

Diesel vs. Electric Traction

The decision whether or not to electrify a line typically follows multi-factorial considerations. Many inputs can vary with local conditions and/or market prices. The decision will therefore be on individual basis for each project. Approaches, criteria and methods, however, can (and should for comparability reasons) be standardised, which would result in a standardised cost benefit analysis.

Relative to diesel operation, electrification has high capital costs with lower annual operating costs. As such, significant revenues (from freight and/or passenger operations) are needed to justify the additional investment for electrification. (It should be noted that in high speed rail operations, electrification is the norm in order to meet train performance requirements). Typically, the unit capital costs of infrastructure and systems for electrification is in the range of US$0.35 million to US$2 million per track-km. Annual savings of electric operations versus that of diesel-electric depends on the costs of electricity versus diesel in the locality in that particular year.

It should be noted that most major freight networks of the world are not electrified, and that high freight volumes are required to financially justify electrification. Most significant among these are in Canada, Australia, US and Brazil. Counter examples are the Russian and Chinese networks which operate their heavy haul trains with electric traction. It is also important to note that many "green" technologies are in development and could offer cost-effective solutions to the AIHSRN in the not-so-distance future.

Electrification should be considered as an option for all AIHSRN lines, and decisions should be made for each line using a financial cost-benefit analysis.

As a principle, provisions for electrification should be made even if lines are intended to be diesel operated for an indefinite period. Provision, however, may be limited to elements that are expensive to retrofit if precautions are made. In particular:

- A strip of land should be set aside along alignments to later accommodate cables and poles and may already be constructed as part of the track substructure (particularly embankments and cuttings);
- Cable ducts and pole foundations should be included or their retrofit be prepared on bridges and viaducts; and
- Sufficient clearance above the track under bridges and in tunnels.

It may, according to local conditions, also be prudent to reserve land and building rights for intake and traction substations.

Standardisation

Electrification is unlikely to differ from international best practice. However, common standards for traction voltage and overhead line properties need to be defined in order to ensure interoperability of traction units. It is possible (but not desirable) for equipment to be equipped to operate under different systems, as units can be equipped to switch between different voltages, and/or use more than one set of pantographs. This is quite common in Europe where a great variety of systems exist and standardisation did not take place.

Traction energy can principally be obtained from local high voltage networks as long as quality and reliability requirements are met. Energy can be taken from the public grid and further be distributed by a railway-owned grid if required.

The public power supply company will have to ensure sufficient generation capacity in its power stations. Additionally specific characteristics of the railway load (fluctuating demand, current imbalance on the phases of the three-phase public grid) have to be taken into account.

Traction Voltage

Internationally, the most common traction voltages are:

- 1.5 and 3 kV DC;
- 15 kV 16⅔ Hz AC; and
- 25 kV 50 Hz AC.

DC systems with lower voltage require fairly heavy cables and generate significant electrical losses over longer distances. They are outdated and are replaced by AC systems with higher voltages in many countries. 16⅔ Hz systems are traditional in Europe; they are outdated and are internationally not used for new installations.

25 kV 50 Hz (sometimes 60 Hz) has become a standard for all new systems and also for all recent new lines in Africa. Equipment is available from a wide range of suppliers from different countries, and technology is proven under a great variety of ambient conditions. 25 kV 50 Hz is, therefore, recommended as the standard electrification system for AIHSRN.

Overhead Line

Mainline railways typically use overhead contact lines for traction power supply to rolling stock. Third rail is common only for suburban rail and metro systems, and not applicable under AIHSRN requirements.

Height and geometry of overhead contact lines vary between systems and nations, and standard values need to be determined for AIHSRN. Interoperability with existing and planned lines needs to be considered but may not become imperative for AIHSRN. Interoperation can be secured by second sets of pantographs, as commonly used in Europe, in case of different parameters.

For AIHSRN, a reasonable contact line height could be about 0.3 m above the kinematic envelope height. For stacked container trains this would be 6.50 m above top-of-rail.

The overhead contact line should be designed for operation with the 1,950 mm wide pantographs as defined in the Technical Specifications for Interoperability of European Railways. The pantograph should have pure carbon or metallised carbon contact strips for good current collection and low wear.

3.3.4 Signalling

General Principles

Railway signalling is comprised of technical equipment, which follows certain rules for operation. The primary purpose of railway signalling is the safe and economic operation of the railway. Its basic requirement is to prevent train collisions and to ensure safe speeds.

Signalling systems comprise equipment for train detection, for setting and modification of routes and for train operation management. Signalling has not left its ancient key principle to keep trains physically apart but has seen quite a number of recent innovations. It is likely that innovation will continue during AIHSRN implementation. It will accordingly be recommendable to: 1) determine a set of basic technologies that are unlikely to change over time; and 2) ensure upgradability of equipment.

The choice of signalling equipment should also follow particular conditions prevailing in some regions, such as long distances with few stations, unpopulated land, lack of communication infrastructure, challenging ambient conditions and also unauthorised removal. Any preferred system may therefore not too strongly rely on wayside infrastructure.

Conventional Systems

Conventional fixed block systems are used worldwide. They comprise fixed block sections, track occupancy detection devices and fixed wayside signals (or cab signals displaying the wayside signal aspect in the cabin for improved signal visibility). Signals, either trackside colour-light signals or cab signals on the driver's display, provide protection from undue entrance of a train into a block (e.g. protecting an already occupied block section). In the case a signal is passed, an automatic brake application will be triggered by the Automatic Train Protection (ATP) system (if the systems are so equipped). One block between two occupied blocks is kept empty, as safe distance between two consecutive trains. Block length normally is not shorter than the safe train braking distance. Provision must be made for the worst combination of parameters and line capacity limits particularly where semi-high speeds (with longer braking distances) or combinations of faster and slower trains are used.

Conventional systems are implemented worldwide and manageable with fairly simple provisions.

Communication-based Train Control Systems

Communications-based train control (CBTC) systems use radio communication to transmit information on train position and integrity to a control centre and to distribute information and commands to traction units (train drivers).

It is typically combined with a moving block system, under which not more than the safe braking distance needs to be kept empty ahead of a train, with a positive effect on line capacity.

In CBTC systems, each train identifies its current position and its integrity ('no train separation, no wagons lost'). This is communicated via data radio to the interlocking centre in charge. Based on the information received from all trains, the interlocking centre issues information to all trains such as safe distance to go, order to proceed and local speed restrictions.

Accordingly, CBTC systems with moving block provide greater line capacity and are much less dependent on wayside infrastructure than conventional systems.

CBTC has been developed for metro railways and is frequently used for new metro lines. There are applications in Europe (Paris, Nuremberg, London, etc.), America (New York, Vancouver, etc.), China, and elsewhere. Due to its superior capacity it also has been applied on the central urban sections of suburban railways operation according to main line standards and with main line technology. Examples are London (Thameslink), Istanbul (Marmaray) and under implementation in Paris (EOLE).

CBTC is becoming the worldwide standard on account of its keys attributes (capacity, less wayside equipment, safety and costs); and for these reasons it is the best choice for AIHSRN. Conventional block signalling may be installed where dictated by an existing environment, i.e. in conventionally equipped networks. Conventional block signalling may also be applied as a second system to AIHSRN, for:

- Interoperation with conventionally equipped lines; and
- Servicing of secondary lines, industrial sidings and depots.

Track Occupation Detection

Track occupation detection systems provide information of occupied track sections to the interlocking. Based on the information received from all track occupation systems, the interlocking issues to the train's information like safe distance to go, order to proceed and local speed restrictions, either by means of radio communication to the cab display or by lineside colour light signals (outdated). Track occupation detection systems are integrated in the CBTC system and act as back-up systems against loss of train positioning.

Track occupation detection may still require fixed infrastructure that can use

- Track circuits; and/or
- Axle counters.

Both track circuits and axle counter systems are proven over decades under all kinds of ambient conditions and are available from a wide range of suppliers.

Standardisation

CBTC is state-of-the-art, internationally proven and obtainable from several suppliers. It should be applied as a standard throughout AIHSRN.

AIHSRN's standard may face boundaries where other systems are already in use or planned, particularly on the new standard gauge lines. Incompatibility can be avoided by installing more than one system in the affected traction units, as commonly done in Europe. However, Europe is moving toward standardising on a single system, and a standardised system is recommended for AIHSRN.

The European Rail Traffic Management System (ERTMS) standard and its components European Train Control System (ETCS) and Global System for Mobile Communication - Railway Applications (GSM-R) have become a worldwide de-facto standard and thus are proposed also for AIHSRN. ERTMS is a processor-based system that has been standardised as a mandatory state-of-the-art replacement in Europe for existing obsolete mechanical, electromechanical, and/or electronic signalling systems of a lower integration level; and is also to be applied for all new and upgraded lines and for major replacement of outdated signalling. It is noteworthy that GSM-R is to be replaced by Future Railway Mobile Communication System (FRMCS) using most recent advances developed for general public mobile communication.

As a unified replacement for existing signalling systems in Europe, three levels of ETCS have been specified which are mutually upward compatible. All levels have integrated ATP – Automatic Train Protection (automatic train stop if signals are passed at danger) – functionality.

- ***ETCS Level 1:*** This could be fairly described as a one-to-one replacement of existing train protection devices and signalling systems by using existing or new computerised interlocking and trackside Eurobalises which are electronic transmitter/responder ("transponder") devices providing information to the train about its position ("electronic milepost") and triggering emergency brake applications when signals are passed at danger. Train radio only is used for voice communication and operational messages but in its basic application, not for signalling. More recent advances however use the train radio (or a local cable loop) also for information of signal aspects that have changed while the train still is waiting in front of the signal. Information of occupied track sections is by track occupancy detection systems.

- ***ETCS Level 2:*** This is similar to ETCS Level 1 but instead of trackside signals there is a continuous radio link to the trains indicating signal aspects on a display. The trackside signals are replaced by fixed marker boards. Eurobalises only are used as electronic mileposts for train positioning. Thus in comparison with ETCS Level 1, the costs for trackside signals are greatly reduced but track occupancy detection systems are still required.
- ***ETCS Level 3:*** The future ETCS Level 3 system has CBTC functionality and does not rely on track occupancy systems, so moving block operation is inherently available. The trains position themselves in the railway network using Eurobalises, GPS etc., and continually check their integrity. In comparison with ETCS Level 2, most track occupancy detection systems can be omitted. ETCS Level 3 tends to have lower capital costs than Level 2 or Level 1 when there are long line sections of newly built track (as for AIHSRN). An additional advantage of Level 3 is that it is upward compatible so that trackside Level 2 and 1 systems using part of the existing technology (signals, interlockings and track occupancy detection systems) can be used by Level 3 rolling stock (albeit only with Level 2 and Level 1 functionality) which as a preliminary measure could be less costly than a full upgrade to Level 3 (this is similar to the current European approach for existing lines).

Eurobalises are electronic devices placed in the track. They are activated by radio waves emitted by on-board transceivers (combination of transmitter and receiver) and they respond by sending position data and information about the signal to the on-board equipment. Eurobalises that only send positioning data do not need a stationary power supply or connection to other trackside equipment. In this case they act as electronic mileposts.

ERTMS including ETCS and GSM-R components are available from a number of experienced manufacturers for signalling and communication equipment. The European Union anti-trust authority closely supervises the competition in the market. The systems are mutually interoperable even if supplied by different manufacturers, so trackside and on board equipment need not be supplied by the same manufacturer, nor need, after some years, any new equipment be purchased by the same manufacturer.

Since ERTMS with its components ETCS and GSM-R (and its successor FRMCS) is an integrated signalling and train radio system, and it is available in a competitive market, the recommendation is for the ETCS Level 3 (still under development) with CBTC functionality (moving block, high capacity, minimum number trackside devices). In case ETCS Level 3 is not fully developed when the first AIHSRN lines will be built, a combination of ETCS Level 2 and CBTC can be chosen, as has been successfully applied on busy central sections of suburban trains operating with main line technology and rolling stock.

Note that GSM-R is to be replaced by FRMCS. The future ETCS Level 3 system has CBTC functionality and does not rely on track occupancy systems.

3.3.5 Control and Communications Systems

General Principles

Control and communication systems sustain the collection, transmission, processing and dissemination of all operational data, nowadays also including signalling. Innovation cycles of communication systems have become very short and are not expected to lose pace. Implementation of AIHSRN will in contrast take several decades. The challenge is therefore to ensure integrity across the entire network whilst preserving opportunities to benefit from innovation.

Data Transmission System

An Internet Protocol (IP)-based system should be used as a standard for AIHSRN, with appropriate capabilities to attach state-of-the-art equipment of different generations and sources.

The backbone of the data communication should be a fibre optic transmission system. This fibre optic data transmission system may be supplemented by radio links in the VHF [very high frequency], UHF [ultra high frequency], and microwave frequency range (depending on the availability of frequencies), as a backup system for fibre optics or in difficult terrain.

Generally at least two independent transmission paths should be available.

The data transmission system (including digitalised voice data) will use standard IP with IP addresses, interfaces and communication protocols standardised, ideally on a network-wide basis. It should be open to different equipment and, in turn, equipment should not be limited to undisclosed communication properties.

For radio communication, FRMCS as successor to standard radio system GSM-R may be used, with standardised data transmission properties. Alternatives exist, such as trunked radio according to the TETRA [Terrestrial Trunked Radio] standard, but they are not integrated to the ETCS signalling system. When using them for the wireless data communication required for ETCS, costly interface equipment has to be used (Finland).

Control & Communication Systems

Typical control and communication systems of railways comprise:

- Data transmission system;
- Radio communication system;
- Train position monitoring and operations control systems;
- Automatic Equipment Identification (AEI) for rolling stock, containers and semitrailers;
- SCADA [supervision, control and data acquisition] systems for traction power, general power and fixed electro-mechanical equipment;
- Building management system;
- Telephone system;

- Time distribution (clock) system;
- Public address system;
- (Passenger) information display system;
- Closed circuit television (CCTV) system;
- Access control system;
- Depot and maintenance management systems;
- Station control and management systems; and
- Potentially others.

Due to the rapid progress of communication technologies, details have to be fixed once a defined application is planned. Installations may vary technically; however, interoperability standards should not be violated. Thus basic guidelines for the implementation of the systems should be established.

Equipment, both on an individual basis and as integrated packages, is available from experienced suppliers. It should be possible to retain expandability, upgradability and compatibility between different suppliers' products, as long as proprietary technologies and undisclosed protocols are avoided or minimised, or appropriate interfaces are available.

FRMCS as successor of standard GSM-R is part of the signalling system ETCS at all levels, including future Level 3, which has CBTC functionality for main line railway applications.

Standardisation

Due to the large number of systems, applications and products, and their rapid progress, it will not be worth standardising the entire range of control and communication systems and their equipment.

However, it will be essential to ensure a common basis for their communication and interaction, based upon:

- A standardised fibre optic network;
- Standardised communication channels and protocols;
- Extra capacity for additional applications and upgradability for further equipment generations; and
- Provision for potential (albeit undesirable) dual or multiple equipment at the boundaries of equipment generations or configuration.

3.3.6 Rolling Stock

The following outlines key parameters and technologies that require standardisation across AIHSRN. Principal choices and recommendations are made. Further detailing of their properties may be required at a later stage and will not influence key decision making at this stage.

Interoperability Requirements

Setting of rolling stock parameters will be dominated by their interoperability across the AIHSRN like other aspects discussed above. It will be highly desirable, although not essential, that all rolling stock will be able to operate everywhere in AIHSRN. However, it is important to ensure that freight wagons can operate on the entire AIHSRN as transhipment causes greater effort than change of locomotives or interchange of passengers, and as freight transport will be the backbone of better economic integration of the continent.

Couplers

AIHSRN should have centre buffer couplers as a standard for its entire network. Several systems are common in the railway industry:

- Janney (AAR) couplers, originating from North America but also common on other continents, particularly in China and Southeast Asia;
- SA-3 couplers, originating from the Soviet Union and used in regions with their influence;
- A UIC coupler with automatic coupling of brake hoses, derived from SA-3 but not widely used; and
- Scharfenberg coupler, originating from Germany and mainly used for multiple units (including high speed) and for urban transport (not suitable for higher train loads).

Janney couplers are most popular and well-suited to AIHSRN's requirements. New lines in Ethiopia and Kenya use Janney couplers. We recommend that Janney couplers become standard equipment for the entire AIHSRN.

Multiple units for passenger operation may yet have other couplers, with Scharfenberg couplers as one of the most popular ones. Usually, multiple units are expected to be coupled only among each other, and not with other rolling stock. Rescue of failed multiple units can be secured by adapter couplers carried on board.

Compatibility with the traditional side buffer, screw coupler system can be enabled by coupler wagons if required at all, with different adapter couplers at both ends, as discussed above.

The height of the centre of the automatic couplers is different in its present applications:

- SA3 couplers, Scharfenberg couplers (mostly), and the screw coupler system have their centre at 1,040 mm above top of rail.
- Janney couplers according to North American standard have their centre 876 mm (2ft 10½ inches) above top of rail. In some cases Janney couplers have been fitted to rolling stock originally designed for side buffers and draw hook at 1,040 mm above top of rail.

For AIHSRN, a uniform height of the coupler centre above top of rail is recommended. The exact height has to be:

- Determined against international best practice (in order to secure least possible tailoring of standard products); and

- Aligned with the two relevant freight lines (Addis Ababa and Djibouti, and Nairobi and Mombasa).

Train Brakes

Compressed air brakes are standard for mainline railways for many years although some African railways continue to use vacuum brakes. We recommend compressed air brakes for AIHSRN. Air pressure, braking behaviour and valve couplings should be standardised at a later stage and on a network-wide basis, to enable interoperability of, at minimum, freight wagons across the entire continent. UIC, GB/T and/or AAC rules may be used. An option to use electrical control of pneumatic brakes should be included to support greater train lengths.

4 Transnational Operations of Railways

4.1 Railway Management

4.1.1 Introduction

Current railway operations in Africa are largely individual country-based, with most railway networks operated by state-owned railway organisations. There are, however, cases where:

- Railway operation and maintenance are contracted out to private sector concessionaires, whilst assets are still held by the state;
- Operation, maintenance and asset ownership are let to the private sector, typically up to a fixed date of transfer to the state; and
- Railways are entirely privately owned and operated, particular for mines.

Furthermore, several cooperations of neighbouring states are in place, in order to manage existing lines or to develop future railway projects, such as multinational committees and development organisations for railways in North (Maghreb), East and Southern Africa.

It is likely that these conditions will not fundamentally change when AIHSRN is implemented; as we do not recommend or envisage the entire AIHSRN being run as a pan-African monopoly organisation that would own and operate all lines built under its auspices.

The above means that there is a need to start thinking of the mechanism for seamless and efficient operation of the future multi-country railway network envisaged for AIHSRN.

The following sections discuss various ownership and operation models and institutional structures and their strengths and weaknesses, followed by a discussion on challenges that the railway sector will face and should be prepared for, addressing of which would be critical for successful operation of AIHSRN.

4.1.2 Ownership and Operation

Traditionally integrated in one single entity, recent redevelopment of railway organisations shows three major columns:

- Infrastructure ownership, including its planning, finance, implementation and, potentially, maintenance;
- Rolling stock ownership, including its finance, procurement and, potentially, maintenance; and
- Operation, including revenue collection and maintenance of the above if not maintained by their owners.

Many different organisation models and contractual arrangements have emerged over time, which almost freely combine:

- Integration of the above in one entity or separation in several entities;
- Different forms of risk allocation (particularly revenue risks under gross and net contracts);
- Different levels of governmental influence or control; and
- A great variety of allocation of duties and responsibilities.

The range is between fully integrated state-owned railways on one hand and almost entire privatisation where the state retains the role of a railway regulator on the other. The following tables present descriptions and definitions of various forms of vertically integrated and vertically separated organisations.

Table 4-1: Vertical Integration versus Separation

	Vertically Integrated	Vertical Separated
Definition	Single company owns and maintains fixed infrastructure and also operates trains and owns/maintains rolling stock	One company (typically government-owned) owns and maintains fixed infrastructure; and another operates trains and owns/maintains rolling stock
Types	**Administered Public Monopoly; Regulated Private Monopoly**	**Regulated Access; Regulated Competition**

Source: CPCS

Table 4-2: Administered Public Monopoly versus Regulated Private Monopoly

	Administered Public Monopoly	Regulated Private Monopoly
Definition	A government-owned vertically integrated railway owns and operates the railway; could be self-regulating or regulated by a separate government entity	A private sector-owned vertically integrated railway owns and operates the railway; typically with regulation by government

	Administered Public Monopoly	Regulated Private Monopoly
Examples	Indian Railways; government-owned and operated railways of Africa	Class 1 Railways of North America
Relative Advantage	Gives government maximum control over future rail development and to use as a vehicle of public policy	Best assures optimal integrated railway planning (especially with respect to capacity) and efficient capital investment

Source: CPCS

Table 4-3: Regulated Access versus Regulated Competition

	Regulated Access	Regulated Competition - Multiple Train Service Providers
Definition	Rail services are unbundled from infrastructure ownership and one operator is given the exclusive right to provide all the train service on government-owned infrastructure	Rail services are unbundled from infrastructure ownership and multiple operators are given rights to provide all the train service on government-owned infrastructure
Examples	African rail concessions	Passenger rail franchises in the UK
Relative Advantage	Competition for opportunity and private sector operator drives value and efficiencies. Government retains more downstream control over railway development	Same as with Regulated Access plus completion for rail services further drives efficiencies

Source: CPCS

The tables on the following page present the characteristics and strengths and weaknesses of each model.

Table 4-4: Characteristics of the Different Railway Institutional Models

Model	Infrastructure Ownership	Infrastructure Maintenance and Control	Train Operations	Regulation	Marketing of Rail Services	Example
Administered Public Monopoly	Government-owned Railway	Government-owned Railway	Government-owned Railway	Self-regulation	Railway	Government Railways
Regulated Private Monopoly	Private Sector Railway	Private Sector Railway	Private Sector Railway	Independent Regulator	Railway	North American Class 1 Freight Railways
Regulated Access with Exclusive Operator	Government Landlord Company	Exclusive Operator	Exclusive Rail Operator	Independent Regulator	Rail Operator	Rail Concession of Africa
Regulated Competition with Multiple Operators	Government Landlord Company	Government Landlord Company	Multiple Rail Operators	Independent Regulator	Rail Operators	Western Europe

Source: CPCS

Table 4-5: Strengths and Weaknesses of Each Model

Model	Government Control / Influence over		Competition	Private Sector Involvement in O&M	Risk Transfer to Private Sector
	Development	Service Level			
Administered Public Monopoly	High	High	With other modes	Low	Low
Regulated Private Monopoly	Low	Low	With other modes	High	High
Regulated Access with Exclusive Operator	Moderate	Moderate	Competition for the market and with other modes	Moderate	Moderate
Regulated Competition with Multiple Operators	Moderate	Low	Competition for the market; with other modes and between rail service providers	High	Moderate

Source: CPCS

Infrastructure Ownership

AIHSRN is a pan-African project. This, however, does not necessarily require the entire railway to be one cohesive unit or even uniform in the manner in which infrastructure is owned. Infrastructure ownership will be influenced by project funding and financing structure, which is typically put in place by national governments.

Rolling Stock Ownership

Three main models of rolling stock ownership exist within the world:

- Ownership by the railway operator (be it the private sector or government);
- Ownership by the shipper;
- Ownership by third party.

In the North American rail sector – which is dominated by six private sector-owned Class 1 railways – ownership is split between the railways themselves, shippers and leasing companies. The majority of railcars (wagons) are owned by railcar leasing companies, and the majority of locomotives are owned by the railways. Rolling stock in most other regions of the world is more orientated towards railway ownership. Where the government owns and operates a vertically integrated railway, rolling stock is almost exclusively railway-owned (which is the case throughout Africa).

Given the number of countries in Africa, ownership of some or even all of the freight wagons by third party leasing companies appears to be the optimal structure to have in place. This is in line with the Luxembourg Rail Protocol, which is a new legal regime governing the lease of rolling stock by providing security to secured lenders and leasers of rolling stock when the debtor is located in a contracting state. The protocol has been adopted by 79 states internationally and was presented to AU at a workshop in Addis Ababa on November 13, 2019.

Railway Operations

Railways tend to be more efficient and profitable with larger networks to operate. This was a key driver of significant railway mergers in North America in the latter part of the 20th century. Given the scale and political complexities, a single operator of AIHSRN is not a viable, or even desirable, option. However, significant benefits can be gained by having railways operate across international borders, especially where the countries are small. This is certainly more attainable if the railway operating company is privately owned. This works well when there is vertical separation of infrastructure from operations (such as with Regulated Access and Regulated Competition). Clearly, administered public monopolies, where the government owns infrastructure and operates the railway, will lead to too many railway operators defined by national borders and, in most cases, lacking in operating efficiency to be truly competitive with other modes.

4.1.3 Additional Challenges

To assure the efficient and effective operation of AIHSRN, four mandates will need to be addressed at the continental level. They include:

- Infrastructure, operation and safety regulations;

- Origin-destination way billing; and
- Seamless flow at international borders, including free flow of wagons and minimal delays to passenger trains.

Each of them is discussed below.

Operation and Safety Regulation

AIHSRN will eventually span nearly 50 countries across continental Africa. It is expected that the countries will have their own railway laws and regulatory procedures and organisations. This means that if no action is taken to harmonise rules and regulations or agree on a set of common principles, AIHSRN will be subject to a wide variety and diversity of rules and regulations. Not only would this be cumbersome, but also this can significantly hinder the effective development and operation of the network.

Therefore, there is a need for a common set of operating rules and regulations, which, once agreed, can be implemented by national legislation of respective states.

There are a number of ways to do this, from simply coordinating among relevant states (AU taking the lead role coordinating and creating a regional coordination agency), to creating a continental authority. These options have their own pros and cons, thus consideration needs to be made in identifying what would be the most suitable model to AIHSRN and the AU member states. It should also be noted that the diversity of countries and the lack of political stability in some regions may require ongoing modification of the selected model, approaches and procedures.

Origin-Destination Way Billing

It will be necessary for shippers to bill a freight shipment from origin to destination regardless of their locations in Africa, and they should be able to do this with a single waybill and a single tariff. The following section discusses how this is managed in Europe and North America.

Flow of Freight through Europe

To aid free movement of freight across Europe (EU member states), a policy called the Common Transport Policy (CTP) was created and implemented. Its creation was aimed at establishing institutional conditions for sustainable development of the overall railways system as well as efficient integration of railway infrastructure and means.

The three main objectives of CTP are as follows:[10]

- Stimulation of further development of the Trans-European Transport Networks (TENs) including favouring the development of peripheral regions;
- Further liberalisation of the rail markets to the maximal extent possible (market regulations should be equalised in each Member State and the national product market should be opened up for agents of each EU country); and
- Progressive movement towards "sustainable" development of the rail sector.

[10] Freight Transport in Europe – Policy Issues and Future Scenarios on Trans-Border Alpine Connections (1999)

Flow of Freight through North America

Facilitating the free flow of freight in North America means managing 31 points-of-entry (POE) between the US and Canada, and seven POEs between the US and Mexico with the utilisation of freight rail standards and protocols. These include the following:

- Advanced targeting;
- Rail vehicle and cargo inspection system; and
- Secondary physical inspection.

In addition to the standards and protocol stated above, regulations between Canada and the US, and the US and Mexico have to be observed. With each country having their own regulations and rules, there are some areas of commonality; and this would require close liaison among the respective countries' regulatory bodies.

There are other agreements that have had to be developed and implemented to ensure the efficient free flow of not only freight traffic but passenger traffic as well. Some of the agreements are listed below:

- Operating agreements between Amtrak and the Canadian railways to operate on Canadian tracks;
- Agreements between the railways and their respective labour unions to operate trains into either the US or Canada with foreign crews;
- Agreements between the US and Canadian freight railways to operate on each other's tracks when doing cross-border run-throughs (includes where the cross-border run-throughs will terminate – i.e. which rail yard); and
- Agreements among the freight railways, US Customs and Border Protection (CBP), and their Canadian counterparts to allow for run-through trains between the US and Canada and to identify how shipment information will be transmitted to the inspection agencies, as well as how inspections will occur.

AIHSRN will need to implement cross-border policy and procedures to facilitate multi-country way billing from origin to destination.

Seamless Flow at International Borders, Including Free Flow of Wagons

If proper processes are not in place, rail operations at international borders will become a capacity pinch point and will add significantly to transit times and costs. Given the large number of countries in Africa and its history of close-bordered railways, this is a real concern that has to be dealt effectively for AIHSRN to function efficiently. The most critical requirement is that wagons are able to flow across international borders regardless of ownership. The second critical requirement is that trains not be unduly delayed due to customs clearance. The most effective way to meet these requirements is to have a single operator on both sides of the border as they would be most motivated and best able to assure efficient operations at the borders, possibly having even locomotives and train crews operating on both sides of the border.

However, a single operator is not required to have the efficient flow of wagons across borders. Interoperable technical standards as well as regulations in place governing customs clearance and rail wagon management would help assure efficient exchange or rail wagons at border posts.

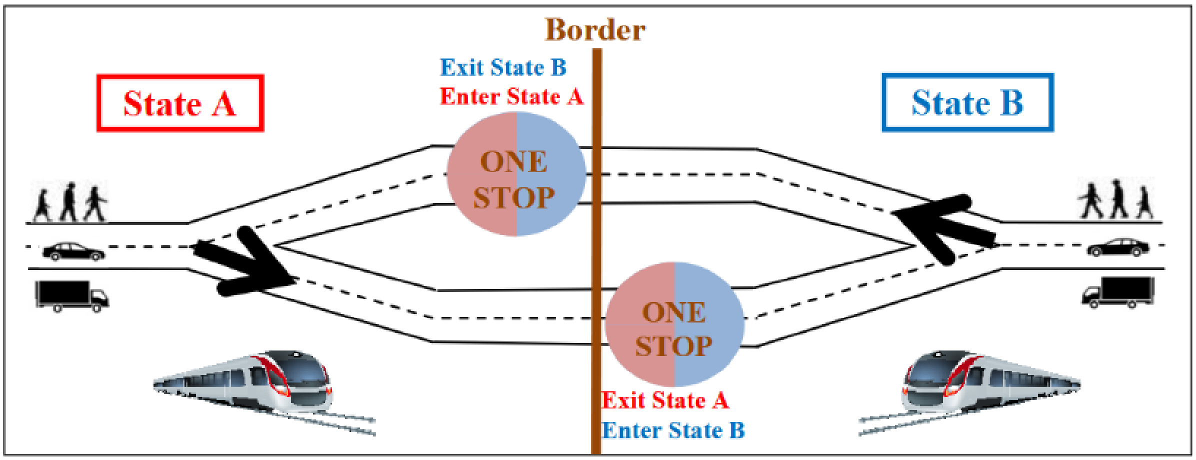
It is also important to plan the evolution of AISHRN in order to meet new challenges, and to adapt infrastructure towards meeting whatever new challenges are faced. Railways have to reach sea ports efficiently, and intermodal container depots in close proximity to or in border towns have to be developed to support a seamless operation. In addition to infrastructure and policies fundamentally related to rail freight, the road network connecting and adjacent to the rail facilities needs to be planned and implemented to assist in combating inland container depot (ICD) congestion and delays to border crossings.

Minimising Delay for Passenger Trains at International Borders

For AIHRSN to be attractive for international passengers, it is important that measures to minimise transit time is considered. We suggest that the development of AIHSRN includes one-stop border posts (OSBPs) for passenger trains. An OSBP aims at reducing transit and processing times between two countries by providing all border control processes from both countries at one location. OSBP promotes a coordinated and integrated approach to the movement of people and improvement of security. OSBP would eliminate the need for people to be processed twice.

Below are several figures illustrating various OSBP models that exist.[11]

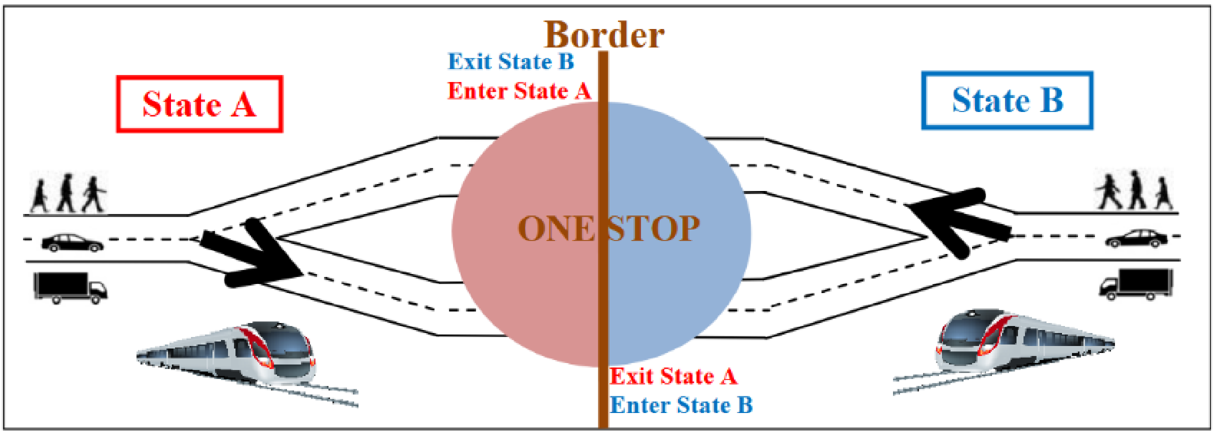
Figure 4-1: Juxtaposed OSBP



Source: One Stop Border Post Source Book, 2nd Edition, 2016.

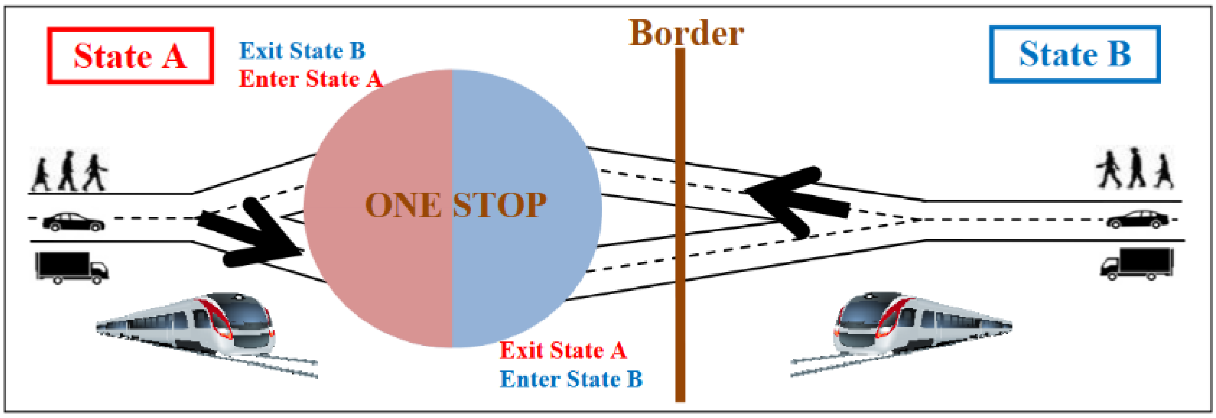
[11] One Stop Border Post Source Book, 2nd Edition, 2016

Figure 4-2: Straddling OSBP



Source: One Stop Border Post Source Book, 2nd Edition, 2016.

Figure 4-3: Single Country OSBP



Source: One Stop Border Post Source Book, 2nd Edition, 2016.

The four main foundation principles of OSBPs are:

1. Legal and Institutional Framework – at a typical border post there are several government agencies responsible for border controls. For effective and efficient OSBP operations, these agencies (from partner countries) need to work in a coordinated manner to minimise duplication and redundancies.

2. Simplification and Harmonisation of Procedures – the joint operation of the OSBP requires specific considerations for the operating environment when OSBP procedures are created to ensure reduced processing times. Operating an OSBP with no procedural optimisation would have little to no impact on transit times.

3. ICT and Data Exchange – consolidation of ICT spending into one facility allows for the efficient use of limited resources to manage borders and enhance intra/interconnectivity of agencies for implementing responsive risk management and transit trends.

4. Hard Infrastructure – OSBP facilities should be sufficiently sized and appropriately functional without being too elaborate or inadequate.

The Case for OSBP

One major factor for evaluating the performance and attractiveness of a transport corridor is the efficiency of the border crossings along the corridor. Generally, transit-related controls occur at three main points (airport, seaport and land border crossings). Land border crossings serve as nodes that link different points along a trade route and are vital for international trade. The situation is particularly acute for landlocked African countries where border crossing processing times and transport costs are high.

The establishment of OSBPs contributes to expediting the movement of goods and people and hence a reduction in transport costs by only requiring one stop for processing.

OSBPs are generally carefully designed by examining existing traffic data and future projections to provide the optimum outcome – baseline, midlife and end-life studies are also conducted to evaluate effectiveness and potential improvements.

Research shows that several countries in Europe offer a system of inspection and passport processing on-train. Although these are done on shorter intercity routes between countries like UK, Ireland, France, Belgium, Netherlands and others, a similar approach may be adopted on passenger trains for AIHSRN.

The approach is to create an on-train customs zone between the last passenger stations before the border post of each country. This would allow time for inspection and processing of passenger passports. Allowance for customs and goods inspections would be carried out at either bordering country's border station.

As can be seen from AIHRSN, there are more borders to cross than those observed in North America. As such, it may be more relevant to adopt – in some cases – similar protocols being developed and used within the European rail network, which involves larger number of countries than that of North America.

4.2 Best Practice for Transnational Operations of Railways – From Legal Perspective

This section discusses in general terms legal and regulatory best practices for transnational operations of railways. Because this cannot always be done in the abstract, we will sometimes refer to the Dar es Salaam-Kigali SGR project – one of the two pilot projects reviewed in this report – and the laws of Tanzania[12] as an example of some of the things being discussed. The focus of our discussion will be:

- Contract of carriage;
- Interoperability; and

[12] Rwanda has yet no railway legislation as there are no railways in that country.

- Border crossings (customs and immigration).

4.2.1 Contract of Carriage

General

Any person who lawfully boards a train in order to be carried from place A to place B enters into a contract of carriage with the rail carrier, usually evidenced by a ticket,[13] and is referred to as a passenger. That passenger's bargaining power with the rail carrier is almost non-existent. The rail carrier, if left to its own devices, can therefore unilaterally set the terms and conditions of the contract of carriage.

To mitigate this inequality of bargaining power between the parties, most countries regulate the contract of carriage of passengers by rail in their domestic law. For example, in Tanzania, various provisions in the *Railways Act, 2017* deal with:

- Liability of the carrier (in this case the Tanzania Railways Corporation) for loss of life of passengers and for delay of passenger trains;
- Persons travelling without a ticket; general conditions on which tickets are issued; general rights of persons to be carried as passengers; carriage of passengers and luggage; conditions of carriage for excess weight of luggage, etc.

In Tanzania, as in most other countries, the contract of carriage of goods by rail is also regulated (see sections 39-46 and sections 53-59 of the *Railways Act, 2017*), although market forces (e.g. competitive road transport), especially if the shipper is a large one, somewhat evens out the inequality of bargaining power between the rail carrier and the shipper of goods in many countries.

In addition to what is provided under national law and usually as a substitute thereof (at least for transnational movements), a number contracts of carriage are also regulated at the international level by way of an international convention to remove inconsistencies between the national laws of the different countries involved in the movement of passengers or goods covered by the contract. The most notable of these international conventions being:

- The Warsaw Convention 1929 for the unification of certain rules relating to international carriage by air covers the carriage by air of passengers and their luggage and of cargo – adopted by 152 countries;[14]
- The Athens Convention 1974, relating to the carriage of passengers and their luggage by sea – adopted by 25 countries;[15]
- The Brussels Convention 1924 for the unification of certain rules of law relating to bills of lading re: carriage of goods by sea – this convention and its variants were adopted by over 70 countries.[16]

[13] See section 49(1) of Tanzania's *Railways Act, 2017*
[14] See here.
[15] See here.
[16] See here.

Convention Concerning International Carriage by Rail (COTIF)

For rail transport, the main international text is the *Convention concerning International Carriage by Rail* (COTIF). This Convention has been adopted by 50 states, plus the European Union.

While the motto of OTIF (*Organisation intergouvernementale pour les transports internationaux ferroviaires* – Intergovernmental Organisation for International Carriage by Rail)[17] is: "Unified railway law to connect Europe, Asia and Africa", only three African countries are members of OTIF and parties to COTIF, namely Algeria, Morocco and Tunisia.

COTIF comprises two parts:

- The Convention itself, which governs the running of OTIF; and
- The seven appendices that establish uniform railway law.

The first two of these appendices govern respectively the contract of carriage of passenger and goods by rail:

- Uniform Rules concerning the Contract of International Carriage of Passengers by Rail (CIV - Appendix A to the Convention);
- Uniform Rules Concerning the Contract of International Carriage of Goods by Rail (CIM - Appendix B to the Convention). While most member states have adopted all seven appendices to COTIF, Pakistan and Russia have adopted only this particular one.

Main Options

The best practices for transnational operations of railways in the context of AIHSRN would be, for example, in the case of the Dar es Salaam-Kigali SGR for Tanzania and Rwanda to:

- Join OTIF and sign COTIF. In that case the uniform rules embodied in Appendix A and Appendix B of COTIF would apply to every contract of carriage:
    - of passengers by rail for reward or free of charge, when the place of departure and the place of destination are situated in two different OTIF member states, irrespective of the domicile or the place of business and the nationality of the parties to the contract of carriage; or
    - of goods by rail for reward when the place of taking over of the goods and the place designated for delivery are situated in two different OTIF member states, irrespective of the place of business and the nationality of the parties to the contract of carriage.
- Adopt a bilateral agreement which would adopt common uniform rules for every contract of carriage or passengers or goods when the place of departure and the place of destination are situated in two signatory states; these rules could be exactly those set out in Appendix A and Appendix B of COTIF if, for whatever reason, the two signatory

[17] Official website of OTIF here.

states did not wish to become a member of OTIF, or they could be something somewhat different. For Tanzania and Rwanda those rules could be those found in Tanzania's *Railways Act, 2017* since Rwanda has no railway legislation of its own.

- Do nothing and allow the national laws on the carriage of passengers and goods in each of the two countries to continue to apply as they exist.[18] For example, despite the fact that Canada and US (together with Mexico) are parties to a comprehensive free trade agreement and the fact that millions of tonnes of cargo cross the Canada-US border each year by rail,[19] each of the two countries has its own legal requirements governing the contract of carriage goods by rail.[20] This is also the case for the contract of carriage passenger by rail. This option may not amount to best practices in an abstract sense, but it is probably what exists for most countries outside the EU that exchange rail traffic between each other.

4.2.2 Interoperability

"Interoperability" is defined in the *Oxford English Dictionary* as "the ability of two or more pieces of equipment … to operate in conjunction". More specifically "interoperability", in the current context, refers to the technical compatibility of infrastructure, rolling stock, signalling, etc. between two rail systems or, as defined in Article 2(b) of the Directive 2008/57/EC of the European Parliament and of the Council of 17 June 2008 on the interoperability of the rail system within the Community:

> the ability of a rail system to allow the safe and uninterrupted movement of trains which accomplish the required levels of performance for these lines. This ability depends on all the regulatory, technical and operational conditions which must be met in order to satisfy the essential requirements.

Some rail systems are naturally integrated or interoperable by reason of the markets they were designed to serve. For example,

> The North American rail industry is highly integrated. Companies operating on integrated rail networks build track to a standard gauge,[21] and tracks are maintained to similar standards. Loaded rail cars are usually pulled by locomotives owned and operated by the track owner, but North American integration allows railways to interchange or hand off cars and locomotives that meet industry standards to other railways to complete a journey.[22]

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[18] This would require Rwanda adopting its own railway legislation before the Dar es Salaam-Kigali SGR became operational.
[19] As an example 12.5 million barrels of crude oil and other liquid fuels were transported by rail from Canada to US in February 2019. See US Energy Information Administration – Petroleum and Other Liquids – Data – Movements of Crude Oil and Selected Products by Rail.
[20] Namely Chapter 801 (Bills of Lading) of Title 49 of the United States Code for intra-US and US-Canada movements and the *Railway Traffic Liability Regulations* for intra-Canada and Canada-US movements.
[21] Canadian railways adopted the gauge in use in the northern states of the US in the 1870s.
[22] See Government of Canada – Rail Transportation.

In addition, both the Canadian and US Governments make sure, through regulatory measures, that the railways in their respective countries adopt similar standards. For example, railway signal and traffic control systems standards are regulated in Canada by way of the Railway Signal & Traffic Control Systems Standards issued by the Canadian Ministry of Transport and in the US by way of Part 236 of Title 49 of the Code of Federal Regulations. Both sets of regulations require that railway signal and traffic control systems, which affect the safety of railway operations, be installed and modified in accordance with AREMA[23] – Communications and Signals Manual of Recommended Practice (AREMA C&S Manual) as amended from time to time.

In the case of a new rail infrastructure joining two countries – e.g. the proposed Isaka-Kigali SGR – future interoperability can be achieved by both countries issuing similar Employer's Requirement for the Design and Build Contract.

When rail lines already exist in two countries and they already connect, interoperability can be improved by having the two countries join OTIF or create an agency like the European Safety Agency.

OTIF – As we saw earlier the *Convention concerning International Carriage by Rail* (COTIF) comprises two parts:

- The Convention itself, which governs the running of OTIF; and
- The seven appendices that establish uniform railway law.

The last two of these appendices govern matters related to interoperability:

- Uniform Rules concerning the Validation of Technical Standards and the Adoption of Uniform Technical Prescriptions applicable to Railway Material intended to be used in International Traffic (APTU - Appendix F to the Convention);
- Uniform Rules concerning the Technical Admission of Railway Material used in International Traffic (ATMF - Appendix G to the Convention)

For the purpose of these Uniform Rules, "Railway Material" includes both vehicles (rolling stock) and railway infrastructures (railway lines and fixed installations).

Another option would be for the two (or more) countries having railways carrying out transnational operations to set up a specialised inter-governmental agency dedicated to the promotion of interoperability and the harmonisation of technical standards.

Although it has a wider mandate than just interoperability and although its jurisdiction extends to more than just two or three countries, the European Railway Agency is such a specialised agency.[24]

As set out in Article 1 of the Regulation (EC) No 881/2004 of 29 April 2004 establishing the European Railway Agency:

[23] Official website of AREMA here.
[24] Official website of the European Railway Agency (European Union Agency for Railways) here.

> The objective of the Agency shall be to contribute, on technical matters, to the implementation of the Community legislation aimed at improving the competitive position of the railway sector by enhancing the level of interoperability of railway systems and at developing a common approach to safety on the European railway system, in order to contribute to creating a European railway area without frontiers and guaranteeing a high level of safety.[25]

4.2.3 Border Crossings (Customs and Immigration)

The idea here is to ease and, if possible, eliminate border impediments or hindrances so as to allow a train, whether carrying passengers or goods, to run from one country into another as if no border existed. This is currently possible in EU countries only by reason of the various treaties adopted by these countries over the last 60 years. The *Agreement Establishing the African Continental Free Trade Area* which came into force in May 30, 2019 is still a long way from providing the same kind of integration.

Border crossings by rail cannot be evaluated independently. One needs to take into account the overall legal environment governing customs and immigration.

Even in the East Africa Community (EAC)[26], which is fairly well integrated, a study for the rejuvenation of the Eastern Africa Rail Master Plan (EARMP) identified the following impediments hindering ease of passage of goods and passengers by rail carriage:

- Overlapping of legal provisions;
- Slow process of adopting necessary changes in national policies, legislation, rules and regulations;
- Absence of effective monitoring and well-structured financing sources;
- Differences in railways laws among Partner States; and
- Lack of clear definitions of specific responsibilities between EAC and the Partner States.

It is thus essential to minimise the need for stopping cargo trains at the border or for wagon-by-wagon inspection by:

- Providing advance clearance of documents; and
- Ensuring that wagons, locomotives and operating crews can move across borders with minimal delay.

[25] The European Railway Agency's interoperability and harmonising technical standards can be found here.
[26] The Treaty for the Establishment of the East Africa Community ("EAC Treaty") was established in 1999 to deepen cooperation among partner states of East Africa. Member States are Burundi, Kenya, Rwanda, South Sudan, Tanzania and Uganda. This treaty includes an undertaking to establish a Common Market, Common Transport and Communication Policies, a Monetary Union and ultimately a Political Federation. (Article 91 of the Treaty is entirely devoted to railways and rail transport.)

Delays resulting from concern over cargo on a single wagon involve either delaying the entire train or switching out the problematic wagon, either of which increases transit time and reduces railway operating efficiency.

For passengers, there are ways to expedite immigration formalities. On some railway routes between Canada and the US, passengers are required to purchase their tickets by 8:30 a.m. on the day of departure as a complete passenger list must be submitted to US Customs and Immigration at that time.[27] Presumably the list helps US Customs and Immigration speed up border verifications.

4.2.4 Regulation by Contract – Railway Concessions

The above presupposes that the transnational railway operations at issue will be carried out by two (or more) state-owned railways, such as, for example, the Tanzania Railways Corporation (TRC), National Railways of Zimbabwe (NRZ), Nigerian Railway Corporation (NRC), etc.

In the event that the railway company or companies involved in the transnational railway operations are operated under a concession agreement, this would introduce the possibility of what is called "regulation by contract". Taking once again the Dar es Salaam-Kigali SGR as an example if a sole concessionaire were to operate the entire railway[28], none of the options discussed in Section 4.2.1 above would be necessary: the applicable uniform rules for the carriage of passengers and goods could be set in the concession agreement itself (by way of an appendix). Interoperability could also be handled by way of the concession agreement. Border crossings, for the most part, could not be handled by way of contractual provisions in the concession agreement. They would be subject to existing customs and immigration laws.

[27] See here.

[28] This is only one of three possible basic scenarios: (1) One concessionaire, having signed a concession with the Rwanda Government, operates the Rwanda portion of the Dar es Salaam-Kigali SGR and interchanges traffic (passengers and goods) with another concessionaire, who having signed a concession with the Tanzania Government, operates the Tanzania portion of the railway. Two concessionaires, two concession agreements. This situation would be akin to two national railways operating in their respective countries but linking at the border and interchanging traffic (e.g. Botswana Railways and National Railways of Zimbabwe); (2) A single concessionaire operates the entire Dar es Salaam-Kigali SGR by way of two separate concession agreements entered into with the Rwanda Government and the Tanzania Government. This was the situation in Kenya and Uganda with respect to the metre-gauge Mombasa-Uganda railway from 2006-2017. Both governments had signed separate, but basically identical, concession agreements with Rift Valley Railways; (3) A single concessionaire operates the entire Dar es Salaam-Kigali SGR by way of one single concession agreement entered into with both the Rwanda Government and the Tanzania Government. This was what happened with the Dakar-Niger Railway which connects Dakar (Senegal) with the Niger River in Mali. The concessionaire – Transrail – was granted that railway's concession through a single concession agreement entered into by both governments.

5 Financing Master Plan Implementation

5.1 Introduction

The purpose of this section is to inform on the funding sources and financing mechanisms that could be deployed for successfully building and operating AIHSRN.

To do so, we delve into different systems to capture international benchmarks and operating conditions and identify the funding sources and financing mechanisms potentially available for rail projects in Africa. We compare the operating and investment structures for both developed and developing countries, and apply a Capital Investment Decision-making Framework in context of local operating conditions to advise on the most suitable delivery structure and associated funding and financing options.

In doing so, we inform the extent of private sector participation practised by respective countries. As we will see, the world has successful examples of fully public to fully private rail operators, with Public-Private Partnership (PPP) structures involving various degrees of railways and train operations integration in-between.

While we draw lessons from those, a contextual perspective will inform the decision-making in financing.

5.2 Cost and Income Components of Rail Projects

The cost components of a large infrastructure project, including rail projects, can be broadly divided into capital expenditures and operating expenses.

In regard to income, the sources can be divided into:

a. Operating income from revenues and operations;

b. Investment income from funds invested in disparate financial instruments or commercial development; and

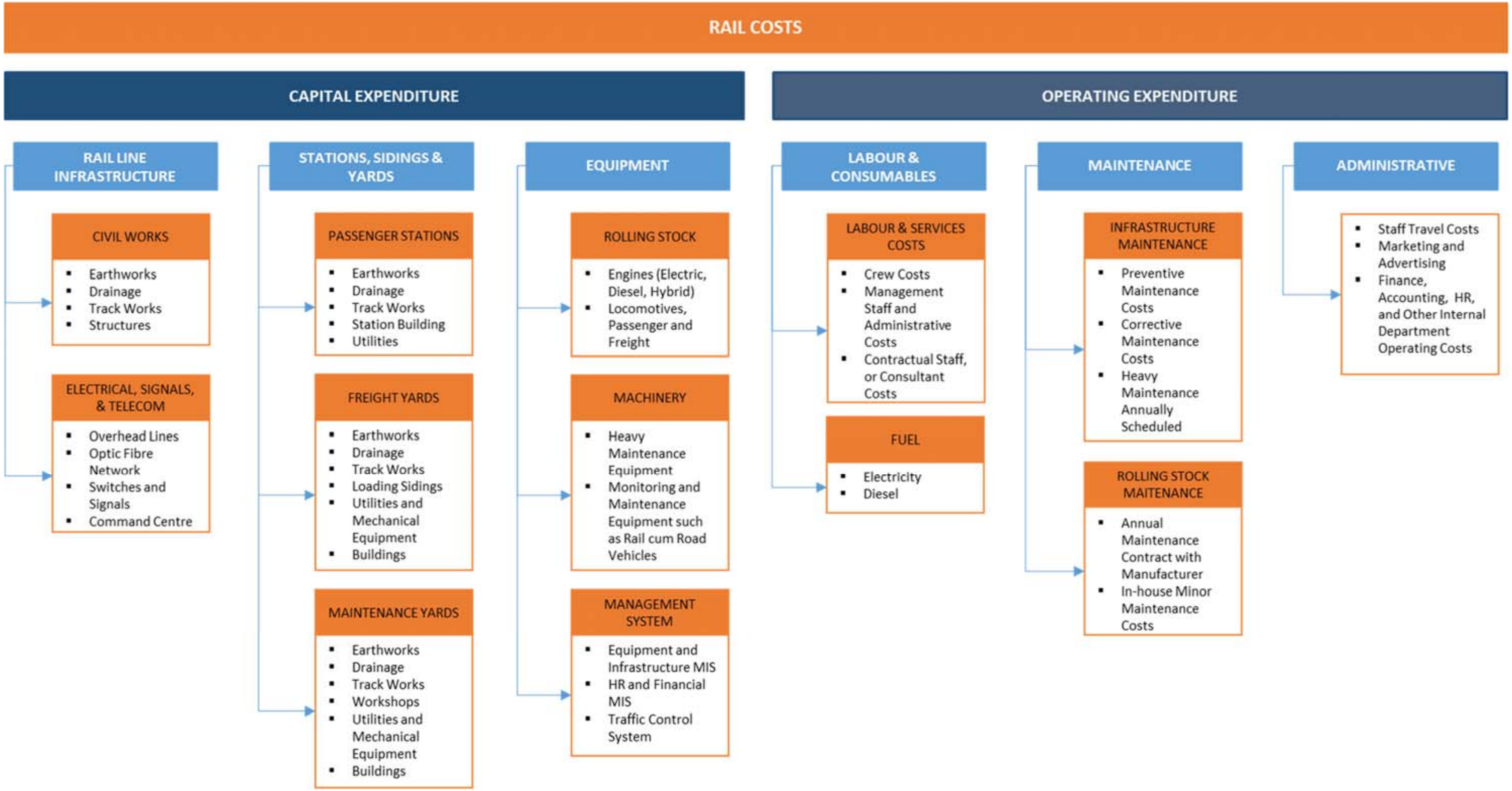
c. Financing income from funds raised through debt, equity and alternate public financing mechanisms.

Using this categorisation, we can recognise sources of expenditures and income for railways along with the respective frequency and time horizon of cash flows. This sets up the foundations for an evaluation framework of the funding sources and financing mechanisms for AIHSRN projects.

Figure 5-1 and Figure 5-2 below categorise cost and income based on their source and type.

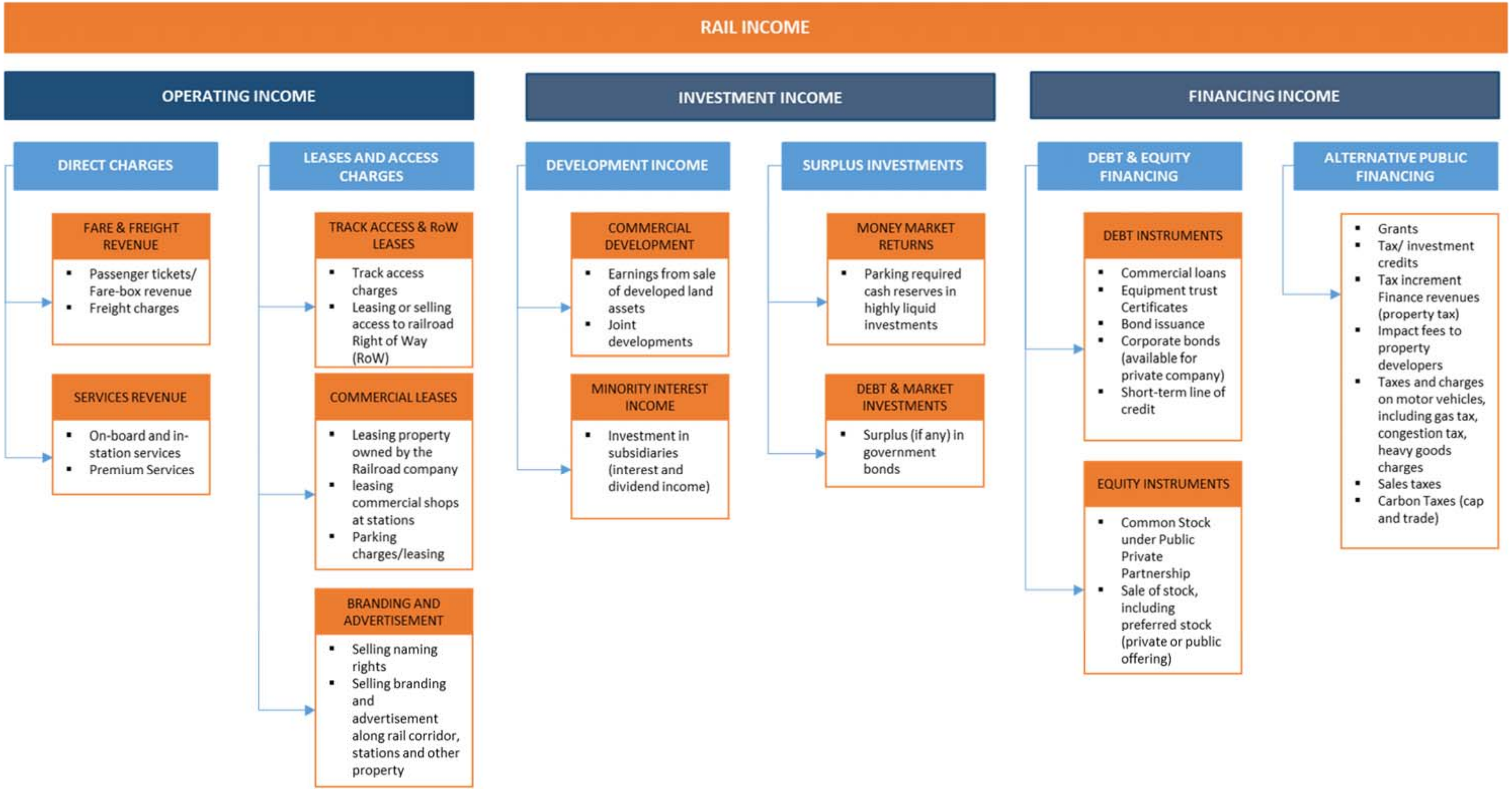
Costs are categorised into capital expenditure (CAPEX) and operating expenditure (OPEX). Capital expenditure is expenses incurred on development of assets that have a life span of greater than one calendar year. These assets include fixed assets such as rail lines, stations, sidings, freight yards, civil structures, heavy equipment, rolling stock and management systems. Operating expenditure on the other hand is the expenditure incurred on activities and consumables with a life span of less than one year. These include labour costs and fuel, which are immediately expensed as services are provided, and annual maintenance charges on fixed assets such as rolling stock, tracks, stations and others. Operating expenses also include the cost of running the business and marketing its products and services, which is categorised as administrative expenditure.

Figure 5-1: Rail Project Cost Structure



Source: CPCS Knowledge Library.

Figure 5-2: Rail Project Income Sources



Source: CPCS Knowledge Library, and references from Report on Alternative Funding and Financing Mechanisms for Passenger and Freight Rail Projects, National Cooperative Rail Research Program, 2015.

With regard to the revenue streams that repay or recover upfront capital costs and cover operating expenses, they primarily come from rail operations. Depending on the structure retained for the railways and train operation, these operating incomes are service- or asset-related revenues and include direct charges such as passenger fare revenue, freight charges and/or track access and Right of Way (RoW) charges. Operating revenues can also include on-board service fees such as food and entertainment, and revenues earned from commercial and railroad leases, sale of RoW, sale of advertising spots, and branding of stations.

Investment income earned from investing surplus funds into financial market instruments or commercial ventures can add to operating revenues. For instance, investment income can be generated from parking available cash in money market instruments, which are short-term, risk-free debt instruments issued by banks. The investment can be made with cash held by the rail operator either under mandated regulatory guidelines, or as reserve for contingent operating requirements. Since the instrument is highly liquid, it can be withdrawn anytime, yet earn an investment return to the operator on day-to-day basis. In rail projects, investment income is typically relatively marginal compared to operating income.

The bulk of costs in rail projects is the upfront capital costs. Sources of finance to meet them will depend on the delivery structures and the associated sharing of responsibilities between the private and public sectors for the different project components (infrastructure, rolling stock, rail maintenance and train operation). Debt and equity instruments are the most common and important financing tools available to the private sector, which are typically raised during the development phase to meet the capital expenditures requirements. They may be again raised in the later years of the project to expand the rail network, buy new rolling stock, or carry out rehabilitation works. Private operators may also use debt to recapitalise the project and use the debt proceeds to pay out dividends to equity shareholders.

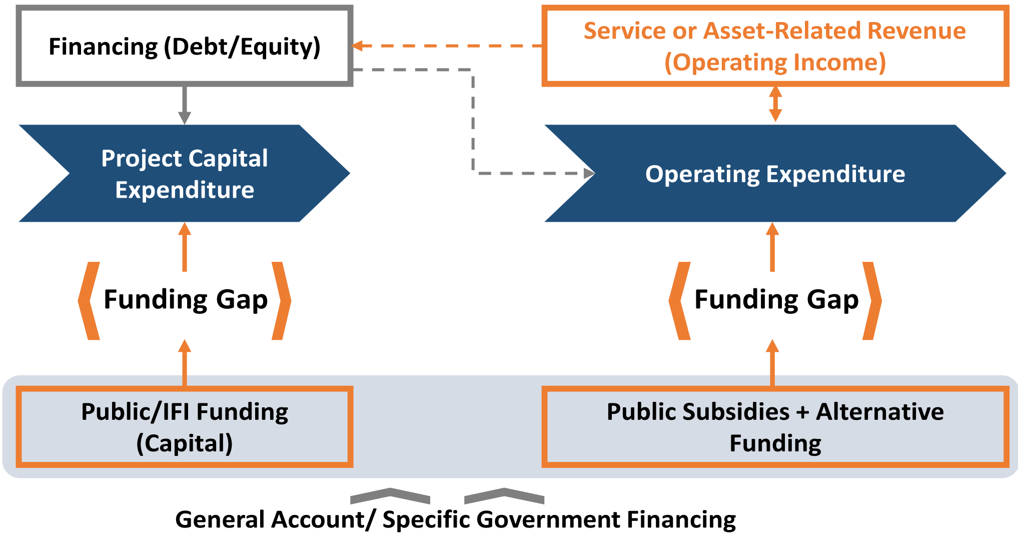
When looking broadly and before any consideration of business models and private sector participation, the operation of railway projects (passengers or freight), like most public transportation infrastructure and services, do not generate, on their own, sufficient operating revenue to cover their full costs. They are dependent on public funding contributions, except for a few exceptions.

This funding gap needs to be filled primarily during construction given the capital required for rail development, but potentially also during operation when public subsidies might be required when operating costs are not fully covered by the associated revenues.

Public contributions for capital expenditures can be funded through public debt products including loans and bonds. In the African context, the financing products from the International Finance Institutions (IFIs) would have to be considered. However, the governments may also seek alternative sources of public funds such as government grants, guaranteed taxes and/or dedicated user charges, to meet its capital investment requirement and cover potential funding gaps. Some of the instruments include tax credits, which offset taxes payable by the rail operator, so-called “impact or development fees”, which are one-time charges levied on property owners benefiting from the development of the railway, and gas taxes, carbon taxes and truck taxes, all of which may penalise users of motorised high-carbon transport to encourage their modal shift to low-carbon rail road transport. However, these alternate sources of income need to be guaranteed in law by the national governments.

The figure below gives a simplified representation of rail funding and financing dynamics.

Figure 5-3: Simplified Representation of Rail Project Funding and Financing



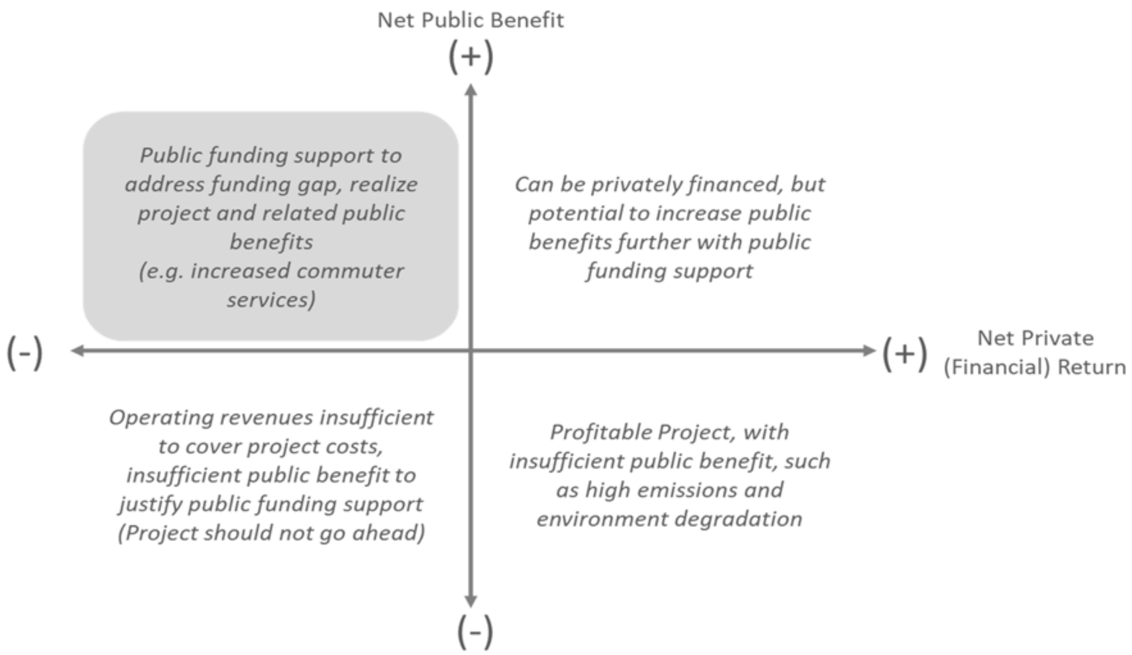
Source: CPCS

5.3 Capital Investment Decision-making Framework for AIHSRN

This section presents a framework that can be adopted in evaluating financing mechanisms and funding sources for AIHSRN capital investment in Africa. Since significant public funding is required for any rail project, owing to the vast amounts of construction capital that is required compared to the operating costs, it is important to consider both the financing costs and the underlying socio-economic benefits accrued to communities. While the section does not examine the social and economic benefits of railways, we do consider these in our investment decision-making framework.

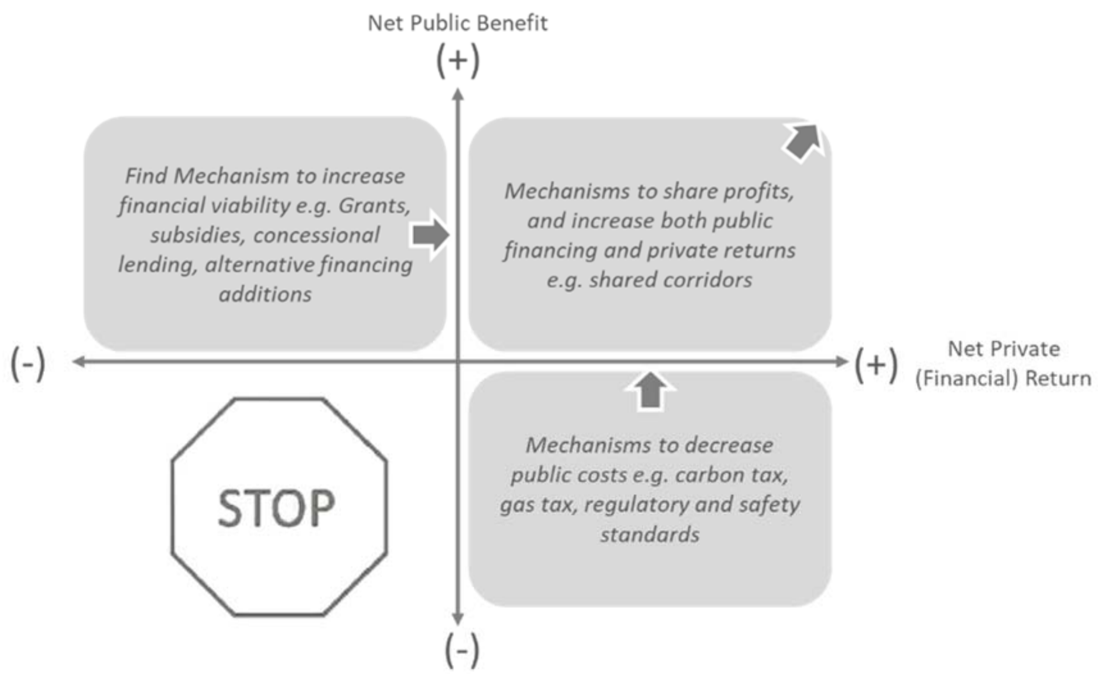
When the socio-economic benefits are justified, public funding or financial concessions may be warranted. Figure 5-4 provides the framework, within which public investment in rail projects may be considered, and Figure 5-5 depicts how the public funding may be channeled. As depicted, if the public benefit from the project is positive, then the project should be executed and there may be a case for finding public support, during the construction and/or the operations phase as necessary. If the project has negative public benefit, i.e. it has a public cost instead, then the public representatives and governments should consider if the project should be done with safeguards or not be executed at all. If the project is financially viable with public cost, then there could be safeguards, such as emissions taxes, to reduce the public cost. If the project is financially infeasible and there is a net public cost, the project should altogether be stopped.

Figure 5-4: Net Public Benefits vs. Net Private Return



Source: CPCS

Figure 5-5: Using Funding and Financing Mechanisms to Increase Public Benefits & Financial Viability



Source: CPCS

Last, while assessing the investment options, we also need to consider the political commitment toward private sector participation, and also the maturity and appetite of the private sector to provide rail expertise in respective countries. When either the government is non-committal to pursue private sector participation, or the private sector is unable to display reasonable confidence to execute the rail project, the project will be highly or completely reliant on public support and execution.

The following section presents the possible delivery structures and public-private sharing typical business models for HSR projects.

5.4 Delivery Structures

The delivery structure is the determination of who should be responsible for providing the infrastructure and encompasses the end-to-end process of infrastructure delivery from developing the specifications, procurement, obtaining finance, constructing, to operating, funding and overseeing delivery.[29]

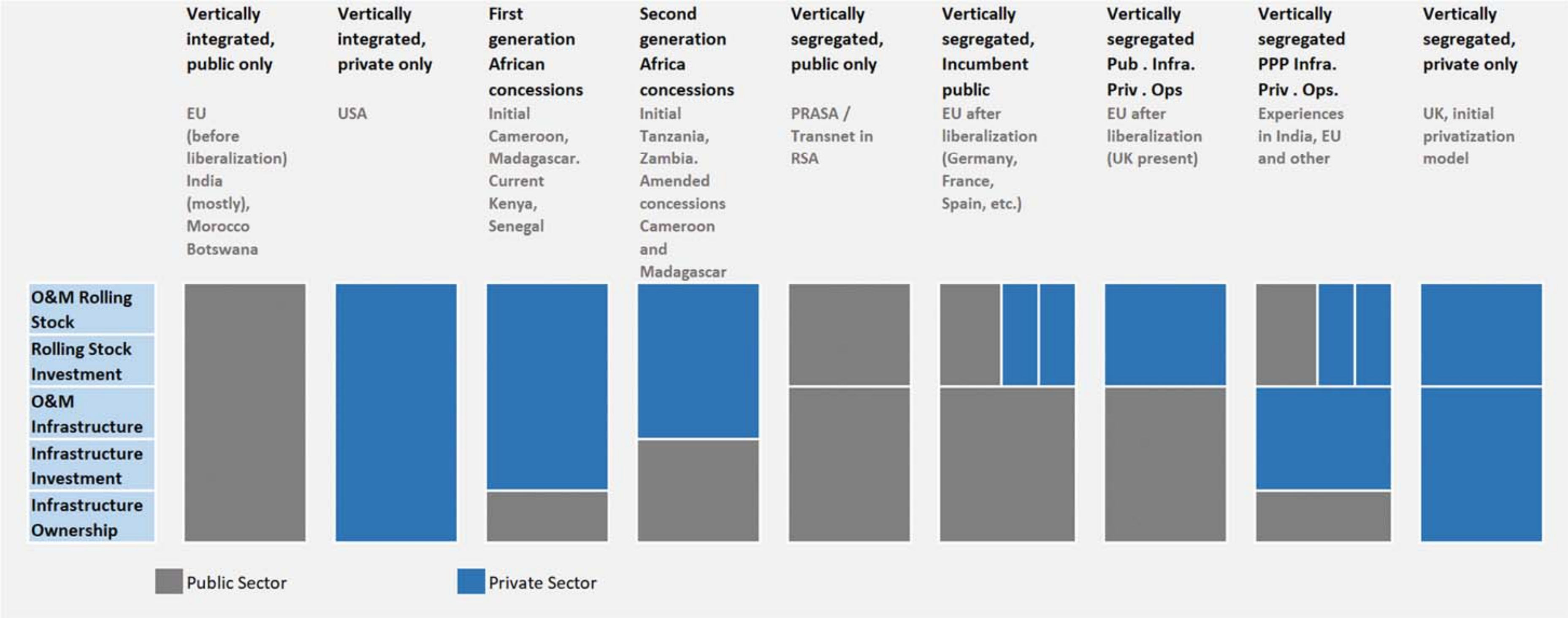
A large range of railways delivery models has emerged based on railways history, existing regulatory framework and market specificities, for which the two main differential criteria are:

- Vertical integration or separation of the railways activities including financing, acquisition, construction, operation and maintenance (O&M) of rails and rolling stocks; and
- Public or private sector allocation of responsibilities for these activities.

The figure below summarises the variety of business models across the world.

[29] Henn, Sloan and Douglas 2012

Figure 5-6: Rail Business Models



Source: Rail Infrastructure in Africa, Financing Policy Options, African Development Bank, 201.

The above figure shows that there are several different models but that none of them is obviously the most suitable for any purpose. The comparative credibility and suitability of the different structures depends on:

- The level of potential operating income in comparison to costs (the financial feasibility or viability degree);
- The commitment and capacity of the government to support railways; and
- The appetite and capacity of the private sector.

It is important to underline that the choices regarding more bundled or unbundled business models, public or private delivery are most often based on political or ideological considerations and that there is no decisive technical evidence in support of a single model.

It is, however, important to understand that the chosen delivery model influences the available funding sources and financing mechanisms since they are not the same for the private and public sectors.

5.5 Financing Mechanisms and Funding Sources

This section presents the financing tools and funding sources potentially available for AIHSRN projects.

We begin with the assessment of funding and financing that are available to either the public or private sector or both, their characteristics in terms of availability and cost, and their time horizon.

Given their importance for transport infrastructure financing in general, and for cross-border rail in particular, we have thereafter made a focus on the financing tools from the two main multilateral IFIs active on the continent: the African Development Bank (AfDB) and the World Bank.

Following from Table 6-1, the funding sources are divided into three branches between financing tools, asset-related revenue generating sources and public funding mechanisms. Financing tools consist of sources that generate financing income such as bonds, commercial loans, equity and equipment trust certificates. Asset-related revenue generating sources include operating income sources such as fare revenue, services revenue and track access charges, and also capital income such as income from sale of assets. Public funding mechanisms include alternative sources of income such as gas tax, carbon tax, sales tax and others.

Table 5-1: Sources of Funding for Rail Projects

Funding Source	Freight	Passenger	OPEX	CAPEX	Magnitude of Funding Potential ($ - Low, $$ - high)	Time Horizon	Availability	Public/ Private Accessibility
Financing Tools (Financing Income Generating Tools)								
Public Sector/Government Funding	✓	✓	✓	✓	$$ - No limit subject to availability of funds and public interest	NA	Depends on country	Public
Public Sector Bonds	✓	✓		✓	$-$$ - Depending on market depth; bonds can be raised in local currency or in international markets; country risk premium will apply. Only Botswana has rating of A2 (Moody's). All other countries are below speculative grade with country risk premium between 3.47% and 13.87% (Damodaran NYU Stern 2019)	Up to 10 years	Strong government bonds market in South Africa, Nigeria, Kenya, Mauritius, UEMOA, Zambia, Ghana, and Namibia; only 7 markets with Treasury bonds above US$1 billion - IFC	Public
Private Sector Bonds	✓	✓		✓	$ - Depending on market depth and credit worthiness; equity risk premium as high as 20%, averaging 13.34% for all African countries	Up to 10 years	Very poor market depth except for South Africa, Botswana and Namibia	Private
Commercial Loans (Available to Private Sector or State-Owned Enterprises)	✓	✓		✓	$ - Depends on market depth	NA	Strong market only in South Africa	Both
Equipment Trust Certificates	✓	✓		✓	$ - Form of secured financing practised in the US ranging from US$20 million to US$200 million, at 2% to 5% above federal rate	NA	Unavailable in African market	Both

Funding Source	Freight	Passenger	OPEX	CAPEX	Magnitude of Funding Potential ($ - Low, $$ - high)	Time Horizon	Availability	Public/ Private Accessibility
Finance or Capital Lease	✓	✓	✓	✓	$ - Finance leases depend on the creditworthiness of the lessee and can be used to finance many different types of assets	NA	NA	Both
Equity Investment (Common or Preferred Stock)	✓	✓		✓	$ - Depends on private sector risk appetite; may vary from 5% to 50% of project value	Perpetual/May decrease over life of the concession	Low availability due to high risk; private investment accounted for only 4% of all infrastructure spend in Africa in 2016	Private
Asset-Related Revenue Generating Sources (Operating and Investment Income Generating Tools)								
Fare Box Revenue	✓	✓	✓	✓	$$ - Critical driver of Operations and future expansions	Perpetual	NA	Both
Premium Services Revenue		✓	✓		$ - Marginal revenue from provision of on-board services	Perpetual	NA	Both
On-Board and In-Station Retail Concession		✓	✓		$ - Marginal revenue from leases	Perpetual	NA	Both
Track Access Charges	✓	✓	✓	✓	$ - Potential to recover marginal cost; however, dependent on demand and industry competition	Concession Based - up to 30 years	NA	Both; private only if track owned by private operator
Lease or Sale of Railroad Right of Way	✓	✓		✓	$ - Potential to recover marginal cost; however, dependent on demand and industry competition	If sold - one time; lease may extend up to 30 years	NA	Public
Sale of Land Assets	✓	✓		✓	$$ - A short term measure, may be able to provide one-time capital funding	One time	NA	Public

Funding Source	Freight	Passenger	OPEX	CAPEX	Magnitude of Funding Potential ($ - Low, $$ - high)	Time Horizon	Availability	Public/ Private Accessibility
Commercial Property Development/Joint Development	✓	✓	✓	✓	$$ - Although high upfront investment	Perpetual	NA	Public
Branding, Sponsorship and Naming Rights		✓	✓	✓	$ - Marginal Cost recovery	Perpetual	NA	Both
Public Revenue (Alternative Public Funding Tools)								
Carbon Tax	✓	✓	✓	✓	$ - Carbon sale proceeds may be invested in HSR; California has dedicated almost 20% of cap and trade proceeds to its HSR program	Perpetual	Only introduced in South Africa	Public
Sales Tax	✓	✓	✓	✓	$-$$ - Depending on fiscal strength of state and political situation	Perpetual	Average tax revenue in Africa was 19.1% in 2015, of which 58% came from Sales Tax/VAT. While there is scope to increase taxes, there is already high reliance on Sales tax/VAT which may impede further increase to fund HSR	Public
Gas Tax	✓	✓	✓	✓	$ - Limited upside as gas/fuel tax may impede economic growth in a low-consumption economy	Perpetual	Unavailable data; fuel tax exists in South Africa	Public

Funding Source	Freight	Passenger	OPEX	CAPEX	Magnitude of Funding Potential ($ - Low, $$ - high)	Time Horizon	Availability	Public/ Private Accessibility
Tax Increment Financing (Incremental Property Tax)	✓	✓		✓	$ - Difficult to implement in poor property tax regimes	Through defined concession period	Low due to poor property tax regime - property taxes lower than 1% in almost all African countries, compared to 2-3% average for OECD countries	Public
Impact Fees		✓	✓	✓	$ - One time measure; difficult to implement under poor property tax regime	One time	NA	Public
Station Parking Charges		✓	✓	✓	$ - Very low revenue source compared to overall operation	Perpetual	NA	Both; private only if lease is with private operator
Heavy Goods Vehicle (Truck) Charges	✓		✓	✓	$ - Limited upside as truck tax may impede economic growth in low-consumption economies	Perpetual	NA	Public

5.6 IFI Funding Sources

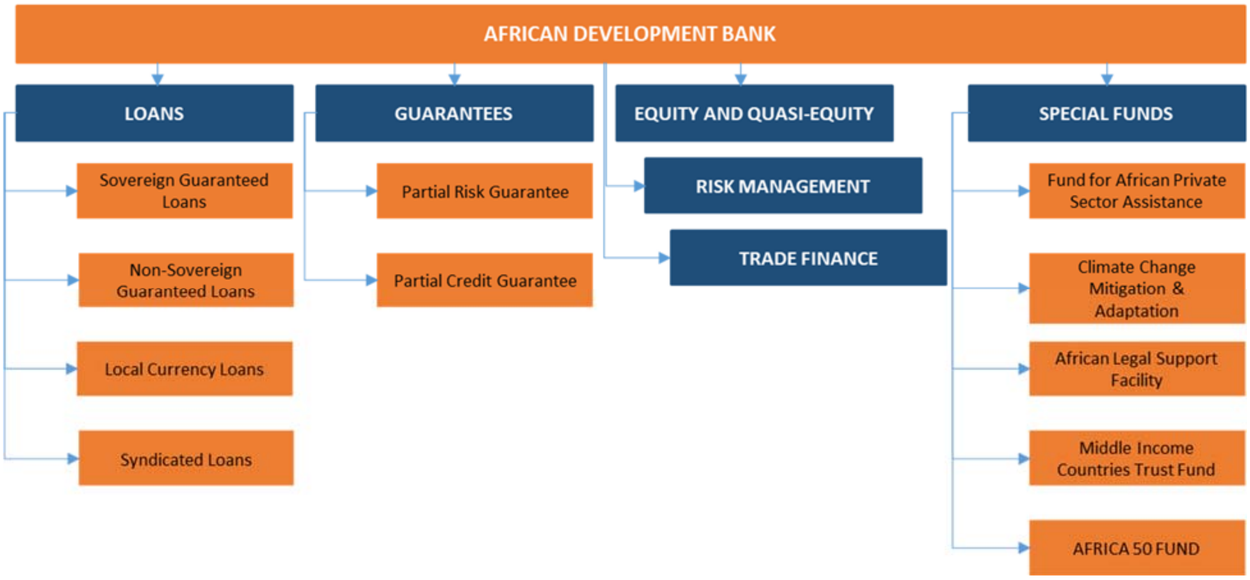
IFIs are decisive contributors to the development of railways across the world. They provide a large diversity of financial products such as technical assistance, grants, loans, equity investments, guarantees and risk management products such as currency hedges. In the context of AIHSRN, there are predominately two IFIs that would be able to provide development funding for such projects. These are AfDB and the World Bank.

African Development Bank

AfDB financial products helping enhance African infrastructure development include loan products, guarantees, equity and quasi equity, risk management products, trade finance, special funds and technical assistance.[30]

[30] Rail Infrastructure in Africa, Financing Policy Options, African Development Bank, 2015

Figure 5-7: African Development Bank Funding Products



Source: CPCS; derived from Rail Infrastructure in Africa, Financing Policy Options, African Development Bank, 2015.

Table 5-2: Sources of Funding from African Development Bank

Funding Source	Freight	Passenger	OPEX	CAPEX	Magnitude of Funding Potential ($ - Low, $$ - high)	Time Horizon	Accessibility to Public/Private
Sovereign Guarantee Loans	✓	✓		✓	$$	Up to 25 Years + 8 years grace period	Provided to RMCs and Public Sector with Sovereign Guarantee from Blend and ADB countries
Non-Sovereign Guarantee Loans	✓	✓		✓	$$	Up to 15 Years + 5 years grace period	Public Sector Companies of ADB and Blend countries without sovereign guarantee and all private sector companies
Nigeria Trust Fund Loan	✓	✓		✓	$ - Up to US$10 million	20 and 27 years for public sector and 15 years for private sector	Both public and private sector of regional member countries of AfDB

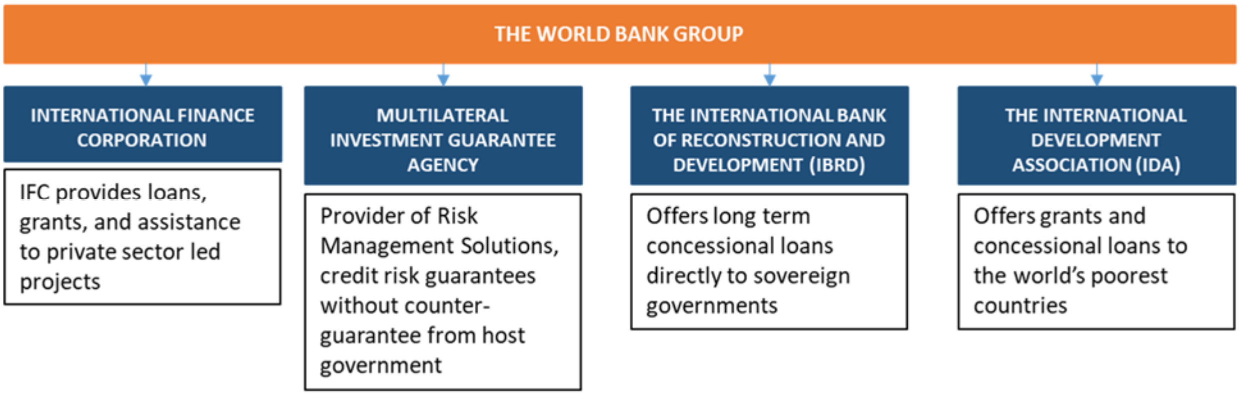
Funding Source	Freight	Passenger	OPEX	CAPEX	Magnitude of Funding Potential ($ - Low, $$ - high)	Time Horizon	Accessibility to Public/Private
Local Currency Loans	✓	✓		✓	$ - Funding method includes issue of domestic bonds, and synthetic loans and currency swaps	Up to 15 Years + 5 years grace period	AfDB members
Syndicated Loans	✓	✓		✓	Depending on structure of loan; commercial banks enjoy preferred creditor status from AfDB, thereby mitigating country risk as they have preferential access to foreign exchange	NA	Both
Partial Risk Guarantees	✓	✓	✓	✓	$ - Protects against exchange rate losses	Through the term of loan/project	Private
Partial Credit Guarantees	✓	✓		✓	$ - Protects banks against default; reduces cost of borrowing for rail developer	Through the term of the loans	Available only to participating banks
Equity and Quasi Equity (including Africa 50)	✓	✓	✓	✓	$ - Bank takes an ownership stake in the business and by doing so accepts part of the business risks. Unlike loans, the bank does not expect a fixed payback but returns through dividends and sale of shares.	Perpetual/AfDB states that it does not expect a return	Private
Risk Management Products	✓	✓	✓	✓	$ - Enable clients to hedge their exposure to market risks, including interest rate, currency exchange and commodity price. These include interest rate swaps, cross currency swaps, commodity swaps, and caps and collars	NA	Private
Trade Finance					NA - Trade finance provides lines of finance for increasing capital liquidity in trade flows. This is inapplicable to High Speed Rail projects	NA	NA

Funding Source	Freight	Passenger	OPEX	CAPEX	Magnitude of Funding Potential ($ - Low, $$ - high)	Time Horizon	Accessibility to Public/Private
Fund for African Private Sector Assistance	✓	✓	✓	✓	This provides untied grants for studies, technical assistance and capacity building for private sector projects and African institutions	NA	Private
Climate Change Mitigation and Adaptation Fund	✓	✓	✓	✓	$$ - useful if funds can be invested in low-carbon, high speed electric rail. The funding sources include Climate Investment Funds (CIF) – of US$7.6 billion, AfDB committed to channel US$1 billion to Africa out of sub-funds Clean Technology Fund (CTF); Strategic Climate Fund (SCF), among others; and Global Environment Facility – AfDB is the implementing agency for Africa	NA	Public
African Legal Support Facility	✓	✓	✓	✓	Under this facility, AfDB helps members countries in negotiating complex commercial contracts and prevent erosion of debt sustainability	During negotiation phase of projects	Public
Middle Income Countries Trust Fund	✓	✓	✓	✓	The fund provides project preparation; technical assistance/capacity and institutional building; analytical work, regional integration	NA	Public

World Bank Group

Similar to AfDB, the World Bank Group also provides loan products, guarantees, equity and quasi equity, risk management products, trade finance, special funds and technical assistance. However, unlike AfDB, the World Bank Group operates through four separate entities, which provide different financial and capacity building tools to address the risks of large infrastructure development. The figure below depicts the World Bank group entities which may help finance or provide risk mitigation solutions towards the development of AIHSRN.

Figure 5-8: World Bank Group Entities



In addition to financing, the World Bank also provides support activities and capacity development, which help with sustained operations of the infrastructure projects. Specifically, for rail development in Africa, the studies by the World Bank include:

- Africa Transport Policy Programme (SSATP) (2003); Railways concessioning toolkit – application to African network.
- AFTTR (2006); Sub-Saharan Africa: Review of selected railway concessions.
- Africa Infrastructure Country Diagnostic (AICD) (2009); Off-track: Sub-Saharan African Railways.
- Public-Private Infrastructure Advisory Facility (PPIAF) (2011); Railway Reform: Toolkit for Improving Rail Sector Performance.
- SSATP (2013); Rail transport: Framework for improving railway performance in Sub-Saharan Africa (SSA).
- Railway reform (2017); Toolkit for improving rail sector performance.

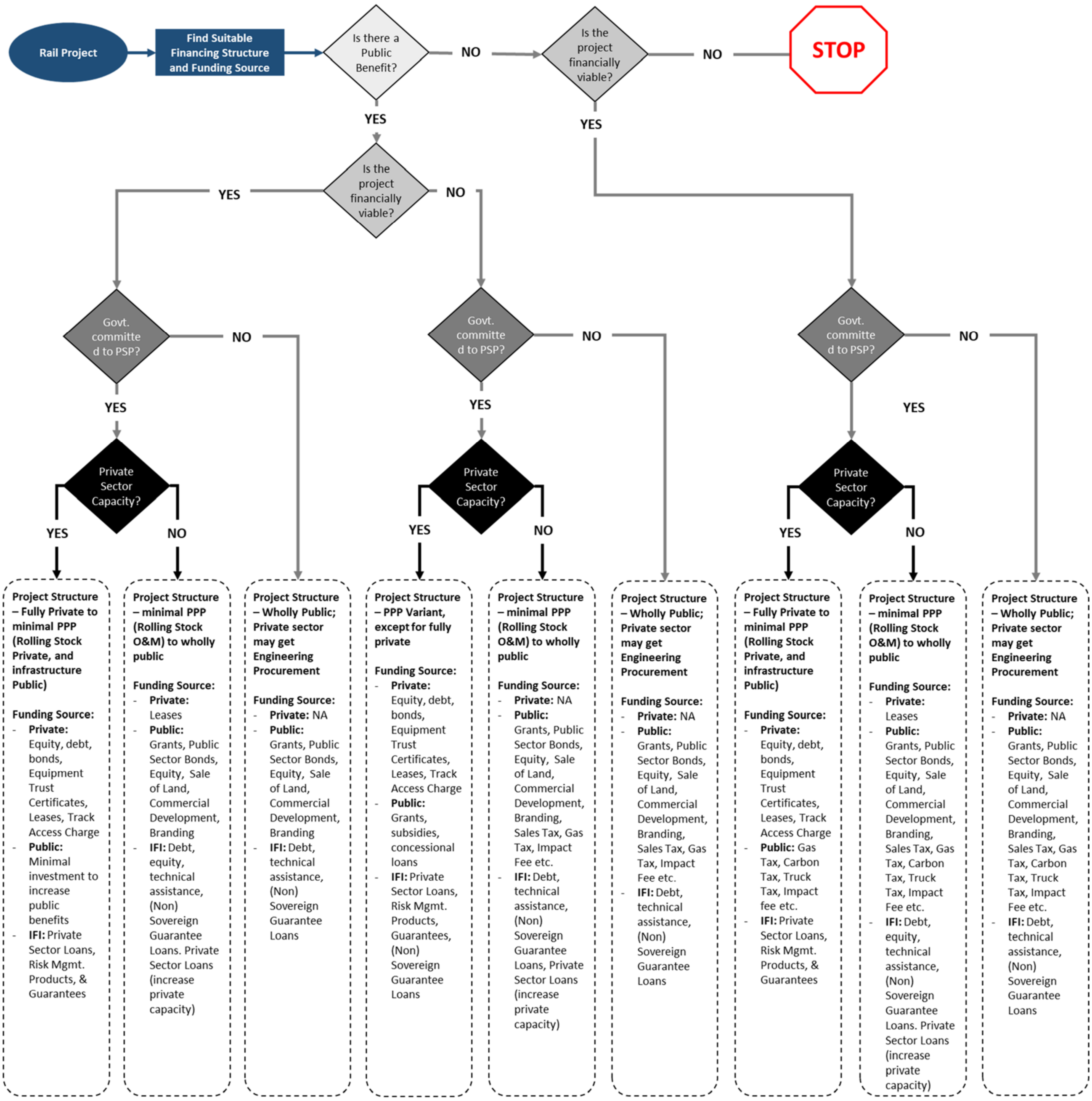
5.7 Delivery and Financing Mechanisms

This section discusses the delivery and financing mechanisms that can be contemplated for AIHSRN projects. In doing so, we revisit and combine our discussion in the previous sections on whether the project has a public benefit and whether it is financially feasible[31], if the country's government has the commitment and capacity to engage in private sector participation, and what are the delivery structures and corresponding funding and financing mechanisms.

[31] In this section "financially feasible project" means that the HSR line operating revenues are sufficient to cover the operating costs and a substantial portion of the capital requirements generating adequate private return, so that a significant private sector participation in the project financing and delivery structure can be envisaged.

Figure 6-9 below depicts the decision-making chart that we can follow in ascertaining which delivery structures, private and public funding sources and financing mechanisms would be best suited for the project requirement.

Figure 6-9: AIHSRN Delivery and Financing Mechanism



For each project, the possibility of private sector participation and the availability and terms of funding and financing options will depend on:

- **The degree of financial feasibility of the project:** If operating revenues are sufficient to cover operating and capital costs, a vertically integrated operation model, privately financed, is possible. Conversely, the need for public operating subsidies will advocate for vertically segregated models (public infrastructure and private operations).
- **The project's size, schedule and geographical footprint:** Funding for the rail projects is most crucial at the construction phase when large amounts of capital are required to build the assets. This is especially risky as the asset may take up to five years to build (10-plus years in case of delays in land acquisition or political uncertainty) and produce no cash flows until it begins operating. In such cases, availability of debt and high-risk equity investors become critical. In the case of cross-border projects in Africa, where the perception of political risk remains relatively high, it may not be possible for governments or private sector companies to access long-term capital with adequate grace periods (period during which interest or principal is not paid). In such cases, IFI funding will be crucial to plug the gap.
- **The project's operating revenue risk, including potential public long-term contributions:** Equally important in the later phases is the operating income. The funding sources in this phase will include freight tariffs, fare box revenues, other incomes from operations, and guaranteed grants or taxes by the government. The operating revenues will not only fund the operating costs but also serve the construction financing. Therefore, the arranging of such financing depends on the operating income projections being met, and the government grants and taxes that were promised being diligently transferred each fiscal period. These funds are therefore variable as predictions may not be achieved, and governments may rescind regulations mandating fixed transfers.
- **The depth of financial markets:** If the region or country has deep financial markets, i.e. the market capitalisation and volume of trade on financial exchange is high, then access to capital is easier and quicker for both the private and the public sectors. Deeper financial markets also reduce interest yields applicable on loans and bonds. In such cases, both the public and the private sectors will find it easy to raise money from diversifiable sources. In absence of financial markets, the money supply will be restricted to international markets, which may charge a high country risk premium. In such situations, IFI credit guarantees and risk management products, such as interest swaps and currency swaps, will also be needed to mitigate investor risk aversion, thereby increasing the overall cost of raising funds.
- **IFI and DFI appetite:** Large infrastructure investment such as cross-border HSR will certainly require the support from all IFIs and Development Finance Institutions (DFIs) potentially concerned, and their buy-in in the structuring phase is recommended.
- **The budgetary situation of project's countries:** The governments' capacity to make financial contributions will depend upon their budget deficit and indebtedness. The health of the countries' public finance will influence not only their capacity to raise the required funding but also the private investors' and funders' appetite for the project.

- **The quality of tax administration and governance:** Several alternative income sources such as carbon tax, gas tax, impact fee, tax increment finance and others require the governments to have a sound tax collection capacity. When tax collections are low and many citizens do not pay taxes, such mechanisms may not be able to service the funding required for the AIHSRN project.

In light of the above discussion, the delivery structure and financing options for each rail line must be assessed individually. Given the lack of market depth and private sector appetite, it is anticipated that much of the financing burden will fall on the public sector. Also, knowing that the state of public finance is constrained in most African nations, IFIs will likely be required to play prominent roles in development of these projects. It is likely that a full-scale private development or a fully funded public railway will be found to be unviable in all or most cases. As such, the optimal structure will be a vertically segregated railway with the private sector responsible for operations and rolling stock and the government responsible for fixed infrastructure.

6 Environmental and Social Impact Management

6.1 Policies (and Principles)

A variety of policies and applicable legislation set out the relevant legal and regulatory requirements. These range from international agreements to relevant sectorial and cross-sectorial policies. Given the large extent of the project, the applicability of numerous other pieces of legislation to the proposed project should also be considered.

Table 6-1: Applicable Policies, Plans and Strategies

Legislation/Act/ Policy	Relevant Countries	Applicability/Comment
IFC Performance Standards on Environmental and Social Sustainability	All	The Performance Standards provide guidance on how to identify risks and impacts and are designed to help avoid, mitigate and manage risks and impacts as a way of doing business in a sustainable manner, including stakeholder engagement and disclosure obligations of the client in relation to project-level activities.
IFC Handbook for Preparing a Resettlement Action Plan (2002)	All	A resettlement policy framework is required for projects with sub-projects or multiple components that cannot be identified before project approval. This instrument may also be appropriate where there are valid reasons for delaying the implementation of the resettlement, provided that the

Legislation/Act/ Policy	Relevant Countries	Applicability/Comment
		implementing party provides an appropriate and concrete commitment for its future implementation.
African Convention on the Conservation of Nature and Natural Resources (1968)	Angola, Benin, Burkina Faso, Burundi, Chad, Cote d'Ivoire, Congo, Djibouti, Democratic Rep. of Congo, Gambia, Ghana, Libya, Lesotho, Liberia, Mali, Niger, Rwanda, South Africa	The African Convention on the Conservation of Nature and Natural Resources aims to enhance environmental protection, foster the conservation and sustainable use of natural resources, and harmonise and coordinate policies within these fields with the view to achieve ecologically rational, economically sound and socially acceptable development policies and programmes.
African Development Bank (AfDB) Involuntary Resettlement Policy	All	The primary goal of the involuntary resettlement policy of the African Development Bank (AfDB, or the Bank) is to ensure that when a bank intervention requires people to be displaced, they are treated equitably and share in the benefits of the project that involves their resettlement, improving their living standards.
Convention on Biological Diversity (1992)	All	The CBD is a multilateral treaty that has three main goals: the conservation of biodiversity; the sustainable use of its components; and the fair and equitable sharing of benefits arising from the use of genetic resources; with the ultimate aim to encourage actions that lead to a sustainable future.
Environmental, Health, and Safety (EHS) Guidelines	All	The World Bank Group EHS Guidelines are referred to in IFC Performance Standard 1 as the technical reference documents with general and industry-specific examples of good international industry practice, to be used as a technical source of information during project implementation.
IFC Environmental, Health, and Safety Guidelines for Railways	All	These guidelines are applicable to activities typically conducted by rail infrastructure operators dedicated to passenger and freight transport. The document includes rail operations, covering construction and maintenance of rail infrastructure as well as operation of rolling stock, such as locomotives and rail cars; and locomotive maintenance activities, including engine services, and other mechanical repair and maintenance of locomotives and railcars.
Gaborone Declaration for Sustainability in Africa (GDSA) (2012)	Botswana, Gabon, Ghana, Kenya, Liberia, Mozambique, Namibia, Rwanda, South Africa, Tanzania	The overall objective of the Declaration is "*To ensure that the contributions of natural capital to sustainable economic growth, maintenance and improvement of social capital and human well-being are quantified and integrated into development and business practice*."

6.2 High-Level Identification of Environmental Impacts

6.2.1 Environmental Risks to be Considered

Routing of railway alignments is likely to have several significant negative environmental impacts. Screening at the initial phase can assist in avoiding certain impacts and allowing for adequate mitigation and technological responses to be considered in the early planning stages of the project. Experience with linear and rail infrastructure assessments indicates that most impacts related to such projects in Africa are of a socio-economic nature, which are discussed in Section 6.3 below. However, the environmental risks that must be considered during the planning phases of such projects can include:

- Air pollution caused by dust, factory emissions and inefficient and poorly maintained diesel engines used in transport systems, especially in urban areas and by dust and smoke in the rural areas;
- Bush fires, especially in forest areas. Measures identified to protect the environment include reducing the number of bush fires and educating the public about the negative consequences thereof. Uncultivated areas tend to carry a high fire risk, particularly during the dry season;
- Declining sizes of animal and plant populations;
- Decrease in levels of biodiversity, which are greatly threatened by the increasing human population seeking more land for settlement and agriculture. Protected areas have played a very important role in the preservation of biodiversity. Due to the relatively high rates of deforestation for cultivation and fuel, with resultant loss of habitat and erosion problems, densely wooded areas are considered important areas for biodiversity.
- Decrease in water quality and availability. Decreasing water availability has resulted from droughts, water abstractions for water supply and irrigation schemes to provide for increasing population numbers, as well as deforestation for land clearing and for timber for utilisation. Improper disposal of wastes and poor agricultural practices, which have encouraged soil erosion and the deposition of sediment into water bodies have contributed to the degradation of water quality;
- Degradation of aquatic environments through inappropriate land practices in the catchment areas, as well as along the length of water courses, with inadequate buffer areas, resulting in siltation and water pollution. This includes cultivation and development in wetlands, building in flood plains and on river banks, and over-exploitation of key habitats for water fowl and their hunting. Aquatic habitats are important from both a habitat perspective and in terms of protecting water quality;
- Deforestation caused by the demand for wood and charcoal, and the conversion of land for agriculture. Not only will trees need to be cleared for a railway line, the line may also create easier access to areas where deforestation is currently limited;
- Encroachment of cultivated and settled land into forests;
- Improper industrial waste management;

- Land degradation from excessive cultivation as well as poor agricultural practices in marginal farming areas and environmentally sensitive areas, such as steep slopes, river banks and wetlands;
- Low utilisation of alternative renewable and resource efficient technologies;
- Noise pollution; and
- Soil erosion from land clearing in unsuitable areas, resulting in a serious environmental problem. Uncontrolled deforestation and burning of bush exacerbate the problem, which affects both water resources and the agricultural potential of soils.

6.2.2 Fatal Flaws

While specific parts of a railway routing may present concerns from either a biophysical or social perspective, or both, the positive social benefit of such regional and continent-wide infrastructure means that there are unlikely to be fatal flaws to the proposed development, even for aspects of environmental concern. Such concerns could be addressed through alternative alignments or mitigating actions.

6.2.3 Construction and Operation Environmental Impacts

There are several impacts associated with the construction and operation of the proposed railway alignments[32], which may have varying degrees of effect on the aspects identified above. These are summarised below.

Construction

- Developments result in physical disturbances and can cause what is termed the "barrier effect", where components such as quarries and construction sites may restrict the movement of animals, especially the smaller, less mobile species. This effect is increased in the case of linear developments.
- Loss of and/or destruction of habitat can result when borrow pits and construction sites are set up, which can impact on aspects such as biodiversity. This impact will be greater where there is a need for cut and fill operations which include blasting of rock, provision of fill from recovery of blast material or from borrow pits elsewhere, and construction of access roads in more remote areas.
- Noise from blasting and/or construction activities may affect animals and humans in the area.
- Vibrations from blasting activities may affect animals and humans in the area. Blasting could also damage buildings.
- Water resources may be negatively affected by construction activities, resulting in pollution and siltation of wetlands and rivers. River crossings are at particular risk.
- Erosion results in loss of topsoil and siltation of water bodies. This aspect must be specifically considered on steep slopes, where earthworks and removal of vegetation

[32] International Finance Corporation, 2007. Environmental, Health and Safety Guidelines for Railways. World Bank Group.

increase the risk of erosion, especially on steep slopes and where cuttings and/or tunnels are considered.

- Flooding could limit access to construction sites, restricting activities to dry periods in certain areas. This should be addressed during construction planning.
- Houses/ structures may be affected, as some houses or buildings might be in the construction right-of-way, thus requiring relocation. Given shortages of land in certain areas, nearby sites for relocation might not be available. Relocation to far-away sites could lead to social fragmentation and impeded access to services and livelihood resources.
- There may be temporary loss of cultivated land to construction right-of-way. Most households are poor and highly dependent on subsistence agriculture. Thus, they are vulnerable to the effects of a loss of land and crops, as this may impact on food security.
- There may be an impact on cultural resources, where graves or sites of spiritual significance situated in the construction right-of-way would have to be relocated.
- Disruption of daily movement patterns will occur if access to the construction right-of-way is restricted. This could disrupt pedestrian paths crossing the route, thus increasing distances people must travel to get to education, health, water and other facilities.
- Construction traffic and activities could pose a safety risk to nearby communities (especially young children).
- The creation of temporary employment opportunities is a positive impact that may result.
- There is a potential for influx of job seekers. Given the high levels of poverty in Africa, large numbers of people might flock to construction areas in search of employment.
- Social pathologies may result. The presence of a migrant construction workforce and large numbers of job seekers could contribute to social problems such as crime and the spread of HIV/AIDS.
- Speculative building or planting may occur. Once word gets out that resettlement or compensation are to take place, people might deliberately move into or cultivate the area they suspect will be appropriated to become eligible for compensation.

While construction is restricted to a limited period, it has the potential for significant negative environmental impacts if activities during this period are not carefully managed. Effective screening in the initial phases may assist in reducing such impacts by ensuring that site selection for the various components has considered sensitive environmental features.

Railway Line

- Alteration, loss of and/or destruction of terrestrial and aquatic habitats will result from the railway line and associated infrastructure such as access roads for maintenance and stations. This can result in the loss of wildlife breeding sites, disruption of watercourses and the introduction of alien invasive species, all of which can have impacts on aspects such as reduced biodiversity.

- The barrier effect is increased with the linear nature of railway lines, which may act as a physical barrier to the movement of animals.
- Erosion risk is also increased with a linear structure if not properly managed, especially on steep slopes and where cuttings and tunnels are located.
- Habitat fragmentation and the edge effect can result when railway lines traverse natural habitats. This can affect the functioning of systems and result in smaller areas that are no longer able to support ecosystem functions. Fragmentation of habitats also effectively increases the edge of such habitats and it is well documented that this adds to the cumulative impact of habitat alteration along the boundaries of habitats.
- Pollution can result from spillage or polluted stormwater runoff from above-ground storage tanks along the route.
- Increased human access may impact on species and ecosystems, with threats to wildlife and vegetation. The risk is especially high with respect to deforestation and poaching in wildlife reserves.
- Permanent loss of land to the railway servitude will result. Even if this is customary land, international best practice dictates that users of the land should be compensated for its loss. Previous experience with land acquisition indicates that most household heads are likely to prefer cash compensation. However, this preference must be viewed with caution as it may not be in the interest of all household members.
- A preferred option to cash compensation is the provision of replacement land of comparable size and quality. It is preferred to provide compensation in the form of a replacement asset (e.g. land and/or a dwelling). However, given the shortage of land, this may not always be possible.
- Fragmentation of landholdings may result where landholdings traversed by the route could be cut into smaller pieces, making cultivation and management of the land more difficult.
- A positive impact of the development is the potential creation of new access routes. The railway servitude may serve as a route for pedestrians or carts through terrain that was previously difficult to traverse. As such, it could improve access to services and stimulate commerce between villages, bolstering local economies and improving villagers' well-being.
- A negative consequence of easy access to the railway route is the risk of theft of railway infrastructure and equipment.

The railway line represents a constant physical barrier and impacts associated with this are of a permanent nature as long as the railway line is in place. There is also infrastructure required along the route, such as fuelling stations which may further fragment habitats and have associated pollution risks.

Transport of Goods

- There is a risk of fire from spontaneous combustion of combustible goods during transport.

- There is a risk to sensitive animals in the area from the noise of the trains. Noise could also affect people (e.g. by impairing learning if the railway passes close to schools).
- Waste water from the operation of trains, and waste from railway operations can lead to contamination of soil and water resources.
- There is a safety threat in terms of risk of injury or death to people crossing the track.
- Wildlife may be threatened directly in terms of risk of injury or death to animals crossing the track.
- There is a risk to sensitive animals in the area from vibrations of the train, while vibrations from the train may cause damage to sensitive or poorly constructed buildings.
- A positive impact is that social investment initiatives by the proponent could benefit communities adjoining the route.

6.2.4 Recommendations

While many of the biophysical mitigations will be site-specific and informed by the findings of detailed impact assessment, the following recommendations are made:

- It is recommended that alignments through protected areas are avoided from an environmental perspective. Where such alignments cannot be avoided, mitigations should be larger and more significant than the impacts.
- The alignments need to be refined to allow for avoidance of sensitive areas wherever possible, and to allow for the accommodation of buffer areas.
- Detailed studies must be undertaken to investigate ways of mitigating the negative impacts and compensating for, or finding offsets wherever possible to address, impacts on biodiversity. This is both from a perspective of protecting biodiversity resources and achieving sustainable utilisation, as well as promoting investor confidence in biodiversity in the region.
- In attempting to mitigate large infrastructure impacts it is important to coordinate all plans across all regional projects.
- In terms of both specific country legislation relating to environmental management and the World Bank Environmental & Social Framework (ESF), Environmental & Social Standard 1 (ESS1 - Assessment and Management of Environmental and Social Risks and Impacts), an Environmental Impact Assessment will be required for each country traversed by the proposed railway alignments. The projects can be classed as Category A as they are likely to have significant adverse environmental impacts that are sensitive, diverse or unprecedented.

6.3 High-Level Identification of Social Impacts

Social impacts that are expected to arise because of construction and operation of the proposed railway alignments are categorised into four broad groups: those arising from construction activities, those related to an influx of construction workers and job seekers into the project area, impacts related to land acquisition for the project, and impacts that are expected to materialise only during the project's operational phase. In each category, positive and negative impacts have been identified, as indicated in Table 6-2 below.

Each of the impacts in the table and recommended mitigation measures to avoid or reduce negative impacts and enhance positive ones is discussed in the following sub-sections.

Table 6-2: Summary of Potential Impacts

Cause of impact		Impact
Construction-related impacts	Positive aspects:	Job creation
	Negative aspects:	Construction-related safety impacts
		Visual/ acoustic/ vibration/ air quality impacts
		Disruption of daily movement patterns
		Negative impacts related to construction camps
Population influx	Positive aspects:	Increased markets for local entrepreneurs
	Negative aspects:	Increased social pathologies
		Conflict/ competition between newcomers and incumbent population
		Increased pressure on local services/ resources
Land acquisition	Positive aspects:	Improvements in housing/ services
		Creation of economic opportunities through resettlement
	Negative aspects:	Displacement of structures and businesses
		Loss of land and crops
		Loss of cultural resources
Operational impacts	Positive aspects:	Reduced transport costs and time
		Regional integration
	Negative aspects:	Operational safety and physical intrusion impacts
		Negative impacts of increased thoroughfare

6.3.1 Construction-related Impacts

Impact Description

This section deals with the positive and negative socio-economic impacts that are expected to occur as a result of construction activities. These include:

- Job creation during construction. Many communities in Africa are characterised by poverty and underdevelopment. Employment on the labour force used for construction of railways – even if it is temporary – will therefore represent a significant economic benefit for members of these communities. In addition to creating job opportunities for construction workers, the project may also lead to indirect employment creation in the informal sector, for instance in terms of food stalls for the convenience of construction workers.
- Construction-related health and safety impacts. Construction activities are likely to result in an increase in traffic volumes on, as well as obstructions in, the roads used for accessing construction areas. Increased traffic and construction works could lead to degradation of these roads. Speeding or reckless driving of construction vehicles through populated areas could also pose a safety risk. This, in combination with obstructions in the access roads, could result in potentially unsafe travelling conditions, thereby

impacting on the safety of both road users and residents in surrounding communities. Animals such as cattle and goats wandering onto the roads would also be at risk. Borrow pits used during construction may also pose a risk, as people (especially children) wandering into borrow pits areas would be at risk of accidents, while water-filled borrow pits that are not rehabilitated after construction may provide breeding sites for vectors of several life-threatening diseases (i.e., mosquitoes and malaria; snails and bilharzia). Areas most at risk of such impacts are those where rail routes traverse large areas occupied by settlements and cultivation.

- Visual, acoustic, vibration and air quality impacts. The quarries, borrow pits and construction sites will affect the quality of the visual environment; increased traffic and construction activities will increase noise in the area; blasting during construction work could cause severe disturbance to nearby communities, and could cause structures to crack; and dust generated by construction activities, and by vehicles moving on access roads during construction, could affect air quality in the area.
- Disruption of daily movement patterns. There are likely to be large numbers of roads of varying sizes crossing the proposed railway alignments. During construction, these roads are likely to be blocked, and this could therefore cause disruption of people's daily movement patterns.
- Negative impacts related to the presence of construction camps. It is well-documented that construction camps used to accommodate workers can be a potential source of annoyance to nearby communities, and pose security-related risks. Specific potential impacts in this regard include negligence about starting fires around the construction site, which could pose a fire hazard; loss or theft of domestic livestock due to poaching by construction workers; a lack of control over contract employees in respect of ablutions, which could pose a health risk to local communities; and littering by construction workers. An additional source of risk is that construction camps are predominately inhabited by single men who can often create social disturbances, usually as a result of drinking and or being away from their wives or girlfriends; these can be a major source of annoyance to nearby communities and can also give rise to various social pathologies.

Mitigation Measures

The following mitigation measures are recommended to reduce negative impacts and enhance positive ones:

- Job creation. Given that communities near the proposed alignments will experience the brunt of the negative impacts from the projects, it is consistent with international best-practice standards (such as the World Bank Operational Policies) that they should be given special consideration for project benefits. It is therefore recommended that as much of the construction work be undertaken through labour-based works as is feasible. Established methods for ensuring fairness and gender equity of the recruitment of local labour (e.g. through the establishment of a local "labour desk") should be employed. To ensure that the benefits of local job creation extend beyond the construction phase of the projects, it is also recommended that the project proponents make use of labour-based works during subsequent railway maintenance.

- Construction-related health and safety impacts. The following measures should be implemented to mitigate the potential impacts described above:
  - Traffic: Safe travelling speeds should be determined for access routes close to populated areas, and measures implemented to ensure that these restrictions are enforced. Such measures may include monitoring vehicle speeds, erecting speed limit signs and installing speed humps. Where railway routes cross existing roads, construction areas should be clearly demarcated with reflective road signs, both at the site and at intervals on either side of the site.
  - Unauthorised access: Unauthorised access to construction sites, borrow pits and quarries should be prevented through appropriate demarcation or fencing of the areas.
  - Water in borrow pits: All borrow pits should be adequately rehabilitated after construction is complete to prevent a drowning risk.
  - Bush fires: Making fires by construction workers should be restricted to areas where these fires can be tightly controlled, or making fires should be prohibited.
  - Community education: A community safety awareness campaign should be implemented in the surrounding communities to sensitise community members to traffic safety risks and the need to prevent children and animals from wandering onto access roads or construction areas.
- Visual/ acoustic/ vibration/ air quality impacts. Measures to mitigate impacts related to the visual environment, noise and air quality are discussed in the previous section on environmental impacts and will not be repeated here. It is anticipated that communities' negative experience of the nuisance impact of construction activities can be further mitigated through the benefits from local job creation on the project (discussed above) and by clear communication of the long-term positive impact the transport system is intended to have.
- Disruption of daily movement patterns. Temporary crossing and access points need to be established at places of frequent traffic across the railway routes. The location of such points should be decided in consultation with affected communities and business owners. For disruption caused by borrow pits, the construction contractor should make alternative routes and/or access points available to the affected community.
- Negative impacts related to construction camps. Where possible, the housing of construction workers in construction camps should be avoided. This could potentially be achieved by accommodating non-local workers in existing communities (although this may create its own set of impacts). If the establishment of construction camps cannot be avoided, camps should preferably not be located at places where they could cause nuisance or safety hazard to surrounding communities. If necessary, local communities should be consulted in the construction site selection process. Only workers may be allowed admittance to the camps, and sufficient ablution and entertainment facilities should be included in the construction camps.

6.3.2 Population Influx

Impact Description

As news regarding the proposed project spreads, expectations regarding possible employment opportunities may also take root. Consequently, areas where construction is set to take place may experience an influx of job seekers. This may begin before construction and is likely to continue after construction has been completed.

If some of the workforce is recruited from outside the local area (for instance, to supply skills required for geotechnical investigations), their presence will constitute an additional influx of people. This impact, however, will most likely be limited to the construction phase of the project.

The influx of construction workers and job seekers is expected to have a variety of social consequences:

- On the positive side, the population influx could present improved opportunities for local entrepreneurs and could offer other benefits for the local economy.
- Increase in social pathologies. An influx of job seekers may lead to an increase in various social pathologies, such as drug/alcohol abuse, abuse of women, prostitution and the incidence of sexually transmitted diseases (STDs). This impact may be aggravated by the presence of a temporary construction workforce. With a predominantly male population, construction camps often become a focal point for promiscuous sexual activities. Such activities, particularly when carried out without protection, can result in increases in STDs and in particular HIV/AIDS among the employees and partners. An influx of construction workers and job seekers might also be accompanied by an increase in crime. Even if individual instances of crime are not as a result of the newcomers, they may still be attributed to them by local communities. As with construction-related safety impacts, areas most at risk of such impacts are those where rail routes traverse large areas occupied by settlements and cultivation.
- Conflict/competition between newcomers and local residents. Since it is likely that at least part of the construction workforce will be sourced from outside the project area, conflict is possible between the newcomers and long-time residents. One possible reason for such conflict would be the perception among locals that the outsiders are taking up jobs that could have gone to unemployed members of the local community.
- Increased pressure on local services/resources. An influx of job seekers into the area, combined with the presence of a construction workforce, could place significant pressure on local infrastructure and resources, such as clinics, firewood, water, etc. This impact may be of concern in areas where services and resources are already under pressure due to an influx of refugees or returning refugees from neighbouring countries.

Mitigation Measures

- Improved opportunities for local entrepreneurs. The measures suggested to enhance the positive economic effects of the project may also help to increase the extent to which local entrepreneurs can benefit from the growth of new markets and customers.

- Increased social pathologies:
    - Improved opportunities for local entrepreneurs: HIV/AIDS and alcohol abuse campaigns should be implemented for construction workers and, if feasible, also in neighbouring communities. Means should be investigated for aligning the awareness campaigns with those of other organisations in the area (e.g. NGOs). These campaigns should use various common-practice methodologies to ensure social and cultural sensitivity.
    - Crime: Construction workers must be clearly identifiable by wearing proper construction uniforms displaying the logo of the construction company. Construction workers may also be issued with identification tags. In addition, clear rules and regulations must be established for access to construction sites and offices to control loitering.
- Conflict/competition between newcomers and incumbent population. The project proponent should ensure that the intention of giving preferential employment to locals for unskilled positions is clearly communicated to discourage an influx of job seekers from other areas. The recruitment policy used to employ people on the project must be fair and transparent and should not be driven by nepotism or corruption.
- Increased pressure on local services/resources. If possible, the project proponent or contractor should assume responsibility for establishing services at the construction camps. If the contractor does not take responsibility for the services for construction camps, the appropriate government department must be informed well in advance of the anticipated timeframe and of the nature of services that will be required.

6.3.3 Land Acquisition

Impact Description

This section deals with impacts associated with the clearing of land within the rail right-of-way. From a social perspective, the most pertinent consequence of land acquisition will be the loss of houses or structures and other immovable assets (such as crops or arable land) situated within the intended land-take area. Although land acquisition can have negative socio-economic consequences (such as physical and economic displacement or the loss of cultural resources), it can also offer certain benefits. It offers the opportunity for improvement in housing, services and economic opportunities.

- Improvements in housing and services. International best-practice principles state that all assets lost through resettlement should be adequately compensated for, and that displaced residential and business structures must be replaced with structures that are at least of an equal standard to those that were lost. In this way, resettlement offers an opportunity for improving people’s quality of housing and general standard of living. Informal dwellings might, for instance, be replaced with formal ones, and water, sanitation and other services installed that were lacking at the original settlement.
- Creation of economic opportunities through resettlement. In addition to the requirement that lost assets be replaced to an equal or improved standard, international best practice also stipulates that resettlement should be accompanied by livelihood

restoration – i.e. post-resettlement support to ensure that incomes and livelihoods of households affected by land acquisition are re-established to at least pre-project levels.

- Displacement of structures and businesses. One of the most significant social impacts resulting from land acquisition for project purposes is the fact that it constitutes physical displacement (the loss of a home and the necessity of moving elsewhere) and/or economic displacement (the loss of productive assets such as cultivated fields or business stands). In many instances it may not be necessary to move structures by more than a few metres, although this would depend on whether there is sufficient space available to erect new structures close to their original locations. Areas where the largest numbers of structures are likely to be displaced are those where land uses traversed by the proposed railway routes are dominated by built-up areas and medium- to low-density settlements.
- Loss of land and crops. Economic displacement caused by construction activities will likely involve the loss of cultivated fields within about 20 to 50 metres of the railway. This impact is likely to be permanent, as cultivation in the right-of-way will probably be prohibited once the railway lines are operational. Many fields affected by the project may also lie partially within the right-of-way. Where a field is already small (e.g. less than 1 ha), the fragmentation of the field through the loss of a part of it to the right-of-way is likely to limit the usefulness of the entire field. In such instances, it may be necessary to replace or compensate for the entire surface area of affected fields rather than only for the portion of these fields situated within the right-of-way. Areas where the largest impact on land and crops is likely to occur are those where cultivation and mixed residential-cultivation predominate.
- Loss of cultural resources. Cultural resources that could potentially be affected by the project include graves and sites of spiritual or other significance (such as initiation sites and informal churches). It is possible that some resources (e.g. graves) might be allowed to remain in the right-of-way if they are outside the direct path of the railway line. Structures such as churches would however need to be relocated out of the right-of-way.

Mitigation Measures

- Improvements in housing and services. To ensure that the benefits described above accrue to persons with displaced assets, the project proponent should adhere to international best-practice principles with regard to resettlement and compensation, such as ESSS 5 (Land Acquisition, Restrictions on Land Use and Involuntary Resettlement).
- Creation of economic opportunities through resettlement. To benefit persons affected by land acquisition, the project proponent should investigate the need for providing them with continued support during, and for a period after construction. Such support may include structured agricultural inputs to be coordinated with government or NGOs in the area, as well as business-related training (financial management or marketing strategies) for business owners.
- Displacement of structures and businesses. Where the right-of-way impacts on community or business assets, the feasibility of adjusting the railway route or narrowing

the right-of-way should be investigated for that particular section in order to bypass these assets. Where impacts on structures or assets cannot be avoided, the affected households or business owners must receive compensation either to the equivalent or better value than their affected asset. Where feasible, compensation should be given in kind rather than cash through the provision of replacement structures at appropriate locations determined in consultation with the affected owners.

- Loss of land and crops. Where it is not possible to avoid an impact on agricultural land, compensation should be provided to affected parties. For customary land ownership, owners will only be compensated for the loss of access or use of the affected land, while for privately owned land, owners will be compensated for both the loss of access or use of land, as well as for the value of the land affected. To determine compensation amounts and methods, a Compensation Determination Committee (CDC) should be established to represent project-affected households, local chiefs, local government and the project proponent. The function of the CDC will be to serve as a platform for negotiation of all matters related to compensation for losses incurred through the project, including methods by which values will be attached to these losses and methods by which compensation will be provided.
- Loss of cultural resources. Before construction commencing, surveys should be undertaken in collaboration with local communities to establish the number, types and locations of cultural resources. Re-internment of graves and relocation of spiritual sites, if required, should be done according to social norms and cultural values of the respective communities. The sites selected for relocation should be acceptable to the communities and should allow for access in the long term. The contractor will be responsible for making provision for accidental discovery of archaeological sites and graves within the area to be affected by construction activities.

6.3.4 Operational Impacts

This section deals with impacts that are likely to arise once the railway alignments are taken into service. These include positive impacts (such as reduced transport cost and time, and increased opportunities for regional integration), as well as negative impacts (such as operational safety and physical intrusion impacts, and impacts associated with increased thoroughfare through roadside villages).

Impact Description

- Reduced transport cost and time. The new transport system will dramatically improve travelling conditions between capitals of adjacent countries, but it is unlikely to have economic and social benefits for most communities adjacent to the line. However, cities linked by the railway lines could experience increased economic growth due to improved conditions for trade, as well as improved access to markets, services such as health, education, finance, facilities, etc.
- Regional integration. The host countries of the proposed railway alignments would benefit from the project through increased cross-border trade, improved availability of services and (assuming reductions in transport costs are translated into lower prices of goods) into greater affordability of goods.

- Operational safety and physical intrusion impacts. The new transport system is also expected to give rise to several safety and other negative impacts, such as increased incidence of pedestrian accidents and noise-related impacts that could negatively affect a community's quality of life and sense of place. Areas surrounding schools close to railway lines would be particularly sensitive to such impacts. Schools are most likely to be encountered in areas identified as built-up, medium- to low-density settlements or mixed residential and cultivation areas.

- Negative impacts of increased thoroughfare. Transmission of STDs such as HIV/AIDS is strongly linked to transport corridors; a case in point is the principal transport corridor through East Africa, running from the Kenyan port of Mombasa to landlocked Uganda, which has gained notoriety as a main route of HIV/AIDS transmission. The proposed project is likely to contribute to the continuing increase in the flow of traffic throughout the project areas, thus creating conditions that will put workers and users of the transport sector at particular risk of HIV and AIDS. Improved transport networks also often introduce new – and sometimes unwanted – innovations to isolated communities or groups of people. On occasion, modernisation is imposed on people unprepared to cope. Smaller villages situated along the railway routes could be at particular risk of such negative impacts.

Mitigation Measures

- Reduced transport cost and time. The benefits of railway systems in terms of reducing transport cost and time would partly depend on whether supporting and connecting transport infrastructure is also improved. An important measure to enhance this positive impact would be coordination between national and state transport authorities in the respective countries to ensure that road access to stations are also upgraded where necessary.

- Regional integration. Cross-border trade depends on other factors apart from travelling conditions. These include efficient customs facilities and processes, equitable import/ export taxes and measures to combat criminal activities that sometimes accompany increased movement across borders (e.g. trafficking in persons). It is recognised that many of these conditions may be beyond the powers of the project proponents to address. Nevertheless, it is recommended that steps be taken at appropriate levels in the project proponents to lobby for policy interventions in this regard, where required.

- Operational safety and physical intrusion impacts. It is not considered feasible or desirable to re-route railway lines to avoid passing through villages, as the reduction in thoroughfare may have a negative economic impact on villages and may just induce development to shift to the side of the railway. More appropriate mitigation measures would therefore include a traffic and rail safety campaign to educate the affected communities and commuters on general safety, as well as clear signalling at road crossings. It is also pertinent to highlight the importance of adequate maintenance.

- Negative impacts of increased thoroughfare. It is recognised that the governments of all host countries are likely aware of the potential of a runaway HIV epidemic and are likely committed to taking pro-active measures to prevent the transport sector from being severely affected by HIV and AIDS. To this end, most would have adopted strategic plans on HIV/AIDS. It is recommended that the project proponents enlist the assistance of the host countries' government agencies responsible for combating HIV/AIDS in rolling out HIV/AIDS awareness and prevention campaigns in communities to be affected by the project.

6.3.5 Conclusions of Social Screening

Based on the information presented above, it can be concluded that no component of the proposed projects is likely to pose a fatal flaw in respect of its anticipated social impacts. Nevertheless, the projects will give rise to many negative social impacts that will require appropriate mitigation to reduce them to acceptable levels. The most significant of these include:

- Displacement of households, loss of land to the project, and possibly also displacement of cultural resources such as graves and sites of spiritual significance; and
- Increase in the prevalence of HIV/AIDS and other social problems due to the presence of a construction workforce, and possibly aggravated by an influx of job seekers into areas where construction is underway.

The project is also expected to generate several positive social impacts (which indeed constitute one of the main reasons for implementing the project). These include:

- Reduced transport time and cost (the ultimate impact of which will depend on the degree to which cost savings by transport providers are passed on to transport users); and
- Increased regional integration due to increased connectivity across international boundaries.

6.3.6 Additional Studies Required

It is mentioned elsewhere in this document that an Environmental and Social Impact Assessment (ESIA) will be required in each country/ for each project component. These ESIAs will have to conform to local environmental legislation. Each ESIA will also be required to include one or more specialist studies focused on the potential social impacts outlined above. These may include:

- A Socio-economic Impact Assessment (SIA);
- A Heritage / Cultural Impact Assessment; and
- Agricultural Impact Assessment (possibly).

In addition to these specialist studies forming part of the component- or country-specific ESIAs, it will also be necessary to compile a Resettlement Action Plan (RAP) for each project component where land acquisition impacts are expected to occur. In accordance with international best-practice standards, each RAP should define:

- The legal and policy requirements to which the resettlement process must comply;
- The impacts that resettlement-affected individuals, households and communities are likely to experience;

- All resettlement-affected households, their affected assets (such as residential structures, agricultural plots, etc.);
- Other resettlement-affected assets that do not belong to individual households (such as communal grazing land), but will be temporarily or permanently lost as a result of the project;
- The process by which affected parties are to be involved in the resettlement planning process;
- The set of compensation principles that will be applied, both for household and for other resettlement-affected assets, to ensure that compensation for or replacement of lost assets will be fair, just and equitable;
- Measures to restore livelihoods and income-generation activities where these have been significantly disrupted;
- Measures to mitigate potential effects resettlement may have on host communities – communities residing on or around sites to which resettlement-affected homesteads will be relocated, or where their replacement assets – such as agricultural fields – will be located;
- Means to effectively address grievances raised by affected communities during and after the resettlement and compensation process;
- Appropriate mechanisms to monitor and evaluate the resettlement/ compensation process;
- The relevant role-players in resettlement implementation, and the roles and responsibilities of these role-players; and
- An indicative programme and time schedule for resettlement implementation.

6.4 Checklist of Mitigation and Monitoring Plans for Residual Environmental and Social Impacts

The proposed mitigation measures based on generic impacts anticipated from the development of railway infrastructure (linear) should be addressed through implementing the following plans and programmes, as a minimum.

i. Waste management plan;

ii. Rehabilitation plan;

iii. Plan to relocate cultural assets; and

iv. Socio-economic mitigation plans:

  - Communication;
  - Capacity building & local development;

- Health education;
- Social monitoring; and
- Environmental education.

Environmental Control Officer monitoring plans will include:

i. Soil management / stockpiling;
ii. Water resources management;
iii. Noise and vibration monitoring;
iv. Fauna and flora monitoring;
v. Air quality monitoring;
vi. Climate data monitoring; and
vii. Waste management monitoring.

The following monitoring plans, to monitor the implementation of the mitigation plans, will be required.

i. Air quality;
ii. Noise and vibration;
iii. Climate;
iv. Geology / geomorphology;
v. Pedology;
vi. Waste management;
vii. Biodiversity (terrestrial and aquatic ecology);
viii. Socio-economic:
    - Communication;
    - Capacity building and local development;
    - Health education;
    - Social monitoring,
    - Environmental education.
ix. Landscape/ land use;
x. Visual;

xi. Heritage, culture and archaeology;

xii. Hydrology;

xiii. Geohydrology;

xiv. Protected areas management; and

xv. Rehabilitation plan.

6.5 Strategic Considerations for Planning and Implementation

This study is not of a scale that allows identification of precise impacts related to possible alignments. Therefore, specific and detailed mitigation measures cannot be recommended before comprehensive studies are undertaken. There is a level of understanding of the context of the environmental and social conditions of the African continent, which is not uniform. There are also many generic mitigations for linear developments and for railway lines. The considerations to be accommodated in the planning of the proposed alignment are summarised below.

- General
    - Minimise width of disturbance area along length of route; and
    - Select the shortest possible route.
- Sensitive environments
    - Avoid sensitive environments – align routes outside of a 100m buffer area for water bodies, away from steep slopes and erosion-prone areas;
    - Limit tree felling;
    - Rehabilitate after disturbance;
    - Apply adequate erosion control measures during and after construction;
    - Contribute towards catchment management to address environmental issues in the area; and
    - Limit access to areas where deforestation will increase.
- Cut and fill operations
    - Use blasting techniques to limit unnecessary damage;
    - Reduce disturbance area around track to a minimum;
    - Follow proper procedures for obtaining fill. Obtain fill from closest legal source, limit new borrow pits and rehabilitate areas properly after use;
    - Limit construction of new access roads; and

- Use existing access roads wherever possible, construct new ones properly and rehabilitate roads no longer required.

- Sustainability matters
    - Protect biodiversity and water resources;
    - Select the shortest route, within limitations of other considerations; and
    - Use the cleanest possible fuel for operation of the train.
- Strategic and cumulative matters
    - Coordinate proposal to align with other development projects currently planned or being implemented in the region;
    - Control access at international boundaries to address cross-border trafficking, particularly into protected areas; and
    - Ensure development provides benefit for the national economies, and impacts are balanced against social and biodiversity concerns.
- Protected areas

    The following points must be considered in detailed specialist studies:

    - Align route within protected areas to accommodate breeding areas and migratory routes of animals, especially with respect to river and water point networks;
    - Limit fragmentation of habitats used in animal distribution;
    - Put measures in place to protect infrastructure from animals and vice versa – consider engineering solutions such as raised structures to allow for movement of animals, and electric fencing of areas of railway line;
    - Protect investment in protected areas, especially those with significant tourism investment which are run on business principles;
    - Ensure coordination of proposed project with planning of all large infrastructure projects in the region; and
    - Investigate compensation options for development within the protected areas to offset biodiversity impacts.

6.5.1 Sustainability Goals

Sustainability provides the framework for environmental decision-making and recognises that sustainable development requires the integration of social, economic and environmental factors in the planning, implementation and evaluation of proposed developments to ensure that they serve present and future generations. The sustainability of the project should thus be measured against the potential to meet the principles enshrined in the following goals: To ensure sustainability the project should, as a minimum, incorporate the following Sustainable Development Goals (SGDs) (United Nations, 2012):

United Nations SDG – Decent Work and Economic Growth (Goal 8) - Promote inclusive and sustainable economic growth, employment and decent work for all

Sustainable economic growth will require societies to create the conditions that allow people to have quality jobs that stimulate the economy while not harming the environment. Job opportunities and decent working conditions are also required for the whole working age population. There needs to be increased access to financial services to manage incomes, accumulate assets and make productive investments. Increased commitments to trade, banking and agriculture infrastructure will also help increase productivity and reduce unemployment levels in the world's most impoverished regions.

United Nations SDG – Industries, Innovation and Infrastructure (Goal 9) - Build resilient infrastructure, promote sustainable industrialization and foster innovation

Investments in infrastructure – transport, irrigation, energy and information and communication technology – are crucial to achieving sustainable development and empowering communities in many countries. It has long been recognized that growth in productivity and incomes, and improvements in health and education outcomes require investment in infrastructure.

United Nations SDG – Sustainable Cities and Communities (Goal 11) - Make cities inclusive, safe, resilient and sustainable

Rapid urbanisation challenges, such as the safe removal and management of solid waste within cities, can be overcome in ways that allow them to continue to thrive and grow, while improving resource use and reducing pollution and poverty. One such example is an increase in municipal waste collection. There needs to be a future in which cities provide opportunities for all, with access to basic services, energy, housing, transportation and more.

United Nations SDG - Climate Change (Goal 13) - Take urgent action to combat climate change and its impacts

To strengthen the global response to the threat of climate change, countries adopted the Paris Agreement at the COP21 in Paris, which went into force in November of 2016. In the agreement, all countries agreed to work to limit global temperature rise to well below 2 degrees centigrade. As of April 2018, 175 parties had ratified the Paris Agreement and 10 developing countries had submitted their first iteration of their national adaptation plans for responding to climate change.

United Nations SDG – Life on Land (Goal 15) - Sustainably manage forests, combat desertification, halt and reverse land degradation, halt biodiversity loss

Efforts are being made to manage forests and combat desertification. There are two international agreements being implemented currently that promote the use of resources in an equitable way. Financial investments in support of biodiversity are also being provided.

Further to the above SDGs, according to UNESCO (2015), by adopting the *Gaborone Declaration for Sustainability in Africa*, 10 countries in Africa[33] have engaged in a multi-year process

[33] Botswana, Gabon, Ghana, Kenya, Liberia, Mozambique, Namibia, Rwanda, South Africa and Tanzania

committed to implementing all conventions and declarations promoting sustainable development, and have undertaken to:

- Integrate the value of natural capital into national accounting and corporate planning and reporting processes, policies and programmes;
- Build social capital and reduce poverty by transitioning agriculture, extractive industries, fisheries and other natural capital uses to practices that promote sustainable employment, food security, sustainable energy and the protection of natural capital through protected areas and other mechanisms; and
- Build knowledge, data, capacity and policy networks to promote leadership and a new model of sustainable development and to increase momentum for positive change.

In summary, appropriate Sustainability Goals for the proposed AIHSRN should address the following, as a minimum:

- Pollution prevention
- Resource conservation
- Zero waste to landfill
- Waste reduction / minimisation
- Zero discharge
- Reduce carbon footprint, zero emissions

7 Implementation Roadmap

7.1 Implementation Framework for Master Plans 2033 and 2043

AIHSRN Master Plan 2033 is a key pillar of Agenda 2063 First Ten-Year Implementation Plan. To give high-level ownership and direction of its implementation at the national level, the pilot projects/links of Master Plan 2033 are recommended to be implemented through the AUDA-NEPAD Heads of State & Government Orientation Committee (HSGOC) processes; in particular, through its Presidential Infrastructure Championing Initiative (PICI) platform.

Given the multiplicity of priority links to be piloted in the first 10 years and beyond (to 2033, and to 2043), other AU championing initiatives, such as the "High Representative" (HR) framework for infrastructure development in Africa, would complement the PICI process, to ensure all HSR pilot projects are implemented/constructed by 2033.

7.2 AIHSRN Pilot Projects

To showcase the early success stories on the African continent to encourage further development of AIHSRN, **two accelerated pilot projects** have been selected, as follows:

Table 7-1: Accelerated Pilot Projects

No.	Pilot Projects	Country	REC Ownership	Comment
1.	Rail Link 34 Kigali, RWA - Dar es Salaam, TZA (Eastern Region, MCA Rank 43) Rail Link 72: Kampala, UGD - Bujumbura, BDI* (Eastern Region, MCA Rank 5)	Burundi, Rwanda, Tanzania, Uganda	COMESA, EAC, ECCAS, IGAD, SADC	Selected based on PPF**
2.	Rail Link 36 Windhoek, NAM - Gaborone, BOT (Southern Region, MCA Rank 4) Rail Link 35 Walvis Bay, NMB - Windhoek, NMB (Southern Region, MCA Rank 38) Rail Link 37 Gaborone, BOT - Johannesburg, SAF (Southern Region, MCA Rank 14)	Botswana, Namibia, South Africa	SADC	Selected based on PPF; “Trans-Kalahari” L37 added to capture higher levels traffic at the request of AUDA-NEPAD.

*Link 72 Kampala-Kigali during Step 1 of this assignment. The links have been adjusted as shown in the table above based on the consultations with the client to better link Burundi to the network.
** The Project Prioritization Framework (PPF) and Multi-Criteria Analysis (MCA) conducted during Step 1 of this assignment is provided in Appendix A.
Source: CPCS

In addition, we recommend another 14 rail links to be supported **as 11 additional pilots** for the following reasons:

- The two accelerated pilots will be further studied at the full feasibility study level and, at this stage, it is not fully clear whether either of them will be viable to be built. Considering that the pilot projects are to demonstrate success stories on the continent, a larger number of pilot projects would increase the chance of successful projects for demonstration of success stories.
- A larger number of pilot projects would enable more equitable distribution of pilot projects across different regions of the continent.
- AIHSRN is an ambitious project to build a large network of railways throughout the continent to meet the stated objectives of the master plans presented above. Considering the number of countries on the continent, the efforts to build the network can be made simultaneously in different parts of the continent.

The recommended 11 additional pilot projects[34] are as follows:

Table 7-2: Additional Pilot Projects

No.	Pilot Projects	Country	REC Ownership	Comment
1.	Rail Link 20 Kampala, UGD - Nairobi, KEN (Eastern Region, MCA Rank 1)	Uganda, Kenya	COMESA, EAC, IGAD	Selected based on PPF*
2.	Rail Link 66 Ouagadougou, BFA - Abidjan, CIV (Western Region, MCA Rank 6)	Burkina Faso, Ivory Coast	CEN-SAD, ECOWAS	Selected based on PPF
3.	Rail Link 4 Tunis, TUN - Algiers, DZA (Northwestern & North Central Regions, MCA Rank 8) Rail Link 5: Algiers, DZA - Sidi Bel Abbes, DZA (Northwestern & North Central Regions, MCA Rank 53) Rail Link 6: Sidi Bel Abbes, DZA - Casablanca, MOR (Northwestern & North Central Regions, MCA Rank 20)	Algeria, Morocco, Tunisia	UMA, COMESA, CEN-SAD	Selected based on PPF; also promoted by UMA as "Trans-Maghreb"
4.	Rail Link 74 Niamey, NER - Cotonou, BEN (Western Region, MCA Rank 18)	Benin, Niger	CEN-SAD, ECOWAS	Selected based on PPF
5.	Rail Link 56 Alexandria, EGY - Khartoum, SDN (Northeastern Region, MCA Rank 41)	Egypt, Sudan	COMESA, CEN-SAD, IGAD	Selected based on PPF; also promoted by IGAD
6.	Rail Link 29 Asmara, ERI - Addis Ababa, ETH (Northeastern Region, MCA Rank 47)	Eritria, Ethiopia	COMESA, CEN-SAD, IGAD	Selected based on PPF
7.	Rail Link 43 Lusaka, ZMB - Beira, MOZ (Southern Region, MCA Rank 52)	Mozambique, Zambia, Zimbabwe	COMESA, SADC	Selected based on PPF
8.	Rail Link 17 Douala, CMR - Bangui, CAF (Central Region, MCA Rank 66)	Cameroon, CAR	CEN-SAD, ECCS	Selected based on PPF
9.	Rail Link 49 N'Djamena, TCD - Bangui, CAF (Central Region, MCA Rank 67)	Chad, CAR	CEN-SAD, ECCS	Selected based on PPF
10.	Rail Link 22 Dakar, SEN - Tambacounda, SEN (Western Region, MCA Rank 68)	Mali, Senegal	CEN-SAD, ECOWAS	Promoted by ECOWAS

[34] Those additional pilot projects have been selected based on a combination of the Master Plan 2033 objectives, equitable distribution of pilot projects across different regions of the continent, and the PPF ranking and high-level financial analysis results, with connecting landlocked countries to sea ports (one of the objectives of Master Plan 2033) being given the highest priority.

No.	Pilot Projects	Country	REC Ownership	Comment
	Rail Link 23 Tambacounda, SEN - Bamako, MLI (Western Region, MCA Rank 21)			as "Dakar-Bamako"
11.	Rail Link 75 Lamu, KEN - Juba, SSD	Kenya, South Sudan	COMESA, EAC, IGAD	Added after Draft Final Report Validation Workshop held in Johannesburg in April 2019; Promoted by IGAD

* The Project Prioritization Framework (PPF) and Multi-Criteria Analysis (MCA) conducted during Step 1 of this assignment is provided in Appendix A.
Source: CPCS.

7.3 Implementation Steps

The key steps to achieving the target of conceptualising, planning, designing and implementing these links by 2023 and 2025 are, as follows:

- Completion of Preliminary Design and Feasibility Assessment Study complete for
  - Two accelerated pilots by December 2021; and
  - Eleven additional pilots by December 2023.
- Implementation of National Readiness Strategy in:
  - Six countries of the two accelerated pilots by December 2022; and
  - Countries of the additional pilots by December 2023.
- Construction of the first kilometre of the:
  - Two accelerated pilots by December 2024; and
  - Eleven additional pilots by December 2025.

Preliminary Design and Feasibility Assessment Study and the National Readiness Strategy are discussed below in more detail.

7.4 Preliminary Design and Feasibility Assessment Study

Preliminary Design and the Feasibility Assessment studies of pilot projects will include assessment of economic and financial feasibility as well as all other tasks necessary to prepare the project for immediate implementation thereafter. The terms of reference for the

Preliminary Design and Feasibility Assessment for the two accelerated pilots are included as Appendices E and G. Key elements are, as follows:

- Preliminary Design of Fixed Infrastructure;
- Estimates of Capital Cost of Fixed Infrastructure;
- Functional Design of Operating and Maintenance Plans;
- Estimates of Rolling Stock; Maintenance Equipment and Facilities; and Capital Costs;
- Estimates of Annual Operating and Maintenance Costs;
- Bankable Traffic and Revenue Study;
- Environmental and Social Impact Assessment including Resettlement Action Plan (RAP);
- Legal, Regulatory and Institutional Analysis;
- Financial Feasibility Assessment;
- Economic Feasibility Assessment;
- Design of Project Structure and Financing Plan; and
- Preparation of Plans for Procurement (with the form depending on project structure).

7.5 National Readiness Strategy

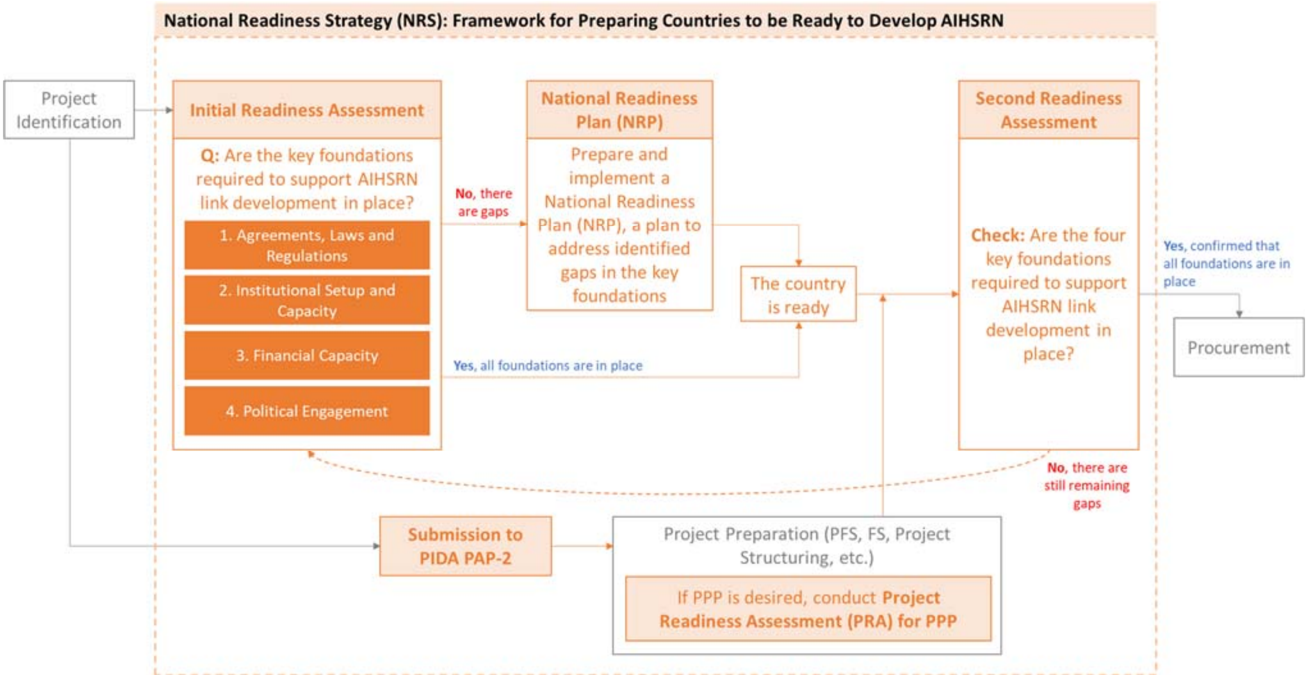
7.5.1 Introduction

The National Readiness Strategy (NRS) provides a strategy and framework for the countries participating in the development of AIHSRN to develop a National Readiness Plan (NRP) to prepare themselves to implement their respective countries' links to form AIHSRN by identifying and implementing the enabling environment to support the execution of the designated AIHSRN link project(s).

It should be noted that as AIHSRN will be developed as individual links under wide-ranging project and financing structures, there is no one-size-fits-all all readiness strategy for all countries. For example, some countries may opt for a Build-Operate-Transfer (BOT) structure for infrastructure development whereas others may choose to retain control of design and construction and decide to finance and procure these works under a typical Design-Build (DB) contract. In addition, among continental African countries, there will be significant differences in state of readiness to implement a railway project of the scale of any of the links of AIHSRN.

These differences will, however, not prevent the execution of AIHSRN if adequate customised NRPs are developed and implemented based on the NRS discussed here (Figure 7-1).

Figure 7-1: National Readiness Strategy



7.5.2 Assessment of National Readiness

Each country's level of readiness should be determined based on the assessment of four main components to ensure that key foundations are in place to support the proposed rail projects:

1. Agreements, laws and regulations;
2. Institutional set-up and capacity;
3. Financial capacity; and
4. Political engagement.

Sub-sections below present the characteristics of each of these components.

1. Agreements, Laws and Regulations

The first key element of a country's readiness is the adequacy of agreements, laws and regulations for successful development, implementation and operation of the railway. They need to be defined within each country to successfully deliver domestic links of the rail plan. They also need to be coordinated between countries following pre-defined continental guidelines to provide overall coherence of the project links and enable cross-border infrastructure/contracts. The coordinated definition of agreements, laws and regulations will in turn enable the effective development and operation of each individual railway as part of an interoperable AIHSRN.

The coordinated approach of each government should be described in cooperation agreements between partnering countries of cross-border rail links to describe general rules and principles of cooperation. Additionally, countries are to assess and modify their regulations as applicable to address the following considerations:

- Standards for the design of fixed infrastructure, systems and rolling stock;

- Rules for the operation and maintenance of the railways;
- Procedures for seamless operation at international borders;
- Treaties covering the cross-border operation of the railway;
- Economic regulation of railways (with respect to freight tariffs and passenger fares) if deemed applicable and desirable;
- Laws permitting the ownership and operation of railway infrastructure by private sector proponents (if and as applicable) under PPP and purely private structures;
- Rules (including obligations of the governments) for safety and security of railway operations; and
- Rules and responsibilities for infrastructure and rolling stock maintenance.

2. Institutional Set-Up and Capacity

Governments must have an adequate institutional setup and sufficient institutional capacity in place to successfully deliver the AIHSRN projects. As part of their plan to prepare themselves, they should assess the capacity of their institutions, and should propose improvements as needed to:

- Procure and manage contracted services for the delivery of infrastructure and operation of the rail line (as appropriate);
- Coordinate all steps of implementation with partnering countries' representatives;
- Ensure timeliness of operations to meet project deadlines;
- Raise and manage financial commitments for railway development and operation (as appropriate);
- Assure participants in the development and operation of the railway adhere to relevant laws and regulations; as well as assure that laws and regulations are updated as circumstances dictate;
- Assure appropriate rules, staff and mechanisms are in place so that rail operations remain seamless at international borders; and
- Represent the government within the AIHSRN framework on issues of cooperation and change.

If the government opts for a structure where it owns and operates the railway, it will need to develop capacity within the railway organisation or within other government entities to undertake key activities such as settlement of interline revenues and settlement of wagon and rolling stock rents (and repair costs) between railways and between railways and equipment lessors.

Conversely, if the government opts to engage the private sector in concession models for various services (design, build, finance, operation or maintenance), considerations will be given to providing sufficient capacity to PPP units to monitor the contracts over their entire duration.

3. Financial Capacity

As stated in Chapter 5, it is unlikely that any links will be developed as purely private projects. As such, governments will need to secure financing for at least portions of the project; in most cases, as a minimum, this will be for initial fixed infrastructure. As discussed in Chapter 5, governments may have a number of financing options:

- Sovereign funding;
- Public institutional finance (pension, insurance and sovereign wealth funds);
- Alternative public finance (such as levying new taxes or increasing the existing ones);
- Private sector equity;
- IFIs and DFIs; and
- Foreign export credit agencies.

The options available for each line will vary depending on the participating countries and their financial situation. It will be incumbent on each country to develop a financial plan suited to their situation and the specifics of the railway project.

4. Political Engagement

No project of this complexity, cost and extended footprint will be successful without the engagement of key political stakeholders impacted by the project. This includes political figures who have jurisdiction over the railway functions and areas where rail lines will be installed as well as the society. This political engagement will be critical to obtain timely validations of the numerous steps through a complex process. It will also be needed to generate transparency in the process and gain public acceptance.

To that end, each country should assess the following:

- The level of engagement of the key political stakeholders (society included) at the national and local levels;
- Stakeholders who will advocate for the project(s) amongst other political stakeholders and amongst civil society;
- Potential political roadblocks and recommendation of mitigations measures;
- The level of transparency regarding the project scope, funding and process; and
- The inclusive characteristics of the project scope and communication outreach to society.

7.5.3 Process of National Readiness Assessment

This section describes the readiness assessment process recommended for countries before implementing plans for developing the AIHSRN links.

The generic implementation process should be a progressive multi-stage process, requiring as a minimum an initial readiness assessment to be completed at the inception of the project and another assessment before launching procurement.

The intent of the initial assessment is dual: assess the level of development of the project foundations even in an early stage, and determine all actions to be undertaken toward full readiness, following the four dimensions previously mentioned. Countries planning for new railways within AIHSRN should therefore conduct a first readiness assessment as soon as possible.

Since the intent of this first assessment is to define the breadth of actions needed to enable the project, we encourage it to be conducted even before the related first prefeasibility and feasibility studies are completed. The initial analysis should be based on information readily available at the time of consideration, including consultation with key stakeholders. Should preliminary studies be already complete for specific links prior to initiating the national readiness assessment, governments of said links should still initiate a national readiness plan.

At the end of the initial evaluation, the project shall be submitted for integration in the PIDA PAP-2 plan as described in the next section.

The second stage of readiness assessment should be completed prior to launching procurement, regardless of the procurement method selected. The purpose of this assessment is to ensure that all actions items identified in the first assessment have been completed and that all key elements are in place prior to procuring the project.

The two levels of assessment are defined as minimum milestones of the national readiness plan and should not prevent additional progress monitoring between the two assessments. As a matter of fact, governments will be encouraged to periodically monitor progress of the implementation of measures and completion of tasks to ensure progressive and timely evolution toward full preparedness of the project.

7.5.4 Integration with PIDA PAP-2

The African Heads of State and government adopted PIDA in January 2012 as the continental strategic infrastructure framework set to run until 2040. The programme was developed to address African infrastructure challenges, specifically the financial gap of approximately US$130-170 billion per year. PIDA established a common vision, framework and global partnership to put in place an inclusive, cost-effective and sustainable regional infrastructure base to promote Africa's socioeconomic development and integration into the global economy.

Although PIDA underscores Africa's infrastructure development all the way until 2040, the programme's Priority Action Plans (PAP) were developed to set out specific actions to take. Accordingly, the first PIDA Priority Action Plan (PIDA PAP-1), which was set out for implementation until 2020, embodied 51 cross-border programmes involving more than 400 individual projects in the energy, transport, ICT and transboundary water resources (TWR) sectors.

In April 2019, Ministers meeting during the Specialized Technical Committee (STC) urged through Declaration of Cairo the AUC and the AUDA-NEPAD to fast-track the development of the second phase of the Programme for Infrastructure Development in Africa (PIDA PAP-2) integrating gender, climate and youth dimensions. This second PIDA Priority Action Plan, known as PIDA PAP-2 (2021-2030), shall be submitted for adoption by the Heads of State and governments at the AU Summit in January 2021 and shall set the priorities for continental infrastructure development of the next decade.

The underlying concept for the planning of PIDA PAP-2 is to promote an integrated, multi-sectorial corridor approach that is employment-oriented, gender-sensitive and climate-friendly and that connects urban/industrial hubs with rural areas. The Integrated Corridor Approach reflects this objective and serves as the basis to ensure that future cross-border infrastructure planning is aligned with AU principles and values of Agenda 2063.

A project as defined in PIDA-PAP 2 is an investment in a basic physical infrastructure asset of a nation or a region. The process for submission of projects for screening within the PIDA PAP-2 framework is for member states to submit projects to the Regional Economic Communities (RECs) and then to submit the project for PIDA PAP-2 consideration.

The specific process for project identification is proposed as follows:

- Member states propose projects to RECs
- Based on the member states' propositions and RECs' Master Plans, RECs will be tasked to submit project proposals to AUC and AUDA-NEPAD for consideration to be included in PIDA PAP-2.

Once submitted, projects are analysed, scored, and prioritised using clear quantifiable criteria that capture the objectives of PIDA PAP-2 in a very transparent manner, the projects selected will be consolidated into a project portfolio. Once approved by the AU Assembly in January 2021, they will be provided the PIDA Quality Label certifying excellence in project preparation.

The two accelerated pilots and the 11 additional pilots shall be considered by member states for inclusion in PIDA PAP-2.

7.6 Project Readiness Assessment for Public-Private Partnership

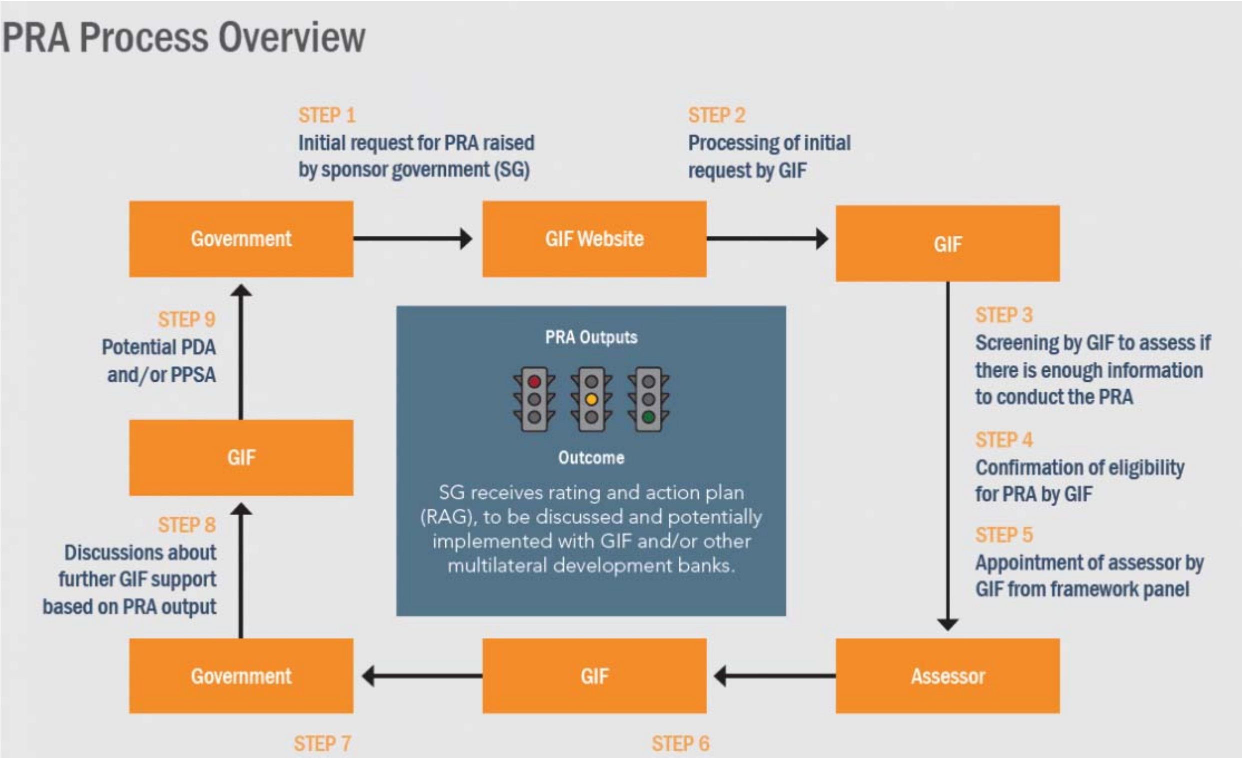
Governments seeking to pursue the participation of private parties in a PPP model to execute, operate and/or maintain designated rail links should set up and implement projects according to the Project Readiness Assessment (PRA) methodology. This methodology was recently developed by the Global Infrastructure Facility (GIF)[35] to standardise the readiness assessment of projects seeking private participation and to provide a tool for governments to generate robust projects (from an investors' standpoint). Applying this methodology to the AIHSRN links seeking private participation would therefore enhance the likelihood of bankable projects and of attractiveness to investors.

Applying this methodology facilitates access to GIF's support, which includes grants and involvement of partnering IFIs, for the execution of projects. According to the process presented below, GIF's determination of a project's eligibility to its programme depends on the outcome of an independently conducted PRA analysis. If governments implement the methodology from

[35] The GIF is a partnership of MDBs, private sector investors and governments jointly working to develop bankable infrastructure projects in emerging markets. See https://www.globalinfrafacility.org/

the inception of the project, they will enhance the likelihood of compliance with GIF's expectations, therefore facilitating the process and expediting access to GIF's support.

Figure 7-1: PRA Process Overview



Source: Global Infrastructure Facility (GIF).

The PRA methodology is based on pre-determined questions in six categories that characterise the different facets of a robust project preparation: technical solution, commercial structure, affordability, governance, regulatory environment and social/environmental. Answers to the questions enable the assessor to allocate a level of readiness between green (ready), amber (semi-ready but incomplete), and red (not ready) to each category of the project and to the project overall. Answers also enable the creation of an action plan to remediate the project deficiencies identified in the questionnaire and thereby enhance the project preparedness.

GIF has determined two possible stages at which point the PRA assessment can be conducted: the first stage is at the prefeasibility stage of the project and the second stage prior to the launch of procurement. As the first assessment is anticipated to be conducted in a very early stage of development, it is to be based on information readily available, including consultation with stakeholders who participated in the initial development of the project. The second stage assessment is to be conducted based on the information generated from additional studies and plans created throughout the project lifecycle, including feasibility studies, financial modelling analyses, institutional modifications, designs and environmental and social studies. The second assessment will therefore be much more detailed than the first.

To support this methodology, GIF created a tool which presents the six categories of project definition and all the pre-determined questions to be answered for Stage 1 and for Stage 2 of the project development. The tool also provides for a standardised output of the color-coded project readiness level (Reb-Amber-Green RAG output).

Figure 7-2: GIF Project Readiness Assessment Tool Output

Global Infrastructure Facility
Project Readiness Assessment (PRA) Tool

PRA Output template (Stage 1): Section A

No.	Project Component	No.	Criteria	Sub-criteria	No. of Qs.	Rating
1	Technical Solution	1.1	Land-use	Identification of site	2	Red
				Planning	2	Red
		1.2	Costing	Preparation of costings	2	Red
		1.3	Viability	Scope development & refinement	2	Red
2	Commercial Structure	2.1	Risk allocation	Risk identification	1	Red
		2.2	Value for money	Methodology	1	Red
		2.3	Contractual structure/ financing	Commercial principles	1	Red
3	Affordability	3.1	Funding	Source of funding	2	Red
				Long term affordability	2	Red
4	Governance	4.1	Country governance	Country governance	4	Red
		4.2	Project Governance	Project organisation	1	Red
				Stakeholder management	2	Red
5	Regulatory Environment	5.1	National	Precedents	3	Red
		5.2	Sectoral	Regulator	2	Red
		5.3	Dispute Resolution	Mechanism	1	Red
6	Social and Environmental	6.1	Social and environmental	Investor impact	1	Red

Source: GIF PRA Methodology Handbook.

It should be noted that the similar readiness nomenclature between the National Readiness Strategy and PRA should not lead to confusion: although there are some overlapping, even complementary characteristics between the National Readiness Strategy and PRA, they are two distinct implementation steps, as they serve different objectives and contain different information.

Indeed, per their respective scope, there will be some overlap between the National Readiness Strategy and PRA: the identification of regulations and institutions to be improved in the national readiness plan to be developed within the framework of the National Readiness Strategy will, for instance, provide answers to questions related to the Governance and Regulatory Environment of the PRA methodology, and vice versa.

However, PRA is intended to be used for projects seeking private funding, not for projects with traditional public procurement only. Therefore, the implementation of the PRA methodology for projects that will not seek private funding will not be necessary, whereas the development of the national readiness plan will be warranted regardless of the anticipated procurement process. In addition, the national readiness plan aims at defining a high-level enabling environment to support the execution of projects, whereas the PRA aims at defining all the components of a robust project preparation, thereby serving different objectives. Finally, if their scopes overlap, they do not match perfectly: as such political considerations will not be included in the PRA; and detailed technical, commercial, social and environmental considerations will not be included in the national readiness plan to be developed within the framework provided by the National Readiness Strategy.

Appendix A. Link Prioritisation Methodology, Its Results and Selection of Pilot Projects

This appendix provides the details on the link prioritisation exercise conducted to select the pilot projects.

Prioritisation Process and Criteria

Introduction

The two pilot projects are to showcase success stories with early wins, to encourage the future development of the HSR network on the African continent. Therefore, the prioritisation of the links will need to take into account technical, financial and economic viability (i.e. higher viability = higher chance of success), as well as issues such as the country's readiness and commitments.

Prioritisation criteria and weights will also need to be based on the vision of AU as well as its member states. Thus the AU's vision and goals become very important because they will set the overarching guiding principles and vision for the project prioritisation.

Defining Base Unit for Analysis

The proposed AIHSRN network consists of 4x6 corridors, which pass through national capitals and economic centres of Africa. Each corridor can be divided into a number of segments. For the purpose of analysis, prioritisation and packaging, it is important to define corridors and segments, as well as "links", the base unit of analysis. The following definitions have been agreed with the Client:

- Corridor: Each of the 4x6 HSR lines running through the continent horizontally and vertically;
- Segment: A shortest section with a national capital or a well-known non-capital economic centre (such as Lagos, Dar es Salaam, and Abidjan) on each end; and
- Link: A segment or a combination of more than one segment that would be used as the base unit of this scoping study and prioritisation, taking into consideration distance, geography and geopolitical issues. For example, a segment connecting Algiers to Niamey may be considered a "link" while Abidjan to Lagos via Accra, Lomé, and Cotonou (i.e. a combination of Abidjan-Accra, Accra-Lome, Lomé-Cotonou, and Cotonou-Lagos segments) may also be considered as a "link".

The list of links defined and analysed are presented in Table A-2 below.

Link Prioritisation Process

Link prioritisation will be undertaken using the following steps:

1. Load potential traffic estimated from available secondary sources on the 4x6 network using Geographic Information System (GIS). This will allow us to:
    a. Define the "links" for prioritisation (as the traffic will be used to divide corridors into links);
    b. Estimate traffic on each of the defined links, which will feed into developing parameters for the multi-criteria analysis (MCA) for project prioritisation.
2. Define the key areas that will be considered in MCA for link prioritisation, such as "contribution to regional integration", "higher chance of success", etc. based on AU's vision and goals, the client's primary objectives for the two pilot projects, and other preferences (if any).
3. For each of the key areas determined above, identify measurable indicators/parameters, which then will be used in the MCA with weights.
4. Review and agree on the MCA criteria with the client.
5. Applying the agreed PPF, rank the links and recommend pilot projects. The recommendation of the pilot projects will take into consideration geographic distribution.

Prioritisation Criteria for MCA

Considerations

The considerations discussed here are for Bullet No. 2 of Section 0 above, i.e. "Define the key areas that need to be considered in the link prioritisation". The MCA criteria developed incorporating these key considerations will be applied to prioritise and rank links.

Guiding Principles and Contribution of HSR to AU Vision and Aspirations

The TOR refers to the guiding principles for AIHSRN as follows:

- Connectivity of capitals and economic hubs;
- Integration approach; and
- Interoperability.

The above are guided by the AU Vision: "An integrated, prosperous and peaceful Africa, driven by its own citizens and representing a dynamic force in international arena".

This AU Vision is the guiding principle for Agenda 2063, whose First 10-year Implementation Plan selects Flagship Projects, including the continental HSR. In particular, HSR development is expected to contribute to AU to achieve the following of the seven Africa Aspirations for 2063:

- **An integrated continent**, politically united, based on the ideals of Pan Africanism and the vision of Africa's Renaissance
- **A Prosperous Africa**, based on inclusive growth and sustainable development

> **Prioritisation Process – Clarity, Transparency and Manageability**
>
> Considering that this assignment looks at potential links across all the AU member states, it is critical that the process is clear, easy to follow and transparent, and the criteria is objective. Further, it needs to be manageable. The process and criteria presented in this Working Paper have been designed accordingly.

Key Areas for Consideration

As mentioned in the introduction of this chapter, we understand that there are two main areas of consideration for prioritising the links to identify two pilot projects as follows:

- Prioritising/selecting the **projects that will be successful or have higher chance of success** (showcasing success stories with early wins); and
- Prioritising/selecting the projects that help AU advance its agenda/vision.

MCA Criteria Applied for Link Prioritisation

Following are the recommended weights of MCA criteria, scoring methods and associated weights.

Table A-1: Applied MCA Framework

No.	Criteria	Rationale for Inclusion	Measure or Parameter	Scoring Method (0-1)	Weight
a.	**Technical Viability**: Presence of existing technical railway capacity and infrastructure	A good proxy for rail sector capacity in the involved countries.	Length of long-distance rail network (route-km) currently being operated	▪ **1pt** 500 km < ▪ **0.5pt** 0 km < ● ≤ 500 km ▪ **0pt** 0 km The route-km is to be measured by combining all the countries involved in the specific link.	10
b.	**Technical Viability**: Presence of existing technical power capacity and infrastructure	The study considers both high and higher speeds; and electric and diesel traction in the short term. In the long term, all the railways would likely move toward electrification. As such, a country's current power generation is a suitable measure of its future capacity to generate power required of railway electrification.	Power generation per person (KWH per person) (Proxy: Power consumption per person)	▪ **1pt** 1,000 KWH per person per year < ▪ **0.7pt** 600 KWH per person per year < ● ≤ 1,000 KWH per person per year ▪ **0.3pt** 100 KWH per person per year < ● ≤ 600 KWH per person per year ▪ **0pt** ≤ 100 KWH person per year The weighted average (by line length) of the countries involved in the specific link is to be used.	5
c.	**Financial Viability:** Financial return	Indicator of project viability.	Financial return estimated by high-level financial analysis	MIRR adjusted to a relative scale of 0 to 1pts, with 0pts given to MIRR of zero or below and 1pt given to MIRR of 10% (hurdle rate used in the financial analysis) or above.	15
d.	**Economic Viability:** Economic return	Indicator of project viability.	Economic return estimated by high-level economic analysis	Benefit-Cost Ratio adjusted to a relative scale of 0 to 1pts	10
e.	**Country's Capacity**: Financing capability of countries or regions	A good indicator of the involved countries' capacity to finance (or capacity to borrow).	Government debt to GDP (tradingeconomics.com)	▪ **1pt** ≤ 30% ▪ **0.75pt** 30% < ● ≤ 60% ▪ **0.5pt** 60% < ● ≤ 90% ▪ **0pt** 90% < The total amount of debt of the involved countries is divided by the total of their GDPs to estimate the combined debt-to-GDP ratio, and points are assigned based on that combined ratio.	10

No.	Criteria	Rationale for Inclusion	Measure or Parameter	Scoring Method (0-1)	Weight
f.	**Country's Capacity**: Political Stability	An indicator of the involved countries' capacity to carry through long-term commitment, critical to large infrastructure development and one of the key factors any private sector would look at if PPP is desired.	Political Stability Index (theglobaleconomy.com); 2.5 = Strong; -2.5 = Weak	▪ **1pt** 1 < ▪ **0.75pt** 0 < ● ≤ 1 ▪ **0.5pt** -1.5 < ● ≤ 0 ▪ **0pt** ≤ -1.5 The values of the countries involved in the specific link are to be averaged.	10
g.	**PPP Potential**: Business environment	While many of the parameters used in developing the index are unlikely relevant to large-scale national infrastructure development spearheaded directly by national governments (such as the HSR), it can be considered as a proxy indicator of overall business environment of the country.	Doing Business Index developed by the World Bank 0 = Worst regulatory performance; 100 = Best regulatory performance	The index score (0-100) adjusted to a relative scale of 0 to 1pts The values of the countries involved in the specific link are to be averaged and assigned a score.	10
h.	**Multi-Country Complexity**: Number of jurisdictions a link needs to go through	The less the number of jurisdictions involved in one link, the less complex the project would be. However, at the same time, cross-border projects are preferred.	Number of countries that would be involved in the link	▪ **1pt** 2 countries ▪ **0.5pt** 3 countries ▪ **0pt** 1 or more than 4 countries	15
i.	**Regional Integration:** Improving intra-African trade	This indicator directly relates to "contribution to AU Vision" and shows the country's willingness and commitment to regional integration.	The status of CFTA ratification	▪ **1pt** Ratified ▪ **0.5pt** Signed ▪ **0pt** Not signed or ratified The values of the countries involved in the specific link are averaged.	10
j.	**Regional Integration:** Improving intra-African trade	This indicator directly relates to "contribution to AU Vision" and shows the country's willingness and commitment to regional integration.	Status of regional corridor treaties (limited to those governed under a joint treaty approved by the footprint states.)	▪ **1pt** If all the countries involved in a particular link are signatory to a regional corridor treaty	5

No.	Criteria	Rationale for Inclusion	Measure or Parameter	Scoring Method (0-1)	Weight
				▪ **0.5pt** If some of the countries involved in a particular link are a signatory to a regional corridor treaty ▪ **0pt** If no country involved in a particular link is signatory to a regional corridor treaty	
				Total	**100**

Source: CPCS

Distributing Pilot Projects over Geographic Regions

In principle, the links ranked the highest and the second highest priorities are to be selected as the pilot projects to be studied further. However, in the event that the top two links are located in the same geographic region, the second-ranked link will be replaced with the next ranked link that is located in a different geographic region with the view of distributing the pilot projects geographically over the continent.

The countries are grouped as follows (also see the map further below) for the purpose of distributing the pilot projects:

- Northwestern and North Central Region: Algeria, Libya, Mauritania, Morocco, Tunisia, Western Sahara
- Western Region: Benin, Burkina Faso, Cape Verde, Gambia, Ghana, Guinea, Guinea-Bissau, Ivory Coast, Liberia, Mali, Niger, Nigeria, Senegal, Sierra Leone, Togo
- Northeastern Region: Djibouti, Egypt, Eritrea, Ethiopia, Somalia, Sudan
- Eastern Region: Burundi, Kenya, Rwanda, South Sudan, Tanzania, Uganda
- Central Region: Angola, Cameroon, Central African Republic (CAR), Chad, Congo, Democratic Republic of Congo (DRC), Equatorial Guinea, Gabon, Sao Tome
- Southern Region: Botswana, Comoros, eSwatini[36], Lesotho, Madagascar, Malawi, Mauritius, Mozambique, Namibia, Seychelles, South Africa, Zambia, Zimbabwe.

[36] Formally Swaziland.

Figure A-1: Country Grouping for Distributing Pilot Projects

Source: CPCS

Definition of Links and Traffic Potential

How Links (Base Unit of Analysis) Was Defined

Segments are lines connecting capital cities and/or major capital cities. Segments were generally handled in one of three manners:

- Where a segment was between 300 km and 1,500 km in length, it become a link.
- Where a segment was less than 300 km in length (or thereabouts) and when there was an adjacent segment of less than 450 km, the segments were connected to form a link.

- Where the segment was over 1,500 km in length, we broke the segment into two segments where there was a major city somewhere in the middle to break the segment. Each segment became a link. However, where there was a logical breaking point, the long segment was treated as a link.

Links Analysed

The result of the foregoing analysis was 74 links that were analysed.

Figure A-2: Africa Integrated High Speed Railway Network (AIHSRN)

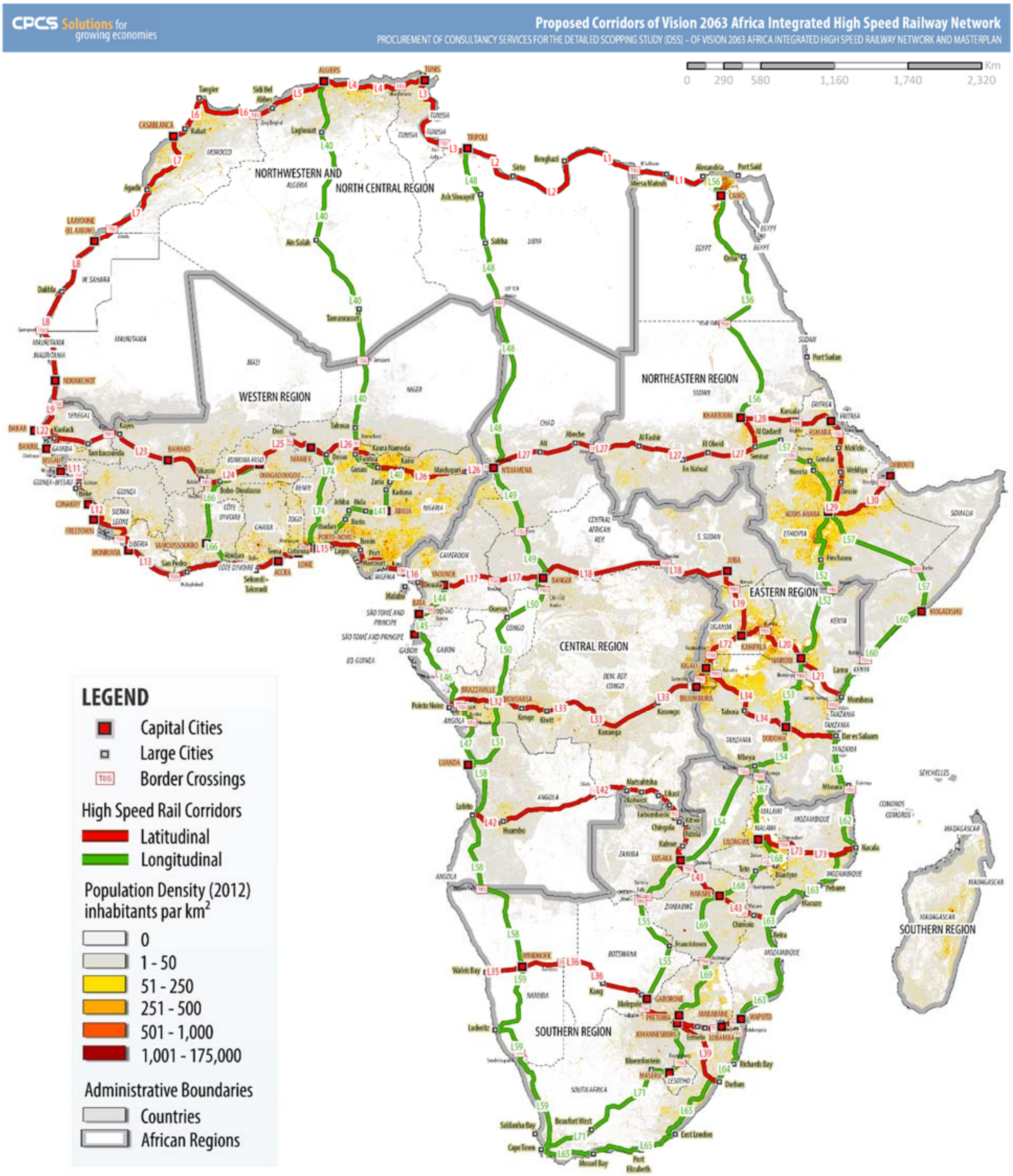


Table A-2: List of 74 Links Initially Analysed for Prioritization

Link	Link Start and Finish	Length (km)	Link	Link Start and Finish	Length (km)
1	Alexandria, EGY - Benghazi, LBY	1,019	38	Johannesburg, SAF - Maputo, MOZ	524
2	Benghazi, LBY - Tripoli, LBY	987	39	Pretoria, SAF - Durban, SAF	626
3	Tripoli, LBY - Tunis, TUN	764	40	Algiers, DZA - Abuja, NGA	3,428
4	Tunis, TUN - Algiers, DZA	700	41	Abuja, NGA - Lagos, NGA	683
5	Algiers, DZA - Sidi Bel Abbes, DZA	388	42	Lobito, AGO - Lusaka, ZMB	2,253
6	Sidi Bel Abbes, DZA - Casablanca, MOR	901	43	Lusaka, ZMB - Beira, MOZ	818
7	Casablanca, MOR - Laayoune (El Aaium), ESH	1,058	44	Yaounde, CMR - Bata, GNQ	353
8	Laayoune (El Aaium), ESH - Nouakchot, MRT	1,152	45	Bata, GNQ - Libreville, GBN	241
9	Nouakchot, MRT - Dakar, SEN	523	46	Libreville, GBN - Pointe Noire, CGO	764
10	Dakar, SEN - Banjul, GMB	434	47	Pointe Noire, CGO - Luanda, AGO	694
11	Banjul, GMB - Conakry, GIN	753	48	Tripoli, LBY - N'Djamena, TCD	2,437
12	Conakry, GIN - Monrovia, LIB	796	49	N'Djamena, TCD - Bangui, CAF	1,019
13	Monrovia, LIB - Abidjan, CIV	903	50	Bangui, CAF - Brazzaville, CGO	536
14	Abidjan, CIV - Accra, GHA	508	51	Brazzaville, CGO - Luanda, AGO	694
15	Accra, GHA - Lagos, NGA	534	52	Addis Ababa, ETH - Nairobi, KEN	1,416
16	Lagos, NGA - Douala, CMR	934	53	Nairobi, KEN - Dodoma, TZA	623
17	Douala, CMR - Bangui, CAF	1,066	54	Dodoma, TZA - Lusaka, ZMB	1,464
18	Bangui, CAF - Juba, SSD	1,551	55	Lusaka, ZMB - Gaborone, BOT	1,309
19	Juba, SSD - Kampala, UGD	672	56	Alexandria, EGY - Khartoum, SDN	2,196
20	Kampala, UGD - Nairobi, KEN	627	57	Khartoum, SDN - Mogadishu, SOM	2,336
21	Nairobi, KEN - Mombasa, KEN	459	58	Luanda, AGO - Windhoek, NAM	1,882
22	Dakar, SEN - Tambacounda, SEN	447	59	Windhoek, NAM - Cape Town, SAF	1,632
23	Tambacounda, SEN - Bamako, MLI	700	60	Mogadishu, SOM - Mombasa, KEN	970
24	Bamako, MLI - Ouagadougou, BFA	835	61	Mombasa, KEN - Dar es Salaam, TZA	370
25	Ouagadougou, BFA - Niamey, NER	523	62	Dar es Salaam, TZA - Nacala, MOZ	986
26	Niamey, NER - N'Djamena, TCD	1,630	63	Nacala, MOZ - Maputo, MOZ	1,993
27	N'Djamena, TCD - Khartoum, SDN	2,396	64	Maputo, MOZ - Durban, SAF	526
28	Khartoum, SDN - Asmara, ERI	742	65	Durban, SAF - Cape Town, SAF	1,582
29	Asmara, ERI - Addis Ababa, ETH	771	66	Ouagadougou, BFA - Abidjan, CIV	1,120
30	Addis Ababa, ETH - Djibouti, DJI	637	67	Mbeya, TZA - Lilongwe, MLI	631
31*	Pointe Noire, CGO - Brazzaville, CGO	398	68	Lilongwe, MLI - Harare, ZIM	851
32*	Brazzaville, CGO - Kinshasa, DOC	19	69	Harare, ZIM - Johannesburg, SAF	1,221
33	Kinshasa, DOC - Kigali, RWA	1,977	70	Johannesburg, SAF - Maseru, LSO	412
34	Kigali, RWA - Dar es Salaam, TZA	1,476	71	Maseru, LSO - Cape Town, SAF	1,135
35	Walvis Bay, NMB - Windhoek, NMB	269	72	Kampala, UGD - Kigali, RWA	420
36	Windhoek, NAM - Gaborone, BOT	1,026	73	Lilongwe, MLI - Nacala, MOZ	814
37	Gaborone, BOT - Johannesburg, SAF	348	74	Niamey, NER - Cotonou, BEN	955

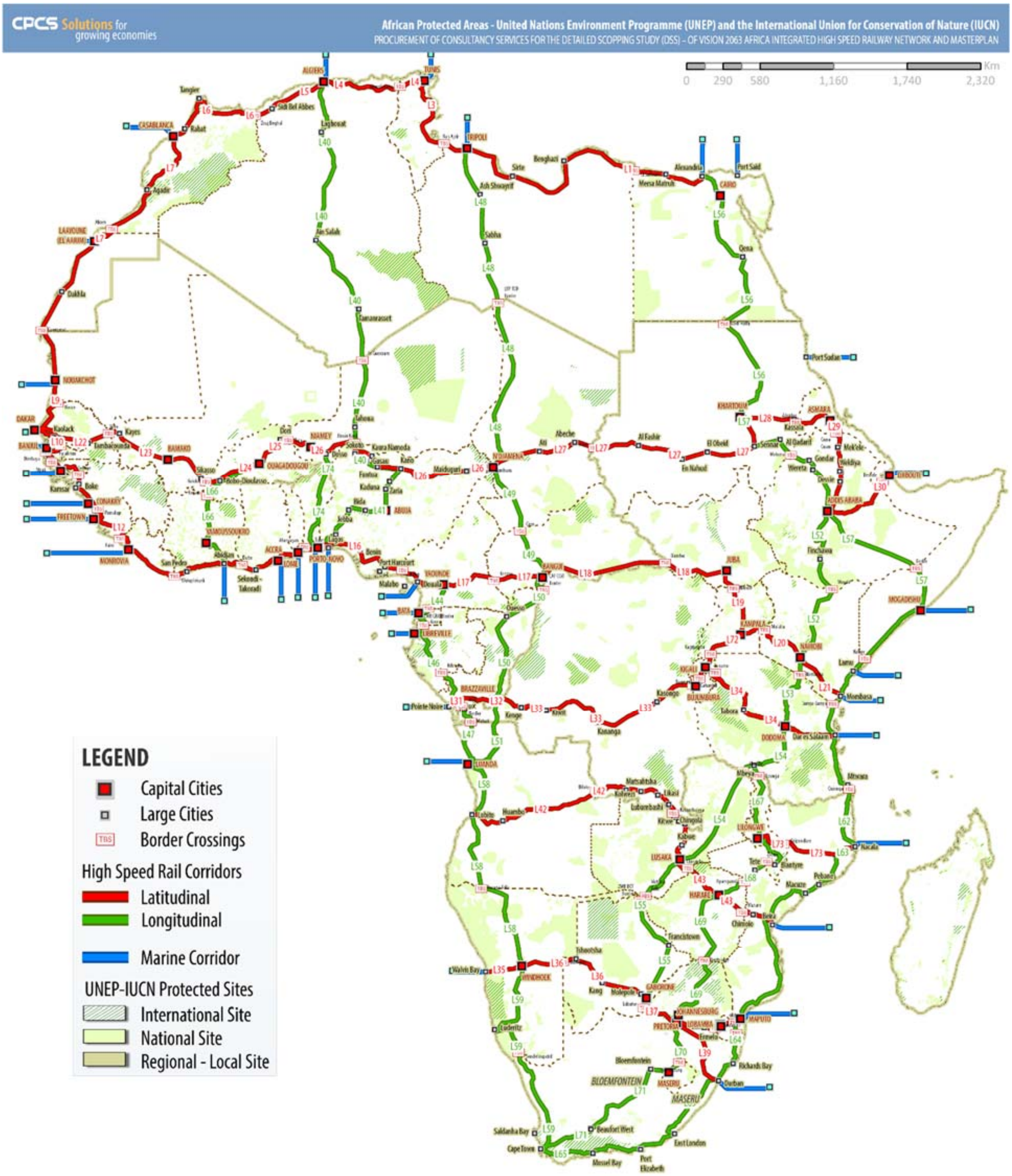
*Links 31 and 32 will be treated as a single link in our analysis.

Note that there have been minor adjustments to a couple of links since the prioritisation took place in the early stage of the assignment as follows, and they are reflected in the main body of this report.

- L33 Kinshasa, DOC - Kigali, RWA has been adjusted to Kinshasa, DOC - Bujumbura, BDI
- L72 Kampala, UGD - Kigali, RWA has been adjusted to Kampala, UGD - Bujumbura, BDI

The 74 links are shown in the map below. The routes were designed to avoid key environmentally sensitive areas. Where it appears that the route is going through sensitive areas, the route follows existing roads to minimise the potential impact on the identified sensitive areas.

Figure A-3: Map of 74 Links and Environmentally Sensitive Areas



Source: CPCS

Traffic Assignment to Links

Freight Traffic

The source of data that was used in our analysis was 2015 UN Comtrade data, specifically using:

- Intercontinental trade traffic between African countries
- Continental import and export trade traffic between each African country and countries in the rest of the world.

We assume all continental freight traffic was by rail except where the land distance is greater than 2,100 km. In this case, we assumed that transport was to the nearest port by rail and then by marine, with final land transport by rail. The following figure shows pure rail transport is more expensive at origin-destination distances of greater than 2,100 km. Assumptions used in the calculations are presented in the table that follows.

Figure A-4: Comparison of Cost ($/ton) of Rail versus Multi-modal Transport as a Function of Origin-Destination Distance (km)

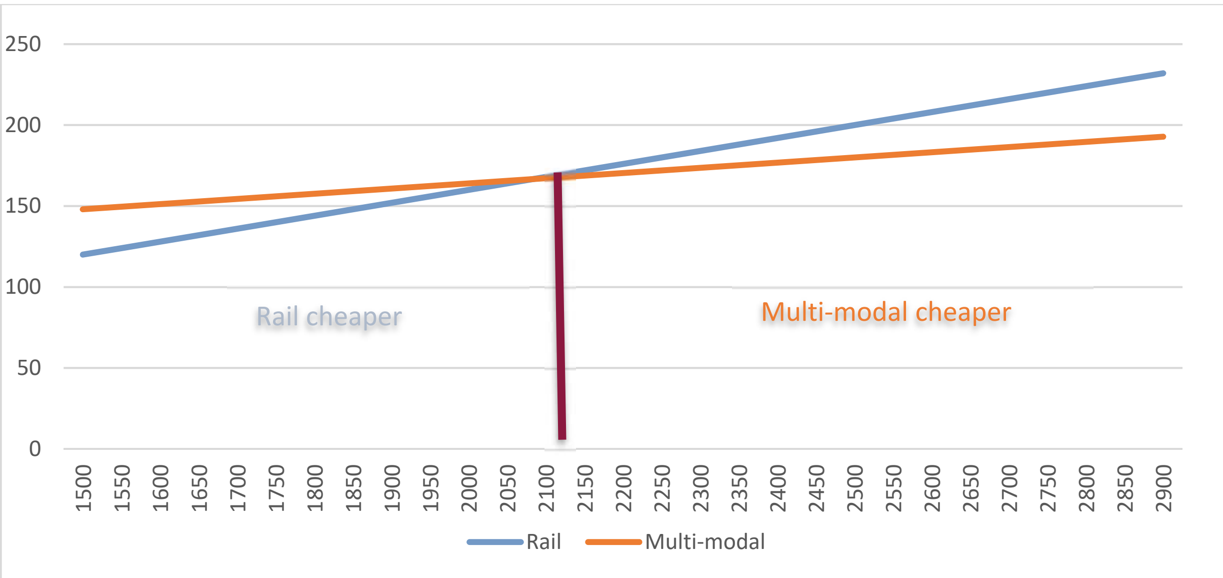


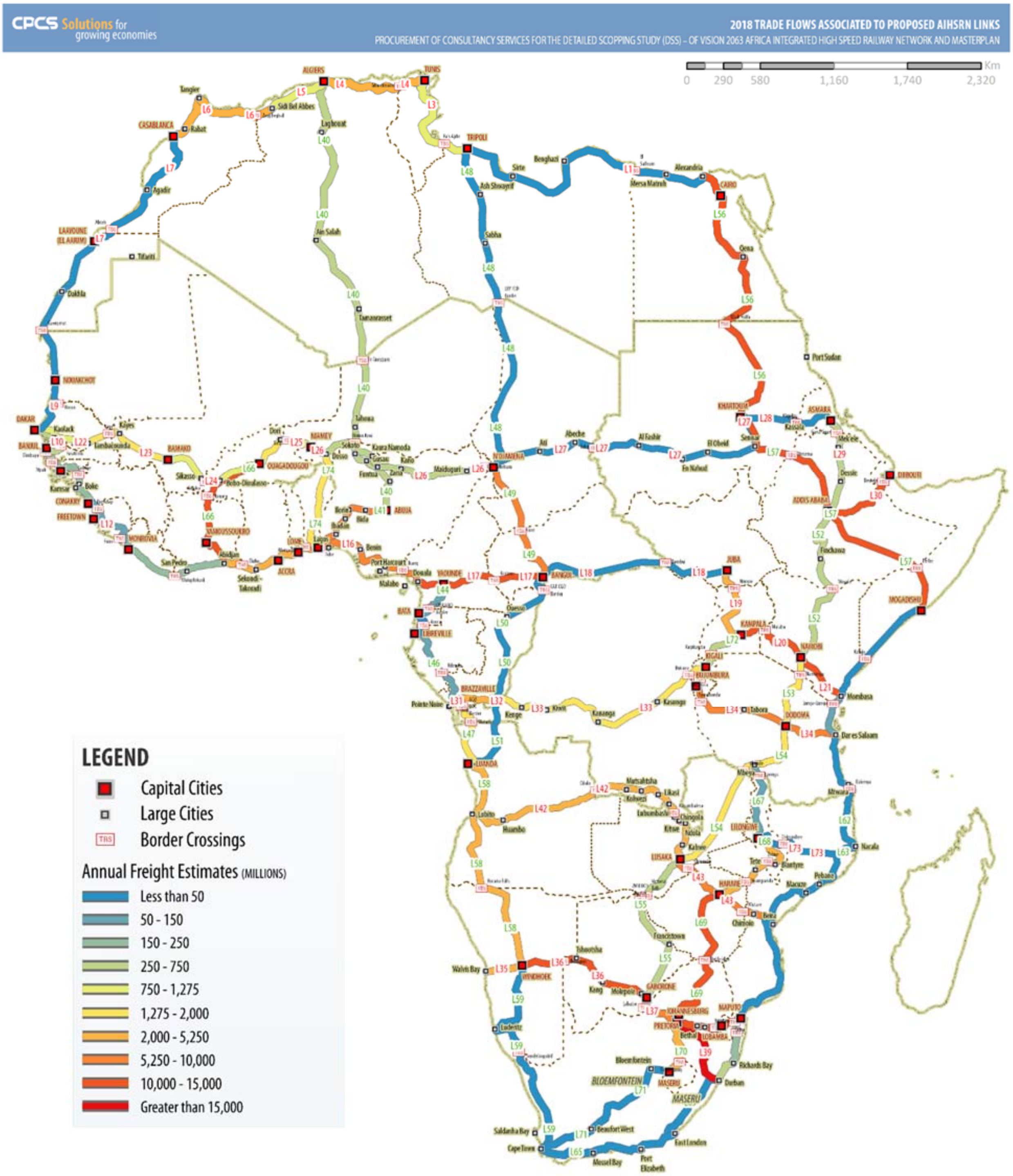
Table A-3: Assumptions Used in Calculations

Parameter	Assumption	Unit
Rail Cost	0.08	$/ton-km
Marine Cost	0.04	$/ton-km
Transload Cost	$10	$/ton
Rail Distance Origin to Port	500	km
Rail Distance Port to Destination	500	km
Marine Distance	80%	of OD distance

With respect to continental import and export traffic, we assumed all traffic was to or from the nearest port and transport was by rail. All rail movements were mapped to move the shortest distance onto the HSR rail network; and this was the basis of freight traffic projections for each link.

The map below shows the estimated freight traffic for 2018. For future freight traffic estimates, GDP by country/region was applied.

Figure A-5: Freight Traffic Estimates by Link (Tonnes), 2018



Source: CPCS

Passenger Traffic

A different approach was taken to estimating passenger traffic. We started by determining the population within 25 km of the route on both sides of the route. This was done by using population density as provided by the 2012 Oakridge National Labs Landscan Population Estimate Database.

To estimate the number of trips per year and average trip length for persons living along each corridor, we looked at statistics of those countries with heavy passenger rail usage and used South Korea as a reasonable basis for analysis, arriving at 2.6 trips per population per year and average trip length of 580 km.[37] This was the basis for estimating ridership (in passenger-km) along each of the corridors.

Table A-4: Passenger Rail Statistics

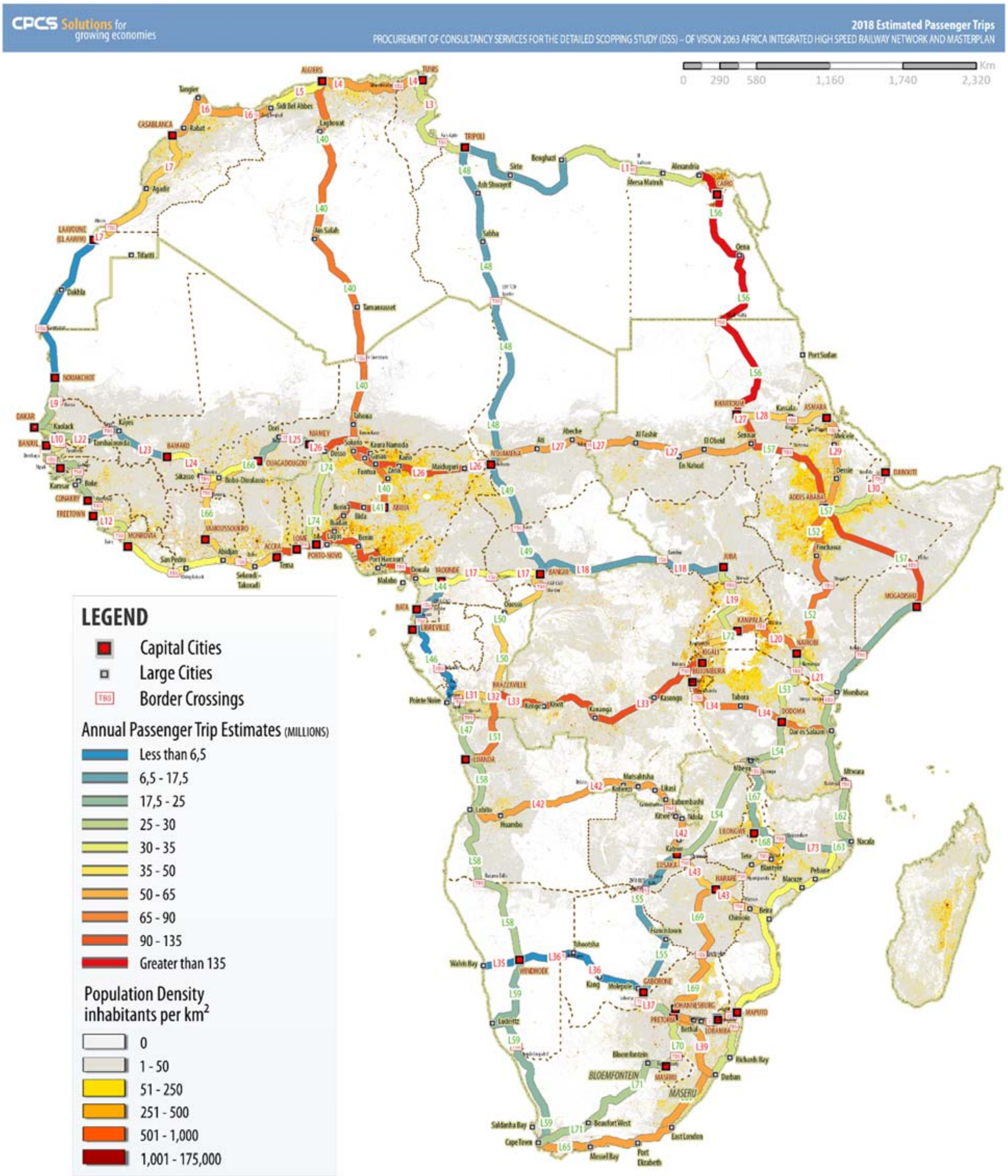
	Passengers per year (millions)	Passenger-km per year (billions)	Average Trip Length (km)	Pop density (pop per sq.km.)	Trips per population
China	1,544	1,346	872	145	1.1
India	8,116	1,161	143	409	5.9
Japan	9,090	432	48	334	72.1
Russia	1,020	123	121	9	7.1
France	1,123	111	98	123	17.3
Germany	2,007	96	48	232	24.5
South Korea	134	78	**581**	517	**2.6**

Note: The statics are on general passenger rail use/traffic, and not limited to high speed railways.
Source: OECD Data and CPCS analysis.

The map below presents 2018 estimates, which were developed by adjusting the 2012 data by population growth rates by country available from the World Bank.

[37] Note that the rail passenger statistics cover general railway passengers, including HSR, and is not limited to HSR. Therefore, some countries' average trip length is fairly short, which would unlikely apply to the case of this African Continental HSR network.

Figure A-6: Passenger Trip Estimates by Link (Number of Trips), 2018



Source: CPCS

For future passenger traffic estimates, population growth estimated by the World Bank by country was applied.

Multi-Criteria Analysis

Analysis Methodology

The MCA criteria applied to prioritise and rank links are presented in Section 0. Below presents how each parameter was measured and converted to points, and further aggregated with weights.

Converting Each Parameter to Points

Parameter A: Length of Long-Distance Rail Network (Route-Km) Currently Being Operated

The following is one of the criteria for assessing technical viability, measure/parameter used and its scoring method.

Table A-5: Parameter A: Length of Long-Distance Rail Network (Route-Km) Currently Being Operated

No.	Criteria	Rationale for Inclusion	Measure or Parameter	Scoring Method (0-1)
a.	**Technical Viability**: Presence of existing technical railway capacity and infrastructure	A good proxy for rail sector capacity in the involved countries	Length of long-distance rail network (route-km) currently being operated	▪ **1pt** > 500 km ▪ **0.5pt** 500 km > 0 km ▪ 0pt 0 km The route-km is to be measured by combining all the countries involved in the specific link.

For each of the links, the route-length of operating railways in the involved countries was identified and aggregated, and points were assigned to each. Examples are shown in the table below.

Table A-6: Parameter A: Length of Long-Distance Rail Network (Route-Km) Currently Being Operated – Scoring Examples

Link	Link Location Country	Operating Rail (Route-km) in the Country	Total Operating Rail (Route-km) in Countries Involved in the Link	Points for the Link (Parameter a)
Example Link 1	A	6,000	6,700	**1.00**
	B	700		
Example Link 2	C	200	500	**0.50**
	D	300		
Example Link 3	E	0	0	**0.00**
	F	0		

The data on each country's operating rail length is provided in at the end of this appendix.

Parameter B: Power Generation per Person (KWH per Person)

The following is one of the criteria for assessing technical viability, measure/parameter used and its scoring method.

Table A-7: Parameter B: Power Generation per Person (kWh per Person)

No.	Criteria	Rationale for Inclusion	Measure or Parameter	Scoring Method (0-1)
b.	**Technical Viability**: Presence of existing technical power capacity and infrastructure	The study considers both high and higher speeds; and electric and diesel traction in the short term. In the long term, all the railways would likely move toward electrification. As such, a country's current power generation is a suitable measure of its future capacity to generate power required of railway electrification.	Power generation per person (kWh per person) (Proxy: Power consumption per person)	▪ **1pt** 1,000 kWh per person per year < ▪ **0.7pt** 600 kWh per person per year < ● ≤ 1,000 kWh per person per year ▪ **0.3pt** 100 kWh per person per year < ● ≤ 600 kWh per person per year ▪ **0pt** ≤ 100 kWh person per year The weighted average (by line length) of the countries involved in the specific link is to be used.

For each link, the power consumption per person in the involved countries was identified and a weighted average was taken, and points were assigned to each. Examples are shown in the table below.

The weighted average was calculated in the following way for each country in the link:

$$= Power\ consumption\ per\ person\ in\ Country\ \times (\frac{Length\ of\ Link\ in\ Country}{Total\ length\ of\ Link})$$

The above was done for each country in the link, the weights for each country were summed and then assigned points.

Table A-8: Parameter B: Power Generation per Person (kWh per Person) – Scoring Examples

Link	Link Location Country	Total Length of Link	Length of Link in Country	Power Consumption Per Person	Weighted Average (Using Above formula)	Summed of Weighted Average	Points for the Link (Parameter B)
Example Link 1	A	1,019	504	1,658	820	1,759	1.00
	B		515	1,857	939		
Example Link 2	C	764	171	1,857	415	961	0.70
	D		593	1,444	1,121		
Example Link 3	E	523	189	0	0	143	0.30
	F		334	223	143		
Example Link 4	G	753	41	0	0	31	0.00
	H		106	223	31		

The data on each country's power consumption per person is provided at the end of this appendix.

Parameter C: Financial Return Estimated By High-Level Financial Analysis

The following is the criteria for assessing financial viability, measure/parameter used and its scoring method.

Table A-9: Parameter C: Financial Return

No.	Criteria	Rationale for Inclusion	Measure or Parameter	Scoring Method (0-1)
c.	**Financial Viability:** Financial return	The study considers both high and higher speeds, and electric and diesel traction in the short term. In the long term, all the railways would likely move toward electrification. As such, a country's current power generation is a suitable measure of its future capacity to generate power required of railway electrification.	Financial return estimated by high-level financial analysis	MIRR adjusted to a relative scale of 0 to 1pts, with 0pts given to MIRR of zero or below and 1pt given to MIRR of 10% (hurdle rate used in the financial analysis) or above.

When the link's estimated MIRR is equal to or above the hurdle rate used in the financial analysis (10%), the full point (i.e. 1 point) was given while MIRR of 0% or below was given 0 points. MIRR between 0% and 10% was adjusted to a relative scale of 0 to 1 point.

Table A-10: Parameter C: Financial Return – Scoring Examples

Link	MIRR	Points for the Link (Parameter C)
Example Link 1	13%	**1.00**
Example Link 2	8%	**0.80**
Example Link 3	-1%	**0.00**

The financial analysis results by link are provided at the end of this appendix.

Parameter D: Economic Return Estimated By High-Level Economic Analysis

The following is the criteria for assessing economic viability, measure/parameter used, and its scoring method.

Table A-11: Parameter D: Economic Return

No.	Criteria	Rationale for Inclusion	Measure or Parameter	Scoring Method (0-1)
d.	**Economic Viability:** Economic return	Indicator of project viability.	Economic return estimated by high-level economic analysis	Benefit-Cost Ratio adjusted to a relative scale of 0 to 1pts

With the highest BCR given 1 point, the BCR was adjusted to a relative scale of 0-1 points.

Table A-12: Parameter D: Economic Return – Scoring Examples

Link	BCR	Points for the Link (Parameter D)
Example Link 1	3.22 (highest)	**1.00**
Example Link 2	1.40	**0.43**
Example Link 3	0.00 (lowest)	**0.00**

The methodology for financial analysis and its results by link are at the end of this appendix.

Parameter E: Government Debt to GDP

The following is one of the criteria for assessing country's capacity, measure/parameter used and its scoring method.

Table A-13: Parameter E: Government Debt to GDP

No.	Criteria	Rationale for Inclusion	Measure or Parameter	Scoring Method (0-1)
e.	**Country's Capacity**: Financing capability of countries or regions	A good indicator of the involved countries' capacity to finance (or capacity to borrow).	Government debt to GDP (tradingeconomics.com)	▪ **1pt** ≤ 30% ▪ **0.75pt** 30% < ● ≤ 60% ▪ **0.5pt** 60% < ● ≤ 90% ▪ **0pt** 90% < The total amount of debt of the involved countries is divided by the total of their GDPs to estimate the combined debt-to-GDP ratio, and points are assigned based on that combined ratio.

For each country, absolute value GDP data and debt-to-GDP ratio was found. Using these two values, we were able to calculate absolute debt values by multiplying the two found data points. The debt and GDP values for all countries in a link were summed, respectively. A ratio of total debt to total GDP was calculated for each link. This new value was then used to assign scores to each link.

Table A-14: Parameter E: Government Debt to GDP – Scoring Examples

Link	Link Location Country	Debt	GDP	Total Debt/Total GDP	Points for the Link (Parameter E)
Example Link 1	A	7,600,000	3,900,000	96.94%	**0.00**
	B	8,400,000	3,500,000		
Example Link 2	C	8,500,000	450,000	82.39%	**0.50**
	D	5,600,000	5,263,000		
Example Link 3	E	3,500,000	32,000,000	35.50%	**0.75**
	F	25,000,000	75,000,000		
Example Link 4	G	5,000,000	3,200,000	25.45%	**1.00**

Link	Link Location Country	Debt	GDP	Total Debt/Total GDP	Points for the Link (Parameter E)
	H	26,400,000	5,820,000		

The data on each country's government to debt is provided at the end of this appendix.

Parameter F: Political Stability Index

The following is one of the criteria for assessing country's capacity, measure/parameter used and its scoring method.

Table A-15: Parameter F: Political Stability Index

No.	Criteria	Rationale for Inclusion	Measure or Parameter	Scoring Method (0-1)
f.	**Country's Capacity**: Political Stability	An indicator of the involved countries' capacity to carry through long-term commitment, critical to large infrastructure development and one of the key factors any private sector would look at if PPP is desired.	Political Stability Index (theglobaleconomy.com); 2.5 = Strong; -2.5 = Weak	▪ **1pt** 1 < ▪ **0.75pt** 0 < ● ≤ 1 ▪ **0.5pt** -1.5 < ● ≤ 0 ▪ **0pt** ≤ -1.5 The values of the countries involved in the specific link are to be averaged and assigned a score.

Each country's political stability index value was found. For the scoring method, the countries' indices were averaged and given a score.

Table A-16: Parameter F: Political Stability Index – Scoring Examples

Link	Link Location Country	Political Stability Index	Average	Points for the Link (Parameter F)
Example Link 1	A	-1.50	-1.92	**0.00**
	B	-2.33		
Example Link 2	C	-1.05	-0.32	**0.50**
	D	0.42		

The data on each country's political stability index is provided at the end of this appendix.

Parameter G: Doing Business Index

The following is the criteria for assessing PPP potential, measure/parameter used and its scoring method.

Table A-17: Parameter G: Doing Business Index

No.	Criteria	Rationale for Inclusion	Measure or Parameter	Scoring Method (0-1)
g.	**PPP Potential**: Business environment	While many of the parameters used in developing the index are unlikely relevant to large-scale national infrastructure development spearheaded directly by national governments (such as the HSR), it can be considered as a proxy indicator of overall business environment of the country.	Doing Business Index developed by the World Bank 0 = Worst regulatory performance; 100 = Best regulatory performance	The index score (0-100) adjusted to a relative scale of 0 to 1pts The values of the countries involved in the specific link are to be averaged.

Each country's doing business index value was found. These values were averaged for each link and converted to a relative scale between 0 and 1.

Table A-18: Parameter G: Doing Business Index – Scoring Examples

Link	Link Location Country	Doing Business Index	Average	Points for the Link (Parameter G)
Example Link 1	A	40	45	**0.45**
	B	50		
Example Link 2	C	70	75	**0.75**
	D	80		

The data on each country's doing business index is provided at the end of this appendix.

Parameter H: Number of Countries Involved In a Link

The following is the criteria for assessing multi-country complexity, measure/parameter used and its scoring method.

Table A-19: Parameter H: Number of Countries involved in the Link

No.	Criteria	Rationale for Inclusion	Measure or Parameter	Scoring Method (0-1)
h.	**Multi-Country Complexity**: Number of jurisdictions a link need to go through	The less the number of jurisdictions involved in one link, the less complex the project would be. However, at the same time, cross-border projects are preferred.	Number of countries that would be involved in the link	▪ **1pt** 2 countries ▪ **0.5pt** 3 countries ▪ **0pt** 1 or more than 4 countries

The number of countries that a link traverses was used to assign points to each link.

Table 1-20: Parameter H: Number of Countries Involved in the Link – Scoring Examples

Link	Link Location Country	Number of Countries in the Link	Points for the Link (Parameter H)
Example Link 1	A	2	**1.00**
	B		
Example Link 2	C	1	**0.00**

The data on each the number of countries involved in a link is provided at the end of this appendix.

Parameter I: Status of CFTA Ratification

The following is the criteria for assessing a link's contribution to regional integration, measure/parameter used and its scoring method.

Table A-21: Parameter I: Status of CFTA Ratification

No.	Criteria	Rationale for Inclusion	Measure or Parameter	Scoring Method (0-1)
i.	**Regional Integration:** Improving intra-African trade	This indicator directly relates to "contribution to AU Vision" and shows the country's willingness and commitment to regional integration.	The status of CFTA ratification	▪ **1pt** Ratified ▪ **0.5pt** Signed ▪ **0pt** Not signed or ratified The values of the countries involved in the specific link are averaged.

Based on the status of a country's CFTA ratification (ratified, signed or not signed), points were assigned first, then the points for each country in a link were averaged.

Table A-22: Parameter I: Status of CFTA Ratification – Scoring Examples

Link	Link Location Country	Status of CFTA Ratification	Score	Points for the Link (Parameter I)
Example Link 1	A	Ratified	1.00	**0.50**
	B	Signed	0.50	
	C	Not Signed or Ratified	0.00	
Example Link 2	D	Signed	0.50	**0.75**
	E	Ratified	1.00	

The data on each country's CFTA status is provided at the end of this appendix.

Parameter J: Status of Regional Corridor Treaties (Limited to Those Governed Under a Joint Treaty Approved by Footprint States)

The following is the criteria for assessing a link's contribution to regional integration, measure/parameter used and its scoring method.

Table A-23: Parameter J: Status of Regional Corridor Treaties

No.	Criteria	Rationale for Inclusion	Measure or Parameter	Scoring Method (0-1)
j.	**Regional Integration:** Improving intra-African trade	This indicator directly relates to "contribution to AU Vision" and shows the country's willingness and commitment to regional integration.	Status of regional corridor treaties (limited to those governed under a joint treaty approved by the footprint states.)	▪ **1pt** If all the countries involved in a particular link are signatory to a regional corridor treaty ▪ **0.5pt** If some of the countries involved in a particular link are a signatory to a regional corridor treaty ▪ **0pt** If no country involved in a particular link are signatory to a regional corridor treaty

Points were assigned to each link based on whether all, some or no countries involved in a particular link are signatory to a common regional corridor treaty.

Table A-24: Parameter J: Status of Regional Corridor Treaties – Scoring Examples

Link	Link Location Country	Status of Regional Corridor Treaties	Points for the Link (Parameter J)
Example Link 1	A	Signatory	**1.00**
	B	Signatory	
	C	Signatory	
Example Link 2	D	Signatory	**0.50**
	E	Non-Signatory	
Example Link 3	F	Non-Signatory	**0.00**
	G	Non-Signatory	

The data on each country's CFTA status is provided at the end of this appendix.

Aggregating Points with Weights

Once the points for each of the criteria for each link were calculated, they were weighted as per the weights presented in Section 0 and aggregated to obtain a "total score" for each link.

The data and points by link are presented at the end of this appendix.

Results

The following table shows 10 ten links that were ranked the highest based on the agreed MCA.

Table A-25: Top 10 Links Based on MCA

Rank	Link No.	Link Description	MCA Score	Region	Recommendation
1	L20	Kampala, UGD - Nairobi, KEN	70.39%	Eastern	**ACCELERATED PILOT PROJECT**
2	L30	Addis Ababa, ETH - Djibouti, DJI	67.72%	Northeastern	Not selected this time because there is new electrified SGR designed to provide passenger and freight transport.
3	L39	Pretoria, SAF - Durban, SAF	61.60%	Southern	**ACCELERATED PILOT PROJECT**
4	L36	Windhoek, NAM - Gaborone, BOT	61.30%	Southern	Not selected this time as pilot projects are limited to two
5	L72	Kampala, UGD - Kigali, RWA	60.76%	Eastern	Not selected this time as pilot projects are limited to two
6	L66	Ouagadougou, BFA - Abidjan, CIV	59.88%	Western	Not selected this time as pilot projects are limited to two
7	L33	Kinshasa, DOC - Kigali, RWA	59.30%	Central and Eastern	Not selected this time as pilot projects are limited to two
8	L4	Tunis, TUN - Algiers, DZA	57.33%	Northwestern & North Central	Not selected this time as pilot projects are limited to two
9	L21	Nairobi, KEN - Mombasa, KEN	57.31%	Eastern	Not selected this time as pilot projects are limited to two
10	L13	Monrovia, LIB - Abidjan, CIV	57.22%	Western	Not selected this time as pilot projects are limited to two

Source: CPCS analysis.

Selection of Accelerated Pilot Projects

As shown above, the following two projects were initially recommended as the accelerated pilot projects:

- L20 Kampala, UGD - Nairobi, KEN; and
- L39 Pretoria, SAF - Durban, SAF.

The consultant took a preliminary look at both links and attempted to gather information to conduct detailed scoping. Based on the initial activities, both L20 Kampala-Nairobi and L39 Pretoria-Durban were replaced by another link within its respective region (i.e. L20 to be replaced with another link in the Eastern region while L39 with another in the Southern region) based on the MCA ranking due to the lack of sufficient information available within the limited timeframe allowed for this assignment.

The rankings for the Eastern Region and Southern Region to find the next-ranked most suitable replacement for L20 and L39 are shown below.

Eastern Region

Table A-25: Selection of Accelerated Pilot in Eastern Region

Rank	Link No.	Link Description	MCA Score	Region	Recommendation
1	L20	Kampala, UGD - Nairobi, KEN	70.39%	Eastern	**Initially selected link.** While substantial studies have been done, the detailed reports could not be provided in time, thus replaced with the next-ranked, most suitable link.
5	L72	Kampala, UGD – Kigali/Bujumbura, RWA/BDI*	60.76%	Eastern	Not selected initially because the Nairobi-Kampala link (L20 above) needs to be built first for this link to be an effective rail link with a port connection. However, with L34 selected, this link would create a further link to landlocked countries. Considering the highly ranked status of this link, and considering that L34 has been well studied, TOR for feasibility study (next phase of AIHSRN) will be prepared for this link to help accelerate AIHSRN's development.
9	L21	Nairobi, KEN - Mombasa, KEN	57.31%	Eastern	Not selected this time because a new SGR rail recently came into operation.
11	L53	Nairobi, KEN - Dodoma, TZA	56.73%	Eastern	Not selected this time as it is not part of a major regional transport corridor.
12	L61	Mombasa, KEN - Dar es Salaam, TZA	56.21%	Eastern	Not selected as it is a coastal link connecting two directly competing ports and is not inward looking (i.e. not contributing to providing port access to inland countries/cities).
43	L34	Kigali, RWA - Dar es Salaam, TZA	47.25%	Eastern	**Pilot Project** replacing L20. (Part of one of the two most important transport corridors of East Africa, and recent detailed study available). In terms of pilot preparation (i.e. preparation of a TOR for a feasibility study to be procured), considering that this line has been extensively studied, TOR for L72 (Kampala-Kigali, ranked No. 5 above) will be prepared to help accelerate AIHSRN's development.

*Initially, this link was Kampala-Kigali, but has been adjusted based on consultations with the client.

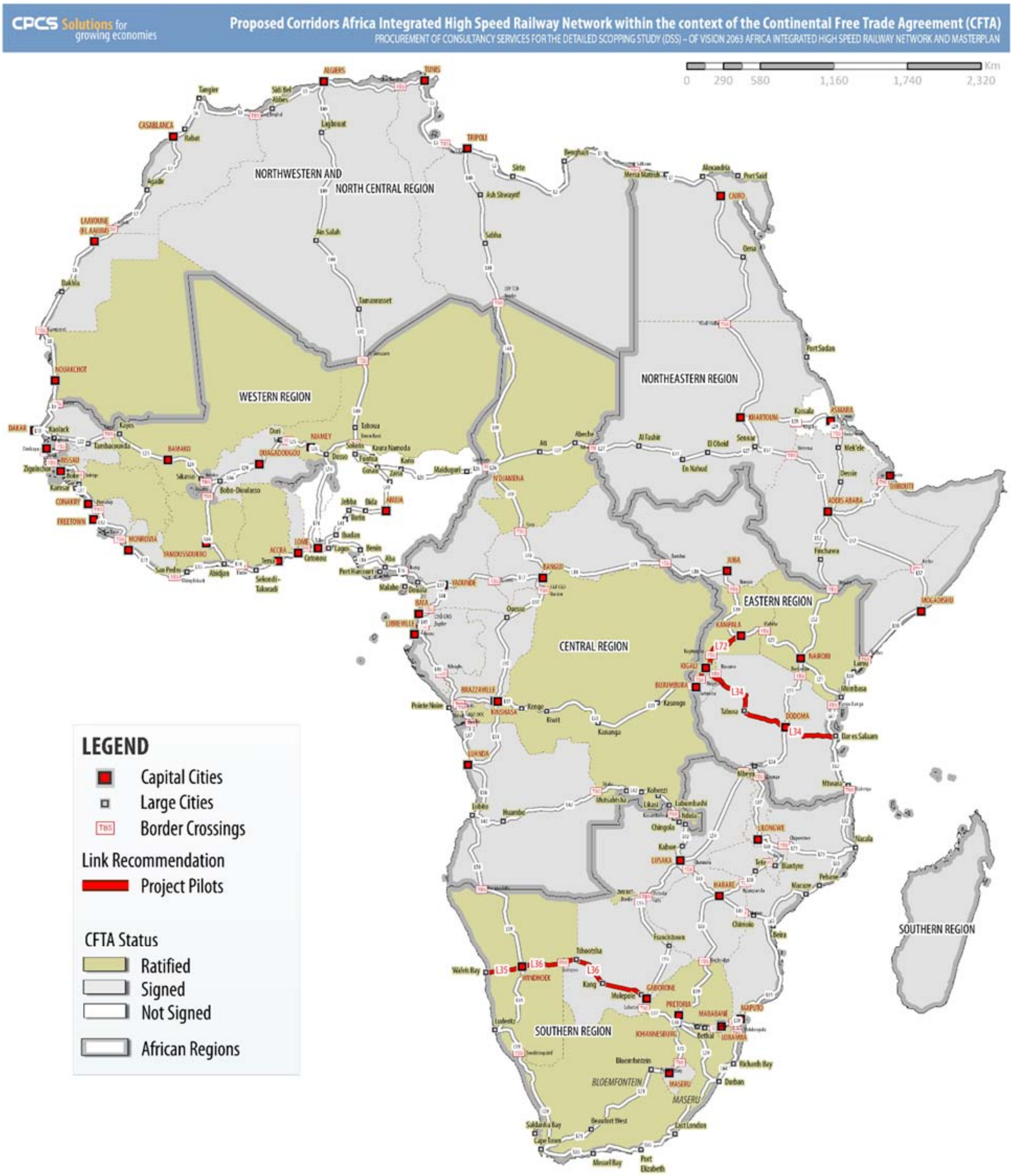
Southern Region

Table A-25: Selection of Accelerated Pilot in Southern Region

Rank	Link No.	Link Description	MCA Score	Region	Recommendation
3	L39	Pretoria, SAF - Durban, SAF	61.60%	Southern	**Initially selected link.** However, Transnet's long-term plan indicates that it has no plan to develop a new rail line on this route, thus replaced with the next-ranked, most suitable link.
4	L36	Windhoek, NAM - Gaborone, BOT	61.30%	Southern	**Pilot Project (combined with L35 Walvis Bay-Windhoek)** replacing L36. (Part of a major transport corridor in Southern Africa where rail link is missing. To make the link more effective, it is combined with L35 Walvis Bay-Windhoek, which was ranked No. 38, to connect with the port).

The links are indicated in the map below:

Figure A-7: Map of Accelerated Pilot Projects



Note: The CFTA ratification status is as of April 2019 when the link prioritisation exercise took place.
Source: CPCS

Raw Data / Inputs to MCA

Length of Existing Long-Distance Rail Network by Country

Country	Parameter A: Length of Long-Distance Rail Network (km)
Algeria	4,175
Angola	2,761
Benin	758
Botswana	888
Burkina Faso	622
Burundi	0
Cameroon	974
Cabo Verde	0
Central African Republic	0
Chad	0
Comoros	0
Congo	795
Democratic Republic of Congo	4,007
Cote d'Ivoire	639
Djibouti	92
Equatorial Guinea	0
Egypt	6,700
Eritrea	306
Ethiopia	659
Gabon	810
Gambia	0
Ghana	953
Guinea	837
Guinea-Bissau	0
Kenya	2,778
Lesotho	2
Liberia	490
Libya	0
Madagascar	854
Malawi	797
Mali	733
Mauritania	728
Mauritius	0
Morocco	1,989
Mozambique	3,116
Namibia	2,382

Country	Parameter A: Length of Long-Distance Rail Network (km)
Niger	0
Nigeria	3,528
Rwanda	0
Saharawi Arab Democratic Republic	0
São Tomé and Príncipe	0
Senegal	906
Seychelles	0
Sierra Leone	84
Somalia	0
South Africa	20,953
South Sudan	0
Sudan	5,478
Swaziland (eSwatini)	301
Tanzania	2,722
Togo	568
Tunisia	2,218
Uganda	1,244
Zambia	1,237
Zimbabwe	3,000

Source: Rail Lines (Total Route-km), World Bank Database

Power Consumption per Person by Country

Country	Power Consumption (billion kWh, 2016 est.)	Population (2016)	Parameter B: Power Consumption Per Person (kWh)
Algeria	55.96	39,113,313	1,431
Angola	9.04	26,920,466	336
Benin	1.14	10,286,712	111
Botswana	3.64	2,168,573	1,677
Burkina Faso	1.55	17,585,977	88
Burundi	0.38	9,891,790	39
Cameroon	6.41	22,239,904	288
Cabo Verde	0.37	526,437	698
Central African Republic	0.16	4,515,392	35
Chad	0.21	13,569,438	15
Comoros	0.04	759,385	51
Congo	0.91	4,871,101	187
Democratic Republic of Congo	7.43	73,722,860	101
Cote d'Ivoire	6.25	22,531,350	277
Djibouti	0.38	912,164	413
Equatorial Guinea	0.47	1,129,424	412
Egypt	159.70	91,812,566	1,739
Eritrea	0.35	4,746,045	75
Ethiopia	9.06	97,366,774	93
Gabon	2.07	1,875,713	1,104
Gambia	0.28	1,917,852	147
Ghana	9.36	26,962,563	347
Guinea	0.56	11,805,509	47
Guinea-Bissau	0.04	1,725,744	21
Kenya	7.86	46,024,250	171
Lesotho	0.85	2,145,785	395
Liberia	0.28	4,390,737	64
Libya	27.30	6,204,108	4,400
Madagascar	1.59	23,589,801	67
Malawi	1.32	17,068,838	77
Mali	2.98	16,962,846	176
Mauritania	1.06	4,063,920	261
Mauritius	2.73	1,260,934	2,162
Morocco	28.25	34,318,082	823
Mozambique	11.57	27,212,382	425
Namibia	3.89	2,370,992	1,641
Niger	1.07	19,148,219	56
Nigeria	24.72	176,460,502	140

Country	Power Consumption (billion kWh, 2016 est.)	Population (2016)	Parameter B: Power Consumption Per Person (kWh)
Rwanda	0.53	11,345,357	46
Saharawi Arab Democratic Republic*	0.00	629,551	0
São Tomé and Príncipe	0.06	191,266	321
Senegal	3.50	14,546,111	240
Seychelles	0.33	91,359	3,563
Sierra Leone	0.28	7,079,162	39
Somalia	0.32	13,513,125	23
South Africa	207.10	54,539,571	3,797
South Sudan	0.39	11,530,971	34
Sudan	12.12	37,737,913	321
Swaziland (eSwatini)	1.43	1,295,097	1,105
Tanzania	5.68	52,234,869	109
Togo	1.26	7,228,915	174
Tunisia	15.27	11,143,908	1,370
Uganda	3.11	38,833,338	80
Zambia	11.04	15,620,974	707
Zimbabwe	7.12	15,411,675	462

* Population estimate from CIA Factbook. 2018 est.
Source: Estimated based on national power consumption data from CIA Factbook and World Bank population data.

HSR Links Financial Analysis Results

Link No.	Link Name	FNPV (Million USD)	MIRR (%)	FIRR (%)
L1	Alexandria, EGY - Benghazi, LBY	(19,858)	1%	-6%
L2	Benghazi, LBY - Tripoli, LBY	(19,110)	-8%	N/A
L3	Tripoli, LBY - Tunis, TUN	(14,298)	5%	-1%
L4	Tunis, TUN - Algiers, DZA	(12,036)	7%	2%
L5	Algiers, DZA - Sidi Bel Abbes, DZA	(6,953)	7%	2%
L6	Sidi Bel Abbes, DZA - Casablanca, MOR	(16,065)	6%	2%
L7	Casablanca, MOR - Laayoune (El Aaium), ESH	(20,648)	2%	-5%
L8	Laayoune (El Aaium), ESH - Nouakchot, MRT	(22,262)	-9%	N/A
L9	Nouakchot, MRT - Dakar, SEN	(10,254)	3%	-3%
L10	Dakar, SEN - Banjul, GMB	(8,288)	5%	0%
L11	Banjul, GMB - Conakry, GIN	(14,538)	3%	-2%
L12	Conakry, GIN - Monrovia, LIB	(15,471)	3%	-3%
L13	Monrovia, LIB - Abidjan, CIV	(17,460)	3%	-2%
L14	Abidjan, CIV - Accra, GHA	(7,227)	8%	5%
L15	Accra, GHA - Lagos, NGA	(7,588)	8%	6%
L16	Lagos, NGA - Douala, CMR	(11,193)	9%	7%
L17	Douala, CMR - Bangui, CAF	(9,268)	9%	8%
L18	Bangui, CAF - Juba, SSD	(30,005)	-8%	N/A
L19	Juba, SSD - Kampala, UGD	(5,442)	9%	8%
L20	Kampala, UGD - Nairobi, KEN	3,707	10%	11%
L21	Nairobi, KEN - Mombasa, KEN	13,053	11%	14%
L22	Dakar, SEN - Tambacounda, SEN	(7,687)	7%	3%
L23	Tambacounda, SEN - Bamako, MLI	(11,837)	6%	3%
L24	Bamako, MLI - Ouagadougou, BFA	(15,517)	5%	1%
L25	Ouagadougou, BFA - Niamey, NER	(8,873)	7%	3%
L26	Niamey, NER - N'Djamena, TCD	(32,036)	5%	-1%
L27	N'Djamena, TCD - Khartoum, SDN	(46,693)	0%	-5%
L28	Khartoum, SDN - Asmara, ERI	(14,617)	3%	-3%
L29	Asmara, ERI - Addis Ababa, ETH	(14,671)	5%	1%
L30	Addis Ababa, ETH - Djibouti, DJI	10,925	11%	13%
L31_L32	Pointe Noire, CGO - Kinshasa, DOC	(5,993)	9%	6%
L33	Kinshasa, DOC - Kigali, RWA	(37,379)	5%	1%
L34	Kigali, RWA - Dar es Salaam, TZA	(19,232)	8%	6%
L35	Walvis Bay, NMB - Windhoek, NMB	(3,317)	8%	6%
L36	Windhoek, NAM - Gaborone, BOT	(9,803)	9%	7%
L37	Gaborone, BOT - Johannesburg, SAF	(716)	10%	9%
L38	Johannesburg, SAF - Maputo, MOZ	(3,184)	9%	8%

Link No.	Link Name	FNPV (Million USD)	MIRR (%)	FIRR (%)
L39	Pretoria, SAF - Durban, SAF	460,139	14%	39%
L40	Algiers, DZA - Abuja, NGA	(66,469)	1%	-4%
L41	Abuja, NGA - Lagos, NGA	(8,987)	8%	6%
L42	Lobito, AGO - Lusaka, ZMB	(40,928)	5%	1%
L43	Lusaka, ZMB - Beira, MOZ	(11,751)	8%	5%
L44	Yaounde, CMR - Bata, GNQ	(6,750)	4%	-1%
L45	Bata, GNQ - Libreville, GBN	(4,641)	2%	-3%
L46	Libreville, GBN - Pointe Noire, CGO	(14,699)	-1%	-4%
L47	Pointe Noire, CGO - Luanda, AGO	(12,200)	6%	2%
L48	Tripoli, LBY - N'Djamena, TCD	(47,139)	-9%	N/A
L49	N'Djamena, TCD - Bangui, CAF	(12,023)	8%	6%
L50	Bangui, CAF - Brazzaville, CGO	(10,701)	4%	-2%
L51	Brazzaville, CGO - Luanda, AGO	(14,267)	6%	0%
L52	Addis Ababa, ETH - Nairobi, KEN	(27,006)	5%	1%
L53	Nairobi, KEN - Dodoma, TZA	(10,249)	7%	4%
L54	Dodoma, TZA - Lusaka, ZMB	(27,008)	5%	1%
L55	Lusaka, ZMB - Gaborone, BOT	(24,985)	2%	-3%
L56	Alexandria, EGY - Khartoum, SDN	(34,483)	8%	4%
L57	Khartoum, SDN - Mogadishu, SOM	(27,605)	8%	7%
L58	Luanda, AGO - Windhoek, NAM	(34,752)	4%	0%
L59	Windhoek, NAM - Cape Town, SAF	(31,587)	-9%	N/A
L60	Mogadishu, SOM - Mombasa, KEN	(18,864)	0%	-5%
L61	Mombasa, KEN - Dar es Salaam, TZA	(7,182)	5%	0%
L62	Dar es Salaam, TZA - Nacala, MOZ	(19,248)	0%	-5%
L63	Nacala, MOZ - Maputo, MOZ	(38,749)	-3%	-6%
L64	Maputo, MOZ - Durban, SAF	(10,187)	4%	-2%
L65	Durban, SAF - Cape Town, SAF	(30,832)	1%	-6%
L66	Ouagadougou, BFA - Abidjan, CIV	(8,055)	9%	8%
L67	Mbeya, TZA - Lilongwe, MLI	(12,247)	3%	-2%
L68	Lilongwe, MLI - Harare, ZIM	(14,703)	7%	3%
L69	Harare, ZIM - Johannesburg, SAF	(15,215)	8%	6%
L70	Johannesburg, SAF - Maseru, LSO	(5,327)	8%	6%
L71	Maseru, LSO - Cape Town, SAF	(22,040)	-4%	-8%
L72	Kampala, UGD - Kigali, RWA	(7,646)	7%	3%
L73	Lilongwe, MLI - Nacala, MOZ	(15,888)	1%	-4%
L74	Niamey, NER - Cotonou, BEN	(17,162)	6%	2%

Source: CPCS analysis.

HSR Links Economic Analysis Results

Link No.	Link Name	ENPV (Million USD)	EIRR (%)	BCR (%)
L1	Alexandria, EGY - Benghazi, LBY	(15,851)	-4%	3%
L2	Benghazi, LBY - Tripoli, LBY	(15,410)	-8%	0%
L3	Tripoli, LBY - Tunis, TUN	(11,414)	0%	8%
L4	Tunis, TUN - Algiers, DZA	(9,388)	4%	23%
L5	Algiers, DZA - Sidi Bel Abbes, DZA	(5,382)	3%	20%
L6	Sidi Bel Abbes, DZA - Casablanca, MOR	(12,591)	3%	18%
L7	Casablanca, MOR - Laayoune (El Aaium), ESH	(16,431)	-4%	3%
L8	Laayoune (El Aaium), ESH - Nouakchot, MRT	(18,024)	N/A	-1%
L9	Nouakchot, MRT - Dakar, SEN	(8,037)	-1%	7%
L10	Dakar, SEN - Banjul, GMB	(6,417)	2%	14%
L11	Banjul, GMB - Conakry, GIN	(11,528)	-1%	6%
L12	Conakry, GIN - Monrovia, LIB	(12,233)	-1%	6%
L13	Monrovia, LIB - Abidjan, CIV	(13,826)	-1%	6%
L14	Abidjan, CIV - Accra, GHA	(5,556)	7%	41%
L15	Accra, GHA - Lagos, NGA	(4,984)	8%	58%
L16	Lagos, NGA - Douala, CMR	(8,120)	8%	58%
L17	Douala, CMR - Bangui, CAF	(8,311)	9%	57%
L18	Bangui, CAF - Juba, SSD	(24,257)	-9%	0%
L19	Juba, SSD - Kampala, UGD	(5,208)	9%	58%
L20	Kampala, UGD - Nairobi, KEN	1,512	13%	110%
L21	Nairobi, KEN - Mombasa, KEN	7,641	16%	166%
L22	Dakar, SEN - Tambacounda, SEN	(6,046)	4%	21%
L23	Tambacounda, SEN - Bamako, MLI	(9,568)	4%	17%
L24	Bamako, MLI - Ouagadougou, BFA	(12,236)	2%	12%
L25	Ouagadougou, BFA - Niamey, NER	(7,032)	4%	21%
L26	Niamey, NER - N'Djamena, TCD	(24,600)	1%	13%
L27	N'Djamena, TCD - Khartoum, SDN	(37,254)	-3%	3%
L28	Khartoum, SDN - Asmara, ERI	(11,426)	-1%	8%
L29	Asmara, ERI - Addis Ababa, ETH	(11,418)	3%	13%
L30	Addis Ababa, ETH - Djibouti, DJI	5,732	14%	139%
L31_L32	Pointe Noire, CGO - Kinshasa, DOC	(3,774)	8%	61%
L33	Kinshasa, DOC - Kigali, RWA	(29,220)	2%	13%
L34	Kigali, RWA - Dar es Salaam, TZA	(16,087)	7%	39%
L35	Walvis Bay, NMB - Windhoek, NMB	(2,804)	7%	39%
L36	Windhoek, NAM - Gaborone, BOT	(8,591)	8%	52%
L37	Gaborone, BOT - Johannesburg, SAF	(797)	11%	89%

Link No.	Link Name	ENPV (Million USD)	EIRR (%)	BCR (%)
L38	Johannesburg, SAF - Maputo, MOZ	(2,496)	10%	77%
L39	Pretoria, SAF - Durban, SAF	342,446	47%	439%
L40	Algiers, DZA - Abuja, NGA	(53,064)	-2%	3%
L41	Abuja, NGA - Lagos, NGA	(6,469)	8%	54%
L42	Lobito, AGO - Lusaka, ZMB	(32,763)	2%	11%
L43	Lusaka, ZMB - Beira, MOZ	(9,350)	6%	35%
L44	Yaounde, CMR - Bata, GNQ	(5,363)	0%	7%
L45	Bata, GNQ - Libreville, GBN	(3,733)	-2%	2%
L46	Libreville, GBN - Pointe Noire, CGO	(11,869)	-3%	1%
L47	Pointe Noire, CGO - Luanda, AGO	(9,718)	3%	16%
L48	Tripoli, LBY - N'Djamena, TCD	(38,119)	-11%	0%
L49	N'Djamena, TCD - Bangui, CAF	(10,413)	7%	40%
L50	Bangui, CAF - Brazzaville, CGO	(8,194)	0%	12%
L51	Brazzaville, CGO - Luanda, AGO	(10,350)	2%	21%
L52	Addis Ababa, ETH - Nairobi, KEN	(21,112)	2%	12%
L53	Nairobi, KEN - Dodoma, TZA	(8,296)	5%	22%
L54	Dodoma, TZA - Lusaka, ZMB	(21,792)	2%	7%
L55	Lusaka, ZMB - Gaborone, BOT	(20,118)	-2%	3%
L56	Alexandria, EGY - Khartoum, SDN	(25,754)	6%	38%
L57	Khartoum, SDN - Mogadishu, SOM	(23,942)	8%	42%
L58	Luanda, AGO - Windhoek, NAM	(28,028)	1%	7%
L59	Windhoek, NAM - Cape Town, SAF	(25,498)	-9%	0%
L60	Mogadishu, SOM - Mombasa, KEN	(15,103)	-3%	2%
L61	Mombasa, KEN - Dar es Salaam, TZA	(5,558)	2%	12%
L62	Dar es Salaam, TZA - Nacala, MOZ	(15,325)	-3%	3%
L63	Nacala, MOZ - Maputo, MOZ	(31,051)	-4%	2%
L64	Maputo, MOZ - Durban, SAF	(7,993)	0%	8%
L65	Durban, SAF - Cape Town, SAF	(24,585)	-4%	3%
L66	Ouagadougou, BFA - Abidjan, CIV	(7,059)	9%	67%
L67	Mbeya, TZA - Lilongwe, MLI	(9,687)	-1%	6%
L68	Lilongwe, MLI - Harare, ZIM	(11,526)	4%	21%
L69	Harare, ZIM - Johannesburg, SAF	(12,380)	7%	43%
L70	Johannesburg, SAF - Maseru, LSO	(4,280)	7%	42%
L71	Maseru, LSO - Cape Town, SAF	(17,703)	-6%	1%
L72	Kampala, UGD - Kigali, RWA	(5,832)	5%	23%
L73	Lilongwe, MLI - Nacala, MOZ	(12,638)	-3%	3%
L74	Niamey, NER - Cotonou, BEN	(13,662)	3%	14%

Source: CPCS analysis.

Government Debt to GDP

Country	Debt-to-GDP Ratio
Algeria	18%
Angola	65%
Benin	22%
Botswana	22%
Burkina Faso	24%
Burundi	14%
Cameroon	36%
Cabo Verde	125%
Central African Republic	39%
Chad	48%
Comoros	28%
Congo	118%
Democratic Republic of Congo	17%
Cote d'Ivoire	25%
Djibouti	91%
Equatorial Guinea	54%
Egypt	101%
Eritrea	20%
Ethiopia	34%
Gabon	67%
Gambia	66%
Ghana	71%
Guinea	19%
Guinea-Bissau	28%
Kenya	57%
Lesotho	46%
Liberia	29%
Libya	17%
Madagascar	42%
Malawi	55%
Mali*	36%
Mauritania	77%
Mauritius	65%
Morocco	63%
Mozambique	88%
Namibia	42%
Niger	30%
Nigeria	21%
Rwanda	40%
Saharawi Arab Democratic Republic	N/A

Country	Debt-to-GDP Ratio
São Tomé and Príncipe	88%
Senegal	37%
Seychelles	62%
Sierra Leone	60%
Somalia*	65%
South Africa	53%
South Sudan*	62%
Sudan	54%
Swaziland (eSwatini)	10%
Tanzania	37%
Togo	20%
Tunisia	69%
Uganda	39%
Zambia	56%
Zimbabwe	78%

Source: World Bank for most data. The estimates for the countries with "*" come from various sources.

Political Stability Index

Country	Parameter F: Political Stability Index
Algeria	-0.96
Angola	-0.29
Benin	0.05
Botswana	1.03
Burkina Faso	-0.92
Burundi	-1.97
Cameroon	-1.08
Cabo Verde	0.90
Central African Republic	N/A
Chad	-1.34
Comoros	0.03
Congo	-0.53
Democratic Republic of Congo	-2.30
Cote d'Ivoire	-1.09
Djibouti	-0.71
Equatorial Guinea	-0.15
Egypt	-1.42
Eritrea	-0.66
Ethiopia	-1.69
Gabon	-0.09
Gambia	-0.21
Ghana	0.09
Guinea	-0.61
Guinea-Bissau	-0.60
Kenya	-1.08
Lesotho	-0.25
Liberia	-0.41
Libya	-2.33
Madagascar	-0.33
Malawi	-0.27
Mali	-1.91
Mauritania	-0.62
Mauritius	0.99
Morocco	-0.41
Mozambique	-0.98
Namibia	0.65
Niger	-1.30
Nigeria	-1.94
Rwanda	0.04
Saharawi Arab Democratic Republic	N/A

Country	Parameter F: Political Stability Index
São Tomé and Príncipe	N/A
Senegal	-0.04
Seychelles	0.68
Sierra Leone	0.03
Somalia	-2.33
South Africa	-0.27
South Sudan	N/A
Sudan	-2.01
Swaziland (eSwatini)	-0.30
Tanzania	-0.58
Togo	-0.74
Tunisia	-1.05
Uganda	-0.56
Zambia	0.11
Zimbabwe	-0.77

Source: Political Stability – Country Rankings, the Global Economy

Doing Business Index

Country	Parameter G: Doing Business Index
Algeria	49.65
Angola	43.86
Benin	51.42
Botswana	65.40
Burkina Faso	51.57
Burundi	47.41
Cameroon	47.78
Cabo Verde	55.95
Central African Republic	36.90
Chad	39.36
Comoros	48.66
Congo	39.83
Democratic Republic of Congo	36.85
Cote d'Ivoire	58.00
Djibouti	62.02
Equatorial Guinea	41.94
Egypt	58.56
Eritrea	23.07
Ethiopia	49.06
Gabon	45.58
Gambia	51.72
Ghana	59.22
Guinea	51.51
Guinea-Bissau	42.85
Kenya	70.31
Lesotho	60.60
Liberia	43.51
Libya	33.44
Madagascar	48.89
Malawi	59.59
Mali	53.50
Mauritania	51.99
Mauritius	79.58
Morocco	71.02
Mozambique	55.53
Namibia	60.53
Niger	53.72
Nigeria	52.89
Rwanda	77.88

Country	Parameter G: Doing Business Index
Saharawi Arab Democratic Republic	0.00
São Tomé and Príncipe	45.14
Senegal	54.15
Seychelles	62.41
Sierra Leone	48.74
Somalia	20.04
South Africa	66.03
South Sudan	35.34
Sudan	48.84
Swaziland (eSwatini)	58.95
Tanzania	53.63
Togo	55.20
Tunisia	66.11
Uganda	57.06
Zambia	65.08
Zimbabwe	50.44

Source: Ease of Doing Business Score, www.doingbusiness.org

Number of Countries Involved in a Link

Link	Link Name	Parameter H: Number of Countries Involved in a Link
L1	Alexandria, EGY - Benghazi, LBY	2
L2	Benghazi, LBY - Tripoli, LBY	1
L3	Tripoli, LBY - Tunis, TUN	2
L4	Tunis, TUN - Algiers, DZA	2
L5	Algiers, DZA - Sidi Bel Abbes, DZA	1
L6	Sidi Bel Abbes, DZA - Casablanca, MOR	2
L7	Casablanca, MOR - Laayoune (El Aaium), ESH	2
L8	Laayoune (El Aaium), ESH - Nouakchot, MRT	2
L9	Nouakchot, MRT - Dakar, SEN	2
L10	Dakar, SEN - Banjul, GMB	2
L11	Banjul, GMB - Conakry, GIN	4
L12	Conakry, GIN - Monrovia, LIB	3
L13	Monrovia, LIB - Abidjan, CIV	2
L14	Abidjan, CIV - Accra, GHA	2
L15	Accra, GHA - Lagos, NGA	4
L16	Lagos, NGA - Douala, CMR	2
L17	Douala, CMR - Bangui, CAF	1
L18	Bangui, CAF - Juba, SSD	2
L19	Juba, SSD - Kampala, UGD	2
L20	Kampala, UGD - Nairobi, KEN	2
L21	Nairobi, KEN - Mombasa, KEN	1
L22	Dakar, SEN - Tambacounda, SEN	1
L23	Tambacounda, SEN - Bamako, MLI	2
L24	Bamako, MLI - Ouagadougou, BFA	2
L25	Ouagadougou, BFA - Niamey, NER	2
L26	Niamey, NER - N'Djamena, TCD	3
L27	N'Djamena, TCD - Khartoum, SDN	2
L28	Khartoum, SDN - Asmara, ERI	2
L29	Asmara, ERI - Addis Ababa, ETH	2
L30	Addis Ababa, ETH - Djibouti, DJI	2
L31-L32	Pointe Noire, CGO - Kinshasa, DOC	2
L33	Kinshasa, DOC - Kigali, RWA	2
L34	Kigali, RWA - Dar es Salaam, TZA	3
L35	Walvis Bay, NMB - Windhoek, NMB	1
L36	Windhoek, NAM - Gaborone, BOT	2
L37	Gaborone, BOT - Johannesburg, SAF	2
L38	Johannesburg, SAF - Maputo, MOZ	3

Link	Link Name	Parameter H: Number of Countries Involved in a Link
L39	Pretoria, SAF - Durban, SAF	1
L40	Algiers, DZA - Abuja, NGA	3
L41	Abuja, NGA - Lagos, NGA	1
L42	Lobito, AGO - Lusaka, ZMB	3
L43	Lusaka, ZMB - Beira, MOZ	3
L44	Yaounde, CMR - Bata, GNQ	2
L45	Bata, GNQ - Libreville, GBN	2
L46	Libreville, GBN - Pointe Noire, CGO	2
L47	Pointe Noire, CGO - Luanda, AGO	3
L48	Tripoli, LBY - N'Djamena, TCD	2
L49	N'Djamena, TCD - Bangui, CAF	2
L50	Bangui, CAF - Brazzaville, CGO	2
L51	Brazzaville, CGO - Luanda, AGO	2
L52	Addis Ababa, ETH - Nairobi, KEN	2
L53	Nairobi, KEN - Dodoma, TZA	2
L54	Dodoma, TZA - Lusaka, ZMB	2
L55	Lusaka, ZMB - Gaborone, BOT	3
L56	Alexandria, EGY - Khartoum, SDN	2
L57	Khartoum, SDN - Mogadishu, SOM	3
L58	Luanda, AGO - Windhoek, NAM	2
L59	Windhoek, NAM - Cape Town, SAF	2
L60	Mogadishu, SOM - Mombasa, KEN	2
L61	Mombasa, KEN - Dar es Salaam, TZA	2
L62	Dar es Salaam, TZA - Nacala, MOZ	2
L63	Nacala, MOZ - Maputo, MOZ	1
L64	Maputo, MOZ - Durban, SAF	2
L65	Durban, SAF - Cape Town, SAF	1
L66	Ouagadougou, BFA - Abidjan, CIV	2
L67	Mbeya, TZA - Lilongwe, MLI	2
L68	Lilongwe, MLI - Harare, ZIM	3
L69	Harare, ZIM - Johannesburg, SAF	2
L70	Johannesburg, SAF - Maseru, LSO	2
L71	Maseru, LSO - Cape Town, SAF	1
L72	Kampala, UGD - Kigali, RWA	2
L73	Lilongwe, MLI - Nacala, MOZ	2
L74	Niamey, NER - Cotonou, BEN	2

Status of CFTA Ratification

Country	Parameter I: Status of CFTA Ratification
Algeria	Signed
Angola	Signed
Benin	No Status
Botswana	Signed
Burkina Faso	Signed
Burundi	Signed
Cameroon	Signed
Cabo Verde	Signed
Central African Republic	Signed
Chad	Ratified
Comoros	Signed
Congo	Ratified
Democratic Republic of Congo	Signed
Cote d'Ivoire	Ratified
Djibouti	Signed
Equatorial Guinea	Signed
Egypt	Signed
Eritrea	No Status
Ethiopia	Signed
Gabon	Signed
Gambia	Signed
Ghana	Ratified
Guinea	Ratified
Guinea-Bissau	Signed
Kenya	Ratified
Lesotho	Signed
Liberia	Signed
Libya	Signed
Madagascar	Signed
Malawi	Signed
Mali	Ratified
Mauritania	Ratified
Mauritius	Signed
Morocco	Signed
Mozambique	Signed
Namibia	Ratified
Niger	Ratified
Nigeria	No Status
Rwanda	Ratified

Country	Parameter I: Status of CFTA Ratification
Saharawi Arab Democratic Republic	Signed
São Tomé and Príncipe	Signed
Senegal	Signed
Seychelles	Signed
Sierra Leone	Signed
Somalia	Signed
South Africa	Ratified
South Sudan	Signed
Sudan	Signed
Swaziland (eSwatini)	Ratified
Tanzania	Signed
Togo	Signed
Tunisia	Signed
Uganda	Ratified
Zambia	Signed
Zimbabwe	Signed

Source: Status of AfCFTA Ratification, Tralac

Status of Regional Corridor Treaties

Country	Parameter J: Status of Regional Corridor Treaties (Limited to Those Governed Under a Joint Treaty Approved by the Footprint States)
Algeria	Non-Signatory
Angola	Non-Signatory
Benin	Signatory (Abidjan-Lagos Corridor Treaty)
Botswana	Non-Signatory
Burkina Faso	Non-Signatory
Burundi	Signatory (Northern Corridor Transit and Transport Agreement)
Cameroon	Non-Signatory
Cabo Verde	Non-Signatory
Central African Republic	Non-Signatory
Chad	Non-Signatory
Comoros	Non-Signatory
Congo	Non-Signatory
Democratic Republic of Congo	Signatory (Northern Corridor Transit and Transport Agreement)
Cote d'Ivoire	Signatory (Abidjan-Lagos Corridor Treaty)
Djibouti	Non-Signatory
Equatorial Guinea	Non-Signatory
Egypt	Non-Signatory
Eritrea	Non-Signatory
Ethiopia	Non-Signatory
Gabon	Non-Signatory
Gambia	Non-Signatory
Ghana	Signatory (Abidjan-Lagos Corridor Treaty)
Guinea	Non-Signatory
Guinea-Bissau	Non-Signatory
Kenya	Signatory (Northern Corridor Transit and Transport Agreement)
Lesotho	Non-Signatory
Liberia	Non-Signatory
Libya	Non-Signatory
Madagascar	Non-Signatory
Malawi	Non-Signatory
Mali	Non-Signatory
Mauritania	Non-Signatory
Mauritius	Non-Signatory
Morocco	Non-Signatory
Mozambique	Non-Signatory
Namibia	Non-Signatory
Niger	Signatory (Abidjan-Lagos Corridor Treaty)
Nigeria	Non-Signatory
Rwanda	Signatory (Northern Corridor Transit and Transport Agreement)

Country	Parameter J: Status of Regional Corridor Treaties (Limited to Those Governed Under a Joint Treaty Approved by the Footprint States)
Saharawi Arab Democratic Republic	Non-Signatory
São Tomé and Príncipe	Non-Signatory
Senegal	Non-Signatory
Seychelles	Non-Signatory
Sierra Leone	Non-Signatory
Somalia	Non-Signatory
South Africa	Non-Signatory
South Sudan	Signatory (Northern Corridor Transit and Transport Agreement)
Sudan	Non-Signatory
Swaziland (eSwatini)	Non-Signatory
Tanzania	Non-Signatory
Togo	Signatory (Abidjan-Lagos Corridor Treaty)
Tunisia	Non-Signatory
Uganda	Signatory (Northern Corridor Transit and Transport Agreement)
Zambia	Non-Signatory
Zimbabwe	Non-Signatory

Source: Various.

MCA Raw Data

Link Number	Link Name	Parameter A: Length of Long-Distance Rail Network (km)	Parameter B: Power Consumption Per Person (kWh)	Parameter C: Financial MIRR	Parameter D: Econ BCR	Parameter E: Total Debt/Total GDP	Parameter F: Political Stability Index	Parameter G: Doing Business Index	Parameter H: Number of Countries Involved in a Link	Parameter I: Status of CFTA Ratification Score	Parameter J: Status of Regional Corridor Treaties
L1	Alexandria, EGY - Benghazi, LBY	6,700	3,085	1%	0.03	89.40%	-1.88	46.00	2	0.50	0.0
L2	Benghazi, LBY - Tripoli, LBY	0	4,400	-8%	0.00	16.50%	-2.33	33.44	1	0.50	0.0
L3	Tripoli, LBY - Tunis, TUN	2,218	2,048	5%	0.08	43.47%	-1.69	49.78	2	0.50	0.0
L4	Tunis, TUN - Algiers, DZA	6,393	1,416	7%	0.23	27.62%	-1.01	57.88	2	0.50	0.0
L5	Algiers, DZA - Sidi Bel Abbes, DZA	4,175	1,431	7%	0.20	17.70%	-0.96	49.65	1	0.50	0.0
L6	Sidi Bel Abbes, DZA - Casablanca, MOR	6,164	902	6%	0.18	35.62%	-0.69	60.34	2	0.50	0.0
L7	Casablanca, MOR - Laayoune (El Aaium), ESH	1,989	726	2%	0.03	63.00%	-0.41	35.51	2	0.50	0.0
L8	Laayoune (El Aaium), ESH - Nouakchot, MRT	728	86	-9%	-0.01	77.30%	-0.62	26.00	2	0.75	0.0
L9	Nouakchot, MRT - Dakar, SEN	1,634	248	3%	0.07	44.84%	-0.33	53.07	2	0.75	0.0
L10	Dakar, SEN - Banjul, GMB	906	203	5%	0.14	38.98%	-0.13	52.94	2	0.50	0.0
L11	Banjul, GMB - Conakry, GIN	1,743	69	3%	0.06	32.36%	-0.37	50.06	4	0.63	0.0
L12	Conakry, GIN - Monrovia, LIB	1,411	45	3%	0.06	29.53%	-0.33	47.92	3	0.67	0.0
L13	Monrovia, LIB - Abidjan, CIV	1,129	173	3%	0.06	24.85%	-0.75	50.76	2	0.75	0.5
L14	Abidjan, CIV - Accra, GHA	1,592	325	8%	0.41	52.67%	-0.50	58.61	2	1.00	1.0
L15	Accra, GHA - Lagos, NGA	5,807	226	8%	0.58	27.77%	-0.64	54.68	4	0.38	1.0
L16	Lagos, NGA - Douala, CMR	4,502	167	9%	0.58	22.52%	-1.51	50.34	2	0.25	0.5
L17	Douala, CMR - Bangui, CAF	974	288	9%	0.57	35.70%	-1.08	47.78	1	0.50	0.0
L18	Bangui, CAF - Juba, SSD	0	35	-8%	0.00	52.86%	-2.50	36.12	2	0.50	0.5
L19	Juba, SSD - Kampala, UGD	1,244	68	9%	0.58	40.98%	-1.53	46.20	2	0.75	1.0
L20	Kampala, UGD - Nairobi, KEN	4,022	141	10%	1.10	52.53%	-0.82	63.69	2	1.00	1.0
L21	Nairobi, KEN - Mombasa, KEN	2,778	171	11%	1.66	57.10%	-1.08	70.31	1	1.00	1.0
L22	Dakar, SEN - Tambacounda, SEN	906	240	7%	0.21	37.10%	-0.04	54.15	1	0.50	0.0
L23	Tambacounda, SEN - Bamako, MLI	1,639	200	6%	0.17	36.68%	-0.98	53.83	2	0.75	0.0
L24	Bamako, MLI - Ouagadougou, BFA	1,355	128	5%	0.12	30.89%	-1.42	52.54	2	0.75	0.0
L25	Ouagadougou, BFA - Niamey, NER	622	75	7%	0.21	26.51%	-1.11	52.65	2	0.75	0.0
L26	Niamey, NER - N'Djamena, TCD	3,528	117	5%	0.13	22.13%	-1.53	48.66	3	0.67	0.5
L27	N'Djamena, TCD - Khartoum, SDN	5,478	214	0%	0.03	53.04%	-1.68	44.10	2	0.75	0.0
L28	Khartoum, SDN - Asmara, ERI	5,784	219	3%	0.08	51.85%	-1.34	35.96	2	0.25	0.0
L29	Asmara, ERI - Addis Ababa, ETH	965	90	5%	0.13	32.56%	-1.18	36.07	2	0.25	0.0
L30	Addis Ababa, ETH - Djibouti, DJI	751	131	11%	1.39	34.78%	-1.20	55.54	2	0.50	0.0
L31-L32	Pointe Noire, CGO - Kinshasa, DOC	5,597	314	9%	0.61	48.84%	-0.97	39.09	2	0.75	0.0
L33	Kinshasa, DOC - Kigali, RWA	4,007	96	5%	0.13	21.53%	-1.13	57.37	2	0.75	1.0
L34	Kigali, RWA - Dar es Salaam, TZA	2,722	94	8%	0.39	36.66%	-0.84	59.64	3	0.67	0.5
L35	Walvis Bay, NMB - Windhoek, NMB	2,382	1,641	8%	0.39	41.50%	0.65	60.53	1	1.00	0.0
L36	Windhoek, NAM - Gaborone, BOT	3,270	1,666	9%	0.52	30.60%	0.84	62.97	2	0.75	0.0
L37	Gaborone, BOT - Johannesburg, SAF	21,841	3,353	10%	0.89	51.64%	0.38	65.72	2	0.75	0.0
L38	Johannesburg, SAF - Maputo, MOZ	24,370	2,497	9%	0.77	53.79%	-0.52	60.17	3	0.83	0.0
L39	Pretoria, SAF - Durban, SAF	20,953	3,797	14%	4.39	53.10%	-0.27	66.03	1	1.00	0.0
L40	Algiers, DZA - Abuja, NGA	7,703	918	1%	0.03	20.33%	-1.40	52.09	3	0.50	0.5

Link Number	Link Name	Parameter A: Length of Long-Distance Rail Network (km)	Parameter B: Power Consumption Per Person (kWh)	Parameter C: Financial MIRR	Parameter D: Econ BCR	Parameter E: Total Debt/Total GDP	Parameter F: Political Stability Index	Parameter G: Doing Business Index	Parameter H: Number of Countries Involved in a Link	Parameter I: Status of CFTA Ratification Score	Parameter J: Status of Regional Corridor Treaties
L41	Abuja, NGA - Lagos, NGA	3,528	140	8%	0.54	21.30%	-1.94	52.89	1	0.00	1.0
L42	Lobito, AGO - Lusaka, ZMB	8,005	323	5%	0.11	54.02%	-0.83	48.60	3	0.50	0.5
L43	Lusaka, ZMB - Beira, MOZ	7,353	492	8%	0.35	70.42%	-0.55	57.02	3	0.50	0.0
L44	Yaounde, CMR - Bata, GNQ	974	323	4%	0.07	40.41%	-0.62	44.86	2	0.50	0.0
L45	Bata, GNQ - Libreville, GBN	810	760	2%	0.02	60.78%	-0.12	43.76	2	0.50	0.0
L46	Libreville, GBN - Pointe Noire, CGO	1,605	762	-1%	0.01	85.29%	-0.31	42.71	2	0.75	0.0
L47	Pointe Noire, CGO - Luanda, AGO	7,563	261	6%	0.16	57.07%	-1.04	40.18	3	0.67	0.5
L48	Tripoli, LBY - N'Djamena, TCD	0	2,037	-9%	0.00	22.90%	-1.84	36.40	2	0.75	0.0
L49	N'Djamena, TCD - Bangui, CAF	0	24	8%	0.40	46.15%	-1.92	38.13	2	0.75	0.0
L50	Bangui, CAF - Brazzaville, CGO	795	140	4%	0.12	103.26%	-1.52	38.37	2	0.75	0.0
L51	Brazzaville, CGO - Luanda, AGO	6,768	273	6%	0.21	53.77%	-1.30	40.36	2	0.50	0.5
L52	Addis Ababa, ETH - Nairobi, KEN	3,437	129	5%	0.12	45.20%	-1.39	59.69	2	0.75	0.5
L53	Nairobi, KEN - Dodoma, TZA	5,500	123	7%	0.22	49.29%	-0.83	61.97	2	0.75	0.5
L54	Dodoma, TZA - Lusaka, ZMB	3,959	465	5%	0.07	43.44%	-0.24	59.36	2	0.50	0.0
L55	Lusaka, ZMB - Gaborone, BOT	5,125	1,320	2%	0.03	54.15%	0.12	60.31	3	0.50	0.0
L56	Alexandria, EGY - Khartoum, SDN	12,178	1,171	8%	0.38	85.32%	-1.72	53.70	2	0.50	0.0
L57	Khartoum, SDN - Mogadishu, SOM	6,137	137	8%	0.42	46.04%	-2.01	39.31	3	0.50	0.0
L58	Luanda, AGO - Windhoek, NAM	5,143	858	4%	0.07	62.79%	0.18	52.20	2	0.75	0.0
L59	Windhoek, NAM - Cape Town, SAF	23,335	2,628	-9%	0.00	52.68%	0.19	63.28	2	1.00	0.0
L60	Mogadishu, SOM - Mombasa, KEN	2,778	80	0%	0.02	57.75%	-1.71	45.18	2	0.75	0.5
L61	Mombasa, KEN - Dar es Salaam, TZA	5,500	124	5%	0.12	49.29%	-0.83	61.97	2	0.75	0.5
L62	Dar es Salaam, TZA - Nacala, MOZ	5,838	269	0%	0.03	47.32%	-0.78	54.58	2	0.50	0.0
L63	Nacala, MOZ - Maputo, MOZ	3,116	425	-3%	0.02	88.20%	-0.98	55.53	1	0.50	0.0
L64	Maputo, MOZ - Durban, SAF	24,069	2,984	4%	0.08	54.33%	-0.63	60.78	2	0.75	0.0
L65	Durban, SAF - Cape Town, SAF	20,953	3,797	1%	0.03	53.10%	-0.27	66.03	1	1.00	0.0
L66	Ouagadougou, BFA - Abidjan, CIV	1,261	195	9%	0.67	24.48%	-1.01	54.79	2	0.75	0.5
L67	Mbeya, TZA - Lilongwe, MLI	3,519	82	3%	0.06	39.27%	-0.43	56.61	2	0.50	0.0
L68	Lilongwe, MLI - Harare, ZIM	6,913	278	7%	0.21	77.35%	-0.67	55.19	3	0.50	0.0
L69	Harare, ZIM - Johannesburg, SAF	23,953	2,087	8%	0.43	54.56%	-0.52	58.24	2	0.75	0.0
L70	Johannesburg, SAF - Maseru, LSO	20,955	2,917	8%	0.42	53.05%	-0.26	63.32	2	0.75	0.0
L71	Maseru, LSO - Cape Town, SAF	20,953	3,797	-4%	0.01	53.10%	-0.27	66.03	1	1.00	0.0
L72	Kampala, UGD - Kigali, RWA	1,244	71	7%	0.23	39.02%	-0.26	67.47	2	1.00	1.0
L73	Lilongwe, MLI - Nacala, MOZ	3,913	320	1%	0.03	77.06%	-0.63	57.56	2	0.50	0.0
L74	Niamey, NER - Cotonou, BEN	758	95	6%	0.14	25.65%	-0.63	52.57	2	0.50	0.5

MCA Scoring

Weights		0.10	0.05	0.15	0.10	0.10	0.10	0.10	0.15	0.10	0.05	
Link Number	Link Name	Parameter A: Score	Parameter B: Score	Parameter C: Score	Parameter D: Score	Parameter E: Score	Parameter F: Score	Parameter G: Score	Parameter H: Score	Parameter I: Score	Parameter J: Score	MCA SCORE
L1	Alexandria, EGY - Benghazi, LBY	1.00	1.00	0.01	0.0062	0.50	0.00	0.46	1.00	0.50	0.0	44.81%
L2	Benghazi, LBY - Tripoli, LBY	0.00	1.00	0.00	0.0007	1.00	0.00	0.33	0.00	0.50	0.0	23.35%
L3	Tripoli, LBY - Tunis, TUN	1.00	1.00	0.05	0.0178	0.75	0.00	0.50	1.00	0.50	0.0	48.36%
L4	Tunis, TUN - Algiers, DZA	1.00	1.00	0.07	0.0516	1.00	0.50	0.58	1.00	0.50	0.0	57.33%
L5	Algiers, DZA - Sidi Bel Abbes, DZA	1.00	1.00	0.07	0.0464	1.00	0.50	0.50	0.00	0.50	0.0	41.41%
L6	Sidi Bel Abbes, DZA - Casablanca, MOR	1.00	0.70	0.06	0.0411	0.75	0.50	0.60	1.00	0.50	0.0	53.40%
L7	Casablanca, MOR - Laayoune (El Aaium), ESH	1.00	0.70	0.02	0.0079	0.50	0.50	0.36	1.00	0.50	0.0	47.41%
L8	Laayoune (El Aaium), ESH - Nouakchot, MRT	1.00	0.00	0.00	0.0000	0.50	0.50	0.26	1.00	0.75	0.0	45.10%
L9	Nouakchot, MRT - Dakar, SEN	1.00	0.30	0.03	0.0165	0.75	0.50	0.53	1.00	0.75	0.0	52.49%
L10	Dakar, SEN - Banjul, GMB	1.00	0.30	0.05	0.0311	0.75	0.50	0.53	1.00	0.50	0.0	50.39%
L11	Banjul, GMB - Conakry, GIN	1.00	0.00	0.03	0.0133	0.75	0.50	0.50	0.00	0.63	0.0	34.38%
L12	Conakry, GIN - Monrovia, LIB	1.00	0.00	0.03	0.0133	1.00	0.50	0.48	0.50	0.67	0.0	44.56%
L13	Monrovia, LIB - Abidjan, CIV	1.00	0.30	0.03	0.0139	1.00	0.50	0.51	1.00	0.75	0.5	57.22%
L14	Abidjan, CIV - Accra, GHA	1.00	0.30	0.08	0.0941	0.00	0.50	0.59	1.00	1.00	1.0	54.51%
L15	Accra, GHA - Lagos, NGA	1.00	0.30	0.08	0.1322	1.00	0.50	0.55	0.00	0.38	1.0	43.31%
L16	Lagos, NGA - Douala, CMR	1.00	0.30	0.09	0.1312	1.00	0.00	0.50	1.00	0.25	0.5	49.15%
L17	Douala, CMR - Bangui, CAF	1.00	0.30	0.09	0.1303	0.75	0.50	0.48	0.00	0.50	0.0	36.43%
L18	Bangui, CAF - Juba, SSD	0.00	0.00	0.00	0.0000	0.00	0.00	0.36	1.00	0.50	0.5	26.11%
L19	Juba, SSD - Kampala, UGD	1.00	0.00	0.09	0.1325	0.75	0.00	0.46	1.00	0.75	1.0	52.31%
L20	Kampala, UGD - Nairobi, KEN	1.00	0.30	1.00	0.2517	0.00	0.50	0.64	1.00	1.00	1.0	70.39%
L21	Nairobi, KEN - Mombasa, KEN	1.00	0.30	1.00	0.3776	0.00	0.50	0.70	0.00	1.00	1.0	57.31%
L22	Dakar, SEN - Tambacounda, SEN	1.00	0.30	0.07	0.0484	0.75	0.50	0.54	0.00	0.50	0.0	35.90%
L23	Tambacounda, SEN - Bamako, MLI	1.00	0.30	0.06	0.0384	0.75	0.50	0.54	1.00	0.75	0.0	53.23%
L24	Bamako, MLI - Ouagadougou, BFA	1.00	0.30	0.05	0.0279	0.75	0.50	0.53	1.00	0.75	0.0	52.83%
L25	Ouagadougou, BFA - Niamey, NER	1.00	0.00	0.07	0.0480	1.00	0.50	0.53	1.00	0.75	0.0	54.24%
L26	Niamey, NER - N'Djamena, TCD	1.00	0.30	0.05	0.0285	1.00	0.00	0.49	0.50	0.67	0.5	44.02%
L27	N'Djamena, TCD - Khartoum, SDN	1.00	0.30	0.00	0.0065	0.00	0.00	0.44	1.00	0.75	0.0	38.47%
L28	Khartoum, SDN - Asmara, ERI	1.00	0.30	0.03	0.0171	0.00	0.50	0.36	1.00	0.25	0.0	38.28%
L29	Asmara, ERI - Addis Ababa, ETH	1.00	0.00	0.05	0.0305	0.75	0.50	0.36	1.00	0.25	0.0	44.71%
L30	Addis Ababa, ETH - Djibouti, DJI	1.00	0.30	1.00	0.3171	0.75	0.50	0.56	1.00	0.50	0.0	67.72%
L31/L32	Pointe Noire, CGO - Kinshasa, DOC	1.00	0.30	0.09	0.1399	0.75	0.50	0.39	1.00	0.75	0.0	53.09%
L33	Kinshasa, DOC - Kigali, RWA	1.00	0.00	0.05	0.0288	1.00	0.50	0.57	1.00	0.75	1.0	59.30%
L34	Kigali, RWA - Dar es Salaam, TZA	1.00	0.00	0.08	0.0896	0.75	0.50	0.60	0.50	0.67	0.5	47.25%
L35	Walvis Bay, NMB - Windhoek, NMB	1.00	1.00	0.08	0.0880	0.75	0.75	0.61	0.00	1.00	0.0	48.17%
L36	Windhoek, NAM - Gaborone, BOT	1.00	1.00	0.09	0.1181	0.75	0.75	0.63	1.00	0.75	0.0	61.30%
L37	Gaborone, BOT - Johannesburg, SAF	1.00	1.00	0.10	0.2016	0.00	0.75	0.66	1.00	0.75	0.0	55.06%
L38	Johannesburg, SAF - Maputo, MOZ	1.00	1.00	0.09	0.1744	0.00	0.50	0.60	0.50	0.83	0.0	45.01%
L39	Pretoria, SAF - Durban, SAF	1.00	1.00	1.00	1.0000	0.00	0.50	0.66	0.00	1.00	0.0	61.60%
L40	Algiers, DZA - Abuja, NGA	1.00	0.70	0.01	0.0075	1.00	0.50	0.52	0.50	0.50	0.5	48.98%
L41	Abuja, NGA - Lagos, NGA	1.00	0.30	0.08	0.1220	1.00	0.00	0.53	0.00	0.00	1.0	34.28%

	Weights	0.10	0.05	0.15	0.10	0.10	0.10	0.10	0.15	0.10	0.05	
L42	Lobito, AGO - Lusaka, ZMB	1.00	0.30	0.05	0.0251	0.00	0.50	0.49	0.50	0.50	0.5	37.42%
L43	Lusaka, ZMB - Beira, MOZ	1.00	0.30	0.08	0.0802	0.50	0.50	0.57	0.50	0.50	0.0	41.68%
L44	Yaounde, CMR - Bata, GNQ	1.00	0.30	0.04	0.0156	0.75	0.50	0.45	1.00	0.50	0.0	49.25%
L45	Bata, GNQ - Libreville, GBN	1.00	0.70	0.02	0.0050	0.50	0.50	0.44	1.00	0.50	0.0	48.15%
L46	Libreville, GBN - Pointe Noire, CGO	1.00	0.70	0.00	0.0019	0.50	0.50	0.43	1.00	0.75	0.0	50.29%
L47	Pointe Noire, CGO - Luanda, AGO	1.00	0.30	0.06	0.0369	0.00	0.50	0.40	0.50	0.67	0.5	38.48%
L48	Tripoli, LBY - N'Djamena, TCD	0.00	1.00	0.00	0.0000	1.00	0.00	0.36	1.00	0.75	0.0	41.14%
L49	N'Djamena, TCD - Bangui, CAF	0.00	0.00	0.08	0.0920	0.75	0.00	0.38	1.00	0.75	0.0	35.98%
L50	Bangui, CAF - Brazzaville, CGO	1.00	0.30	0.04	0.0264	0.00	0.00	0.38	1.00	0.75	0.0	38.75%
L51	Brazzaville, CGO - Luanda, AGO	1.00	0.30	0.06	0.0486	0.00	0.50	0.40	1.00	0.50	0.5	44.35%
L52	Addis Ababa, ETH - Nairobi, KEN	1.00	0.30	0.05	0.0272	0.75	0.50	0.60	1.00	0.75	0.5	56.01%
L53	Nairobi, KEN - Dodoma, TZA	1.00	0.30	0.07	0.0496	0.75	0.50	0.62	1.00	0.75	0.5	56.73%
L54	Dodoma, TZA - Lusaka, ZMB	1.00	0.30	0.05	0.0165	0.75	0.50	0.59	1.00	0.50	0.0	50.79%
L55	Lusaka, ZMB - Gaborone, BOT	1.00	1.00	0.02	0.0063	0.00	0.75	0.60	0.50	0.50	0.0	41.39%
L56	Alexandria, EGY - Khartoum, SDN	1.00	1.00	0.08	0.0872	0.50	0.00	0.54	1.00	0.50	0.0	47.41%
L57	Khartoum, SDN - Mogadishu, SOM	1.00	0.30	0.08	0.0968	0.75	0.00	0.39	0.50	0.50	0.0	37.66%
L58	Luanda, AGO - Windhoek, NAM	1.00	0.70	0.04	0.0151	0.50	0.75	0.52	1.00	0.75	0.0	54.54%
L59	Windhoek, NAM - Cape Town, SAF	1.00	1.00	0.00	0.0001	0.00	0.75	0.63	1.00	1.00	0.0	53.83%
L60	Mogadishu, SOM - Mombasa, KEN	1.00	0.00	0.00	0.0048	0.00	0.00	0.45	1.00	0.75	0.5	39.57%
L61	Mombasa, KEN - Dar es Salaam, TZA	1.00	0.30	0.05	0.0279	0.75	0.50	0.62	1.00	0.75	0.5	56.21%
L62	Dar es Salaam, TZA - Nacala, MOZ	1.00	0.30	0.00	0.0074	0.75	0.50	0.55	1.00	0.50	0.0	49.58%
L63	Nacala, MOZ - Maputo, MOZ	1.00	0.30	0.00	0.0040	0.50	0.50	0.56	0.00	0.50	0.0	32.09%
L64	Maputo, MOZ - Durban, SAF	1.00	1.00	0.04	0.0192	0.00	0.50	0.61	1.00	0.75	0.0	49.42%
L65	Durban, SAF - Cape Town, SAF	1.00	1.00	0.01	0.0068	0.00	0.50	0.66	0.00	1.00	0.0	36.89%
L66	Ouagadougou, BFA - Abidjan, CIV	1.00	0.30	0.09	0.1515	1.00	0.50	0.55	1.00	0.75	0.5	59.88%
L67	Mbeya, TZA - Lilongwe, MLI	1.00	0.00	0.03	0.0136	0.75	0.50	0.57	1.00	0.50	0.0	48.76%
L68	Lilongwe, MLI - Harare, ZIM	1.00	0.30	0.07	0.0486	0.50	0.50	0.55	0.50	0.50	0.0	41.00%
L69	Harare, ZIM - Johannesburg, SAF	1.00	1.00	0.08	0.0976	0.00	0.50	0.58	1.00	0.75	0.0	50.55%
L70	Johannesburg, SAF - Maseru, LSO	1.00	1.00	0.08	0.0954	0.00	0.50	0.63	1.00	0.75	0.0	51.02%
L71	Maseru, LSO - Cape Town, SAF	1.00	1.00	0.00	0.0029	0.00	0.50	0.66	0.00	1.00	0.0	36.63%
L72	Kampala, UGD - Kigali, RWA	1.00	0.00	0.07	0.0532	0.75	0.50	0.67	1.00	1.00	1.0	60.76%
L73	Lilongwe, MLI - Nacala, MOZ	1.00	0.30	0.01	0.0079	0.50	0.50	0.58	1.00	0.50	0.0	47.49%
L74	Niamey, NER - Cotonou, BEN	1.00	0.00	0.06	0.0312	1.00	0.50	0.53	1.00	0.50	0.5	53.93%

Appendix B. Detailed Scoping of Accelerated Pilot Project: Gaborone-Walvis Bay

Introduction

In 2011, a prefeasibility assessment was conducted on a railway line between the coal fields of Botswana and the port of Walvis Bay in Namibia. It was and continues to be known as the Trans-Kalahari Railway (TKR). Two routes were considered for the rail line. Both served Gaborone, the capital and largest city in Botswana, and one served Windhoek, the capital and largest city of Namibia.

Our scoping study of this pilot includes two links of AIHSRN:

- L35 Walvis Bay-Windhoek
- L36 Windhoek-Gaborone

The prefeasibility assessment made it very clear that the single most-important factor impacting the development of the TKR is coal. It goes on to say that without coal, there will be no TKR as it was expected to contribute over 90% of the total traffic carried. Our findings are the same. Links L35 and L36 are important components of AIHSRN. However, without coal, they will be far from financially or economically viable. As such, we have extended the link 70 km east of Gaborone to Mmamabula, the location of a major coal deposit and the focal point of the coal production region as shown below. Throughout this report (depending on context), the line is identified as the Mmamabula-Walvis Bay line (instead of Gaborone-Walvis Bay).

Figure B-1: Location of Mmamabula-Walvis Bay Line

The route length was determined to be 1,926 km with a very significant amount of the route being on flat or gentle terrain.

Route and Cost Analysis

Methodology

Our GIS routing methodology minimises CAPEX estimates by identifying optimal routes for prioritised links. The routing algorithm minimises the level of investment required while maintaining a fair and realistic estimate of the investments that will be made.

Optimised routes based on minimising capital expenditures were developed in a fully fledged, GIS-based multi-criteria evaluation whereby typical costs associated with railroad building are thematically represented over the study area and are used as the primary input for a least-cost path analysis.

Conceptually, CPCS will formulate the thematic cost surfaced based on the reclassification of the following spatial datasets:

- **Topographic Constraints:**
  - Slope (percent rise), elevation above sea level (masl) and distance

- **Current Design Criteria, Existing Rail and Road Infrastructure:**
  - Within the study area, the alignment is weighted to favour existing infrastructure corridors such as major highways, and inactive or dismantled rail RoW
- **Hydrological Constraints:**
  - Cost associated with poorly drained soils, waterway crossings and the infrastructure costs they incur
- **Environmental, Economic and Social Impacts:**
  - Within the study area, the alignment is weighted to favour areas of economic relevance such as natural resource extraction and avoid protected areas and cultural heritages sites

Each of these elements is developed into individual cost surfaces, reclassified based on expert opinion and combined to create a unique cost surface that defines the financial expense required to transit any given area within the study area. It is from this cost map that we will determine the optimal route between a given origin and destination designated by the proposed routes within this RFP. Each constraint that affects the route decision is weighted and reclassified and cumulatively represents the cost associated with any given cell. The routing itself is performed using an algorithm that searches along the cost surface, from neighbouring cells of the starting point, to find the following cell with the lowest value. The algorithm weights the cumulative cost and direction towards the planned destination.

For example, when considering vegetation cover as a constraint for the cost associated with clearing and grubbing, CPCS rail sector experts will determine the weight and associative costs (financial or otherwise) for each type of landcover. Table B-1 and Figure B-2 below are illustrative examples of the stepped-based approach of reclassifying and associating costings across the study area:

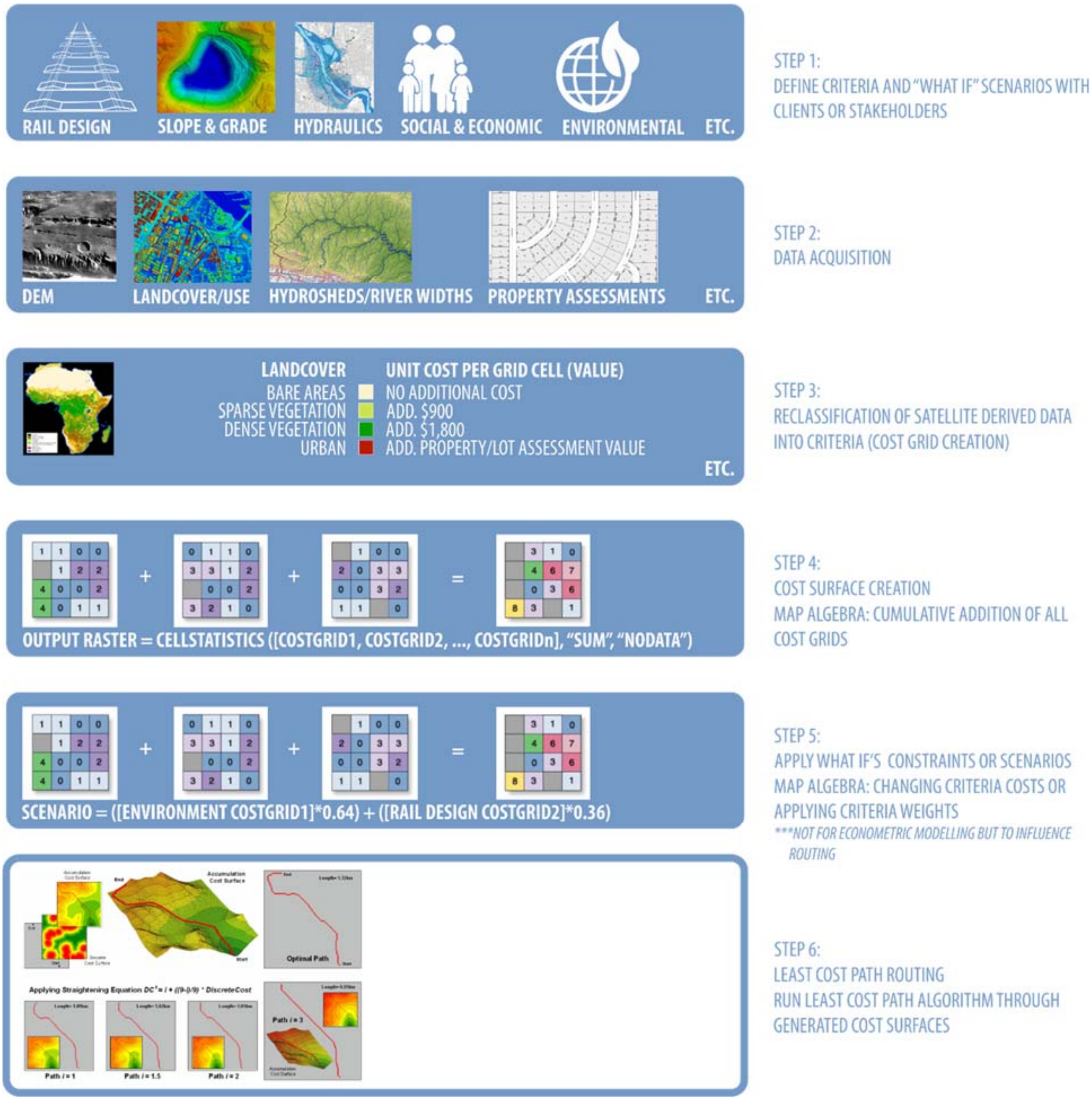
Table B-1: Simplified Example of Unit Costs That Drive the Least-Cost Path Assignment

Landcover Type	Weighting (score)	Desired Slope	Final Weight (Score)
Agricultural Farming / Grassland Farming	Low cost	0 – 3º	Low cost
Forest	Medium cost	3 – 6º	Medium cost
Urban	High cost	6 – 9º	High cost
Waterbody	Extremely high cost	9 – 12º	Extremely high Cost
Other	…	>12º	Excessive costs (Excluded from least-cost path analysis)

Source: CPCS

When these two constraints are cumulatively added and assessed, they will dictate the path used by the GIS routing algorithm. In addition, this example can be illustrated as follows in the GIS. The same assessments and reclassification are done for bridges, viaducts and culverts. It is assumed that railway bridges crossing a river are located at chainages where watercourses have a defined width and, based on those widths, the cost associated with the construction of culverts or bridges of a given span will incur different costs.

Figure B-2: Stepped Approach to Route Alignment Selection



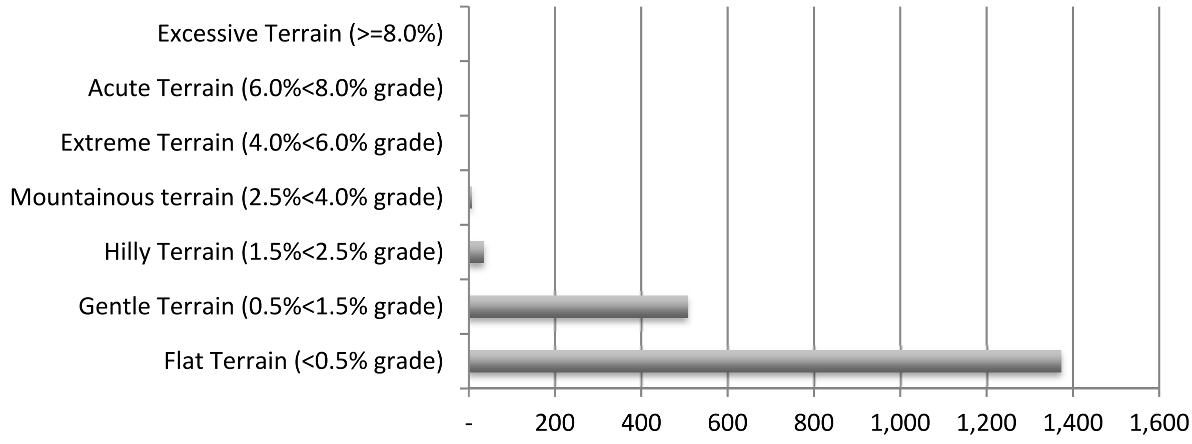
Source: CPCS

Routing Description

The alignment was defined by an iterative process that minimises routing through a cost surface defined from individual thematic costs defined in the methodology section. However, we did commit the maximum search distance of 25 km (50 km buffer) along the Trans-Kalahari Trade Corridor. As such, the alignment negotiated the least-costly path within this mask.

The length of the entire alignment is 1,926 km and nearly 325 km (17%) manages to adopt the existing cape gauge railway right-of-way in Namibia and Botswana. Grades are fairly consistent and only a few sections negotiate grades that are typically not suitable based on railway design criteria.

Figure B-3: Routing Based on Railway Grade (track-km)



Source: CPCS analysis.

Table B-2: Terrain Breakdown

Terrain	Portion of Route
Excessive Terrain (>=8.0%)	0.024%
Acute Terrain (6.0%<8.0% grade)	0.017%
Extreme Terrain (4.0%<6.0% grade)	0.07%
Mountainous terrain (2.5%<4.0% grade)	0.35%
Hilly Terrain (1.5%<2.5% grade)	1.9%
Gentle Terrain (0.5%<1.5% grade)	26.4%
Flat Terrain (<0.5% grade)	71.3%
Total	**100%**

Source: CPCS analysis.

The route negotiates a path through Walvis Bay from its port to Arandis via Swakopmund junction by adopting the existing cape gauge right-of-way. This section of track is roughly 75 km. From this point on, the alignment veers north in favour of maintaining softer grades (0.5%-2.5% rise). The following section is the only part of the alignment that negotiates grades exceeding 2.5% and is located from Okahandja south and through a narrow pass going eastward past Windhoek for approximately 80 km. From that point on, the routing parallels the Trans-Kalahari Highway to the Buitepos (NAM) / Mamuno (BOT) border crossing and continues on following the A2 from that point onwards until it reaches Gaborone. The final link goes north adopting a parallel alignment east of the A1 and the existing cape gauge railway for 120 km before veering east towards the Mmamabula Coal Fields (approximately 20 km).

The costs are presented as part of the financial analysis presented below.

Traffic Review and Update

Freight Traffic

This section presents the traffic review and update, and the forecasts of freight traffic and related revenue for the rail line connecting Gaborone and Walvis Bay, known as the Trans-Kalahari Railway (TKR). The TKR line has a length of 1,926 km from Mmamabula to Walvis Bay through Gaborone and Windhoek using GIS-based Route Optimization Model described above.

Traffic Composition

Freight traffic will remain the dominant activity, with commodities transported including coal, cement, copper, soda ash, grain, fuel and salt. We reviewed the import and export data found from various sources, and updated the demand of existing commodities and potential coal traffic routing through the identified TKR line, in terms of annual tonnage (million tonnes per year). Due to the lack of consistency in the data availability for different commodity types, we compiled data points that are as close to 2019 as possible to construct the base year. The assumptions are provided in Table B-3 below.

Table B-3: Traffic Assumptions

Commodity	Origin	Destination	Traffic Year	Tonnes, MTPY	Growth Rate
Potential Coal Traffic					
Coal	Botswana	Zambia/DRC	2025	0.1	
Coal	Botswana	Zimbabwe	2025	1.0	
Coal	South Africa	Europe	2025	2.5	
Coal	South Africa	Europe	2025	2.0	
Copper - Through traffic	Zambia/Zim/DRC	Ramatlabama	2025	3.0	
Note: 3-year ramp-up period for coal (2022-2025)					
Existing Traffic					
Soda Ash	Sua Pan	South Africa	2019	0.28	1.8%
Salt	Sua Pan	South Africa	2019	0.23	1.1%
Ni/Cu Matte	Selebi-Phikwe	Europe	2019	0.0	-
Fuel	World	Gaborone	2019	0.375	4.5%
Grains	World	Gaborone	2019	0.19	1.7%
Cement	World	Gaborone	2019	0.29	4.5%
Containers	World	Gaborone	2019	0.228	4.5%
Copper	Zambia/DRC	World	2019	1.2	-

Export Traffic Composition

Botswana is the largest producer of natural sodium products in the region. Botswana Ash (Botash), the only extractor situated in Sua Pan, is a 50/50 partnership between the Government and Chlor Alkali Holdings Group of South Africa. The production of soda ash reached 226,667 tonnes in 2017 while soda ash exports totalled US$93.6 million. The company also produced

478,694 tonnes of salt.[38] Soda ash export increased by 12% from 2017 to 2018 (0.28 MTPA), and salt export increased by 34% from 2017 to 2018 (0.233 MTPA).

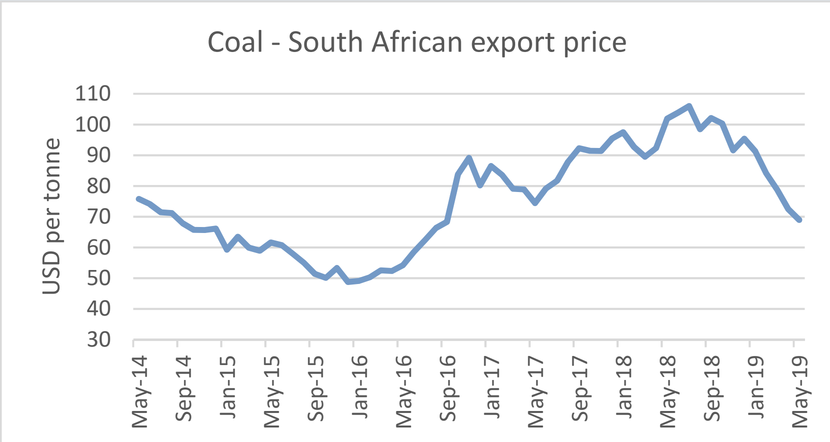
Due to the depressed copper and nickel prices in recent years and the collapse of four nickel-copper miners (including government-owned copper giant BCL) in the last few years, the combined export value of the two commodities went down from US$238 million in 2016 to US$4 million in 2017. Nickel-copper exports have decreased to zero production in January 2019.

Despite Botswana's nickel-copper production coming to a halt, we expect that there will be through traffic for copper from Zambia and DRC. According the World Bureau of Metal Statistics (WBMS), DRC's national copper output has grown to 1.2 million tonnes in 2018; along with Zambia's output of 0.8 million tonnes, the two countries account for around 10% of global copper production.

The coal forecasts are much lower than originally envisioned, due to a reduction of coal use in Europe. Within the last couple of years, governments across Europe have pledged to phase out coal in their power sectors; for example, Britain announced it would phase out coal entirely by 2025, France announced a similar intent by 2023, Italy pledged to quit coal by 2022, and Germany proclaimed to do so by 2038. Another reason for the lower coal forecast is the declining coal price.

Coal Export Price

Coal prices have seen significant fluctuations since 2014. After approaching a high of over US$100 per tonne in 2018, they have declined to $68 per tonne in mid-2019, nearing the 2016 low of $48 per tonne. It is unclear that a new line will be able to pay for itself, given a lower cost of transporting coal via South Africa, which also does not require major capital investment.



Import Traffic Composition

For imports, we observed that in 2018, Botswana imported about 190,000 tonnes of grain/maize, which mostly came from South Africa.[39] Regarding cement import, in 2018 Botswana introduced new legislation and began limiting cement imports to around 30% of estimated consumption, requiring the other 70% to be sourced locally. The imports originate

[38] Botswana National Commission for UNESCO, Mining: On the path to recovery, https://natcomreport.com/reports/Botswana-17/files/assets/common/downloads/publication.pdf

[39] https://allafrica.com/stories/201806190465.html

mostly in South Africa.[40] The cement import volume will be around 0.29 million tonnes per year in 2019.

Regarding containerised cargo traffic, Walvis Bay expects a large port expansion, with a container terminal with a 750,000 TEU capacity per year (double of the existing terminal).[41] More economic opportunities would be provided by the new container terminal to diversify access to markets for Botswana to export and import its products from overseas. The Port also expects to have a dry bulk terminal up to 100 million tonnes per year where coal from Botswana could be stored for export by ship.

South Africa and Botswana are actively discussing a railway link to allow coal exports via Richards Bay port in South Africa and connections to Mozambique.[42] This decreases the attractiveness of exports via Walvis Bay. Given that most coal exports are sent to Asia and the Middle East, exporting them from the east coast of South Africa currently makes more sense. However, Africa's coal consumption is expected to increase by over five times by 2030, making export via Walvis Bay more attractive.

Traffic Growth Assumptions

The growth potential of the coal traffic is capped by the maximum annual production level, expected to be ramped up in a period of three years starting from 2022. The annual growth rates of the other commodities are assumed to be consistent with the GDP and population projections, depending on the commodity type. For example, salt and grain are assumed to grow consistently with the population, while fuel, cement and containers, etc. are assumed to grow in tandem with GDP. The GDP and population projections are taken from IMF[43] and UN[44], respectively.

Traffic Volume and Revenue Forecast

Based on the traffic assumptions in Table B-3 and routings for different destinations, traffic volumes using the TKR line are forecasted until 2063, assuming that the beginning of operation is 2025. Container, cement and fuel grow the fastest, with an annual growth rate of 4.5%. Coal traffic will remain constant due to the assumptions on the maximum production capacity reached in 2025, and no further expansion is envisaged.

[40] https://www.globalcement.com/news/item/7731-botswana-to-restrict-cement-imports
[41] https://www.mtbs.nl/news/namibia-inaugurates-port-of-walvis-bay-container-terminal
[42] https://zululandobserver.co.za/185791/sa-botswana-railway-link-benefit-coal-exports/
[43] https://www.imf.org/external/datamapper/NGDP_RPCH@WEO/OEMDC/ADVEC/WEOWORLD
[44] https://population.un.org/wpp/

Figure B-4: Annual Traffic by Weight and by Commodity

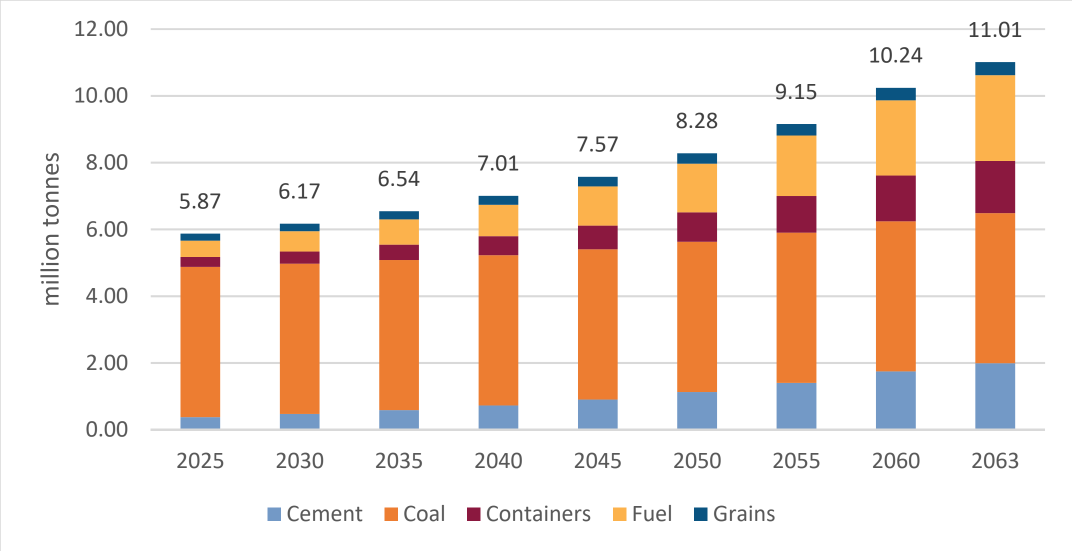
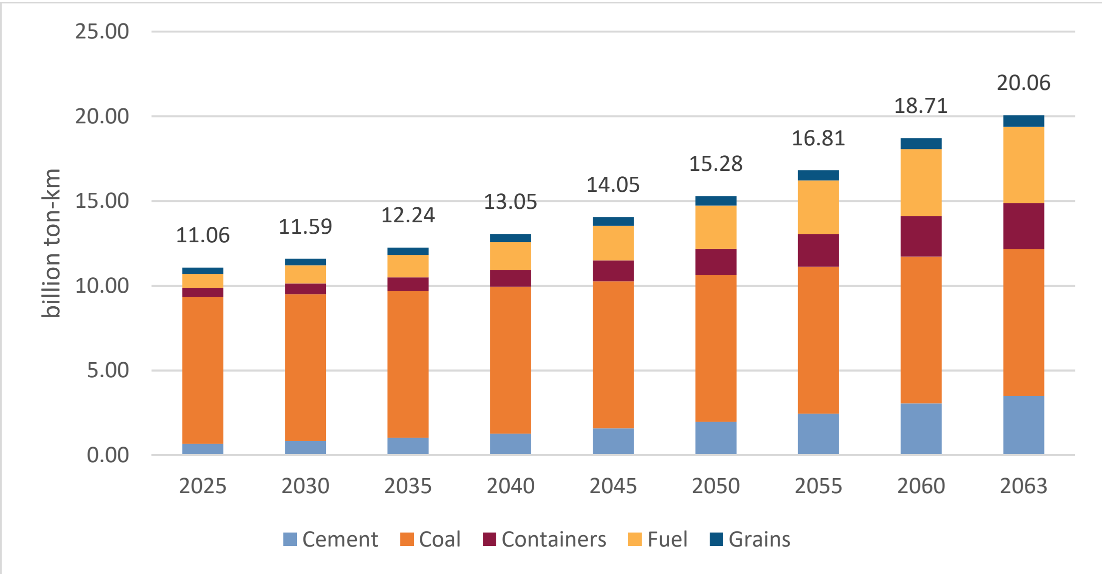


Figure B-5: Annual Traffic by Ton-Kilometres and by Commodity



To forecast the future revenue of the TKR line from freight transport, the following unit prices are used for each type of cargo (see Table B-4). The 1.5% US$ inflation rate is applied to the future years.

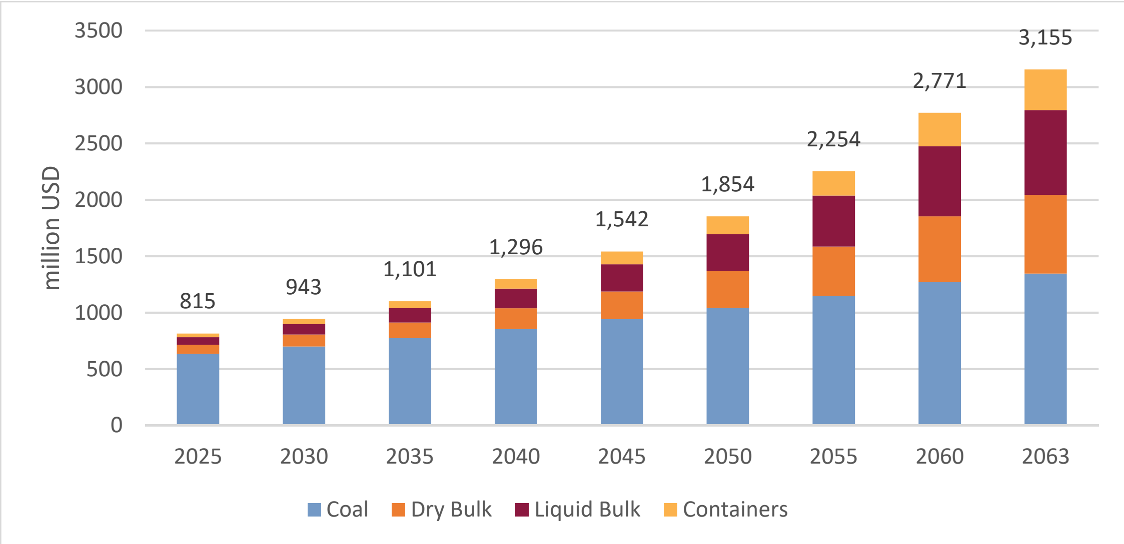
Table B-4: Unit Prices by Cargo Type

Cargo Type	Unit Price	Unit
Coal	0.065	USD/t-km
Dry Bulk	0.070	USD/t-km
Liquid Bulk	0.070	USD/t-km
Containers	0.055	USD/t-km

The model allows users to simulate different scenarios by changing the traffic composition or adding additional commodities in the assumption table. Figure B-6 presents the freight revenue forecast based on the assumptions listed in Table B-3. Freight revenue is expected to be around US$815 million in 2025, and grow by 3.6% annually, reaching US$3.2 billion in 2063.

Consistent with the traffic forecast, coal traffic will continue to be the dominant revenue source for the freight operation. However, thanks to the growth of other cargo types, the revenue share from coal will decrease from nearly 80% in 2025 to around 43% in 2063.

Figure B-6: Freight Revenue Forecast for TKR Line



Passenger Traffic

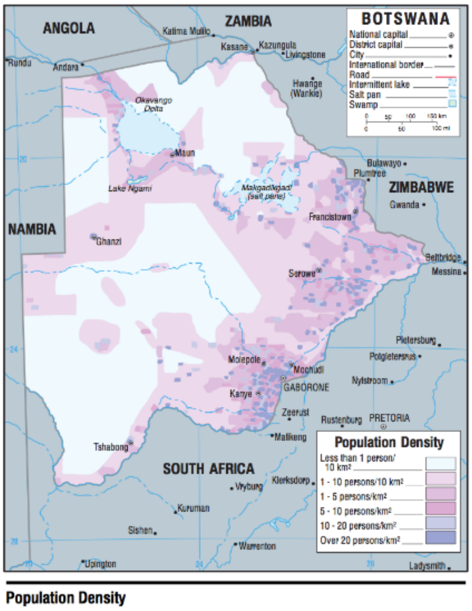
Passenger Service

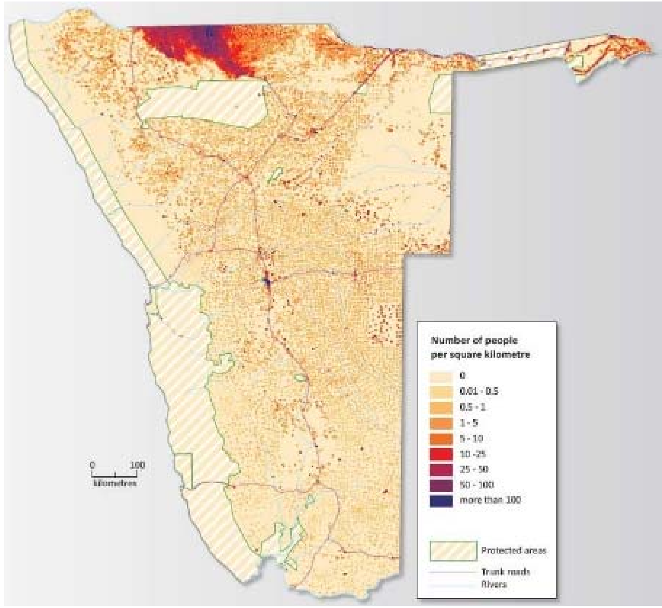
Namibia and Botswana are two of the least densely populated countries[45] in the world with:

- Botswana at 4.0 persons/km^2 and ranked at 220 of 232 nations; and
- Namibia at 3.0 persons/km^2 and ranked at 228 of 232 nations.

[45] According to http://worldpopulationreview.com/countries/countries-by-density/

Figure B-7: Population Density of Botswana and Namibia





The terrain the link will traverse is of the lowest density in the two countries without any major towns or cities with the exception of Gaborone, Windhoek and Walvis Bay, which have populations[46] of 208,411, 268,132 and 52,058, respectively. The approximate rail distance between Gaborone and Windhoek is 1,107 km and between Windhoek and Walvis Bay is 395 km.

Given the low populations and long distance between Gaborone and Windhoek, long-distance passenger service cannot compete with air travel for time-sensitive traffic and with road transport with price-sensitive travellers. It is also not competitive with air travel for costs. It may change in the future with significant population growth, or if fuel prices were to increase or security restrictions on air travel vastly increase. However, as discussed below, rail tourism on all or some of the link holds possibility.

The rail distance and travel times between Gaborone and Windhoek are in the "sweet spot" for rail in that travel time is competitively against air travel, and it can compete on cost against road options with minimum ridership levels. However, the populations of Gaborone and Windhoek are too low to generate ridership levels that are financially viable. There may be a case for rail tourism which is explored below.

Rail Tourism

Currently two tourist trains are routinely operated in Namibia.

- **The Desert Express** (https://www.namibweb.com/jb-train-tours.html) offers overnight trips (in each direction) between Windhoek and Swakopmund. Each train consist of 24 cabins that can accommodate up to two adults and one child. Return trips are often

[46] According to http://worldpopulationreview.com/continents/cities-in-africa/

included as part of a seven-day package combining Swakopmund and Etosha National Park. In 2019, 10 train excursions were operated in each direction Singles typically start at N$6,500 and doubles at N$10,500 (for two). The Desert Express operates on the current rail line between Windhoek to Walvis Bay.

- **Shongololo Dune Express** (https://shongololo.com/route/dune-express/) is operated by Rovos Rail between Pretoria and Swakopmund. It is a luxury 12-day, one-way journey between Pretoria and Swakopmund via Fish River Canyon, Lüderitz, Kolmanskop, Keetmanshoop, Windhoek and Etosha. There were two trips in each direction in 2019 with three return trips currently scheduled for 2020 and 4 in 2021. Rates start in 2020 range from R81,400 to R162,000 for double occupancy (+50% for single supplement).

Figure B-8: Shongololo Dune Express

Virtually all long-distance tourist trains operating in Africa are operated by one of three South African companies with journeys typically starting and/or ending in South Africa. In addition to Rovos Rail, there is the Blue Train (currently operated by a division of Transnet) and Premier Class (currently operated by Shosholoza Meyl). Neither currently has service that operates in Namibia or Botswana.

Botswana Railways reintroduced passenger rail service in 2016 with overnight trains running twice nightly along its trunk line between Lobatse and Francistown. There have not been recent regular tourist train journeys in Botswana but on occasion, Ravos Rail operates its Pretoria to Victoria Falls through Botswana.

Figure B-9: Ravos Rail from Pretoria to Victoria Falls

The rail line between Gaborone and Windhoek will pass in close proximity to the Central Kalahari Game Reserve (Botswana's largest reserve) and the Gemsbok National Park (Botswana's largest national park). On both sides, the unspoiled habitats of the Kalahari Desert present immense potential for eco-tourism; and rail provides an eco-friendly access to the remote vastness of the desert. In addition, the amazing terrain also provides significant potential for rail tourism. This route provides a more direct route between Pretoria and Swakopmund than that currently plied by the Shongololo Dune Express (albeit gauge break may be a challenge); as such it appears likely that Rovos Rail will see real value in this route.

Conclusions on Passenger Rail

The links connecting Gaborone, Windhoek and Walvis Bay hold no real promise for passenger rail traffic, at least in the immediate future. However, it is anticipated that they could be a significant part of future tourist trains excursions of Southern Africa; and could be a driver of economic tourism in Botswana and Namibia.

The rail revenue generated by the tourist trains would be insignificant relative to that of freight traffic; and the overall contribution to the fixed costs of the railways immaterial. However, the economic benefits could be significant. Further analysis at this early juncture is premature but it is important that this be considered at the feasibility assessment of the project.

Financial Analysis

The financial analysis of the proposed Gaborone- Walvis Bay line is conducted using the financial model developed by CPCS. The total length of the project evaluation period used in the financial model is 60 years, inclusive of a three-year construction period. The Internal Rate of Return (IRR), Net Present Value (NPV) and Debt Service Coverage Ratios (DSCR) are evaluated and presented in the results. The financial returns are estimated at the project level as well as from the perspective of the potential financiers (i.e. equity and debt providers).

We conducted the financial analysis at a project feasibility study level, based on the detailed feasibility study update for the Gaborone-Walvis Bay line conducted by CPCS recently. Since freight transportation is expected to dominate the traffic of the TKR line, the financial analysis is carried out only considering the freight services.

The following table presents the main assumptions used for the financial analysis.

Table B-5: Key Assumptions for TKR Line

Assumption	Description
Evaluation Period	• Project Evaluation = 60 years • Effective Operations Period = 57 years • Gaborone-Walvis Bay construction: 2022-2024
Macroeconomic Factors	• Inflation Rate = 2% • Model currency: US Dollars
Tax Structure	• Equity providers and shareholders of the operating company will most likely be the two governments, Botswana and Namibia jointly • Value Added Taxes (VAT) and import duties are excluded in the estimation of CAPEX, OPEX and revenues of the project • Model does not assume a tax holiday
Depreciation and Residual Values	• Straight-line depreciation method used • Rolling stock investments are depreciated over an average of 25 years • Infrastructure CAPEX are depreciated over different periods according to the asset type
Dividend Distribution	• 100% of any surplus cash will be distributed as dividends to the equity holders

Freight Tariffs	• Average rail transport charges for different type of cargos are the following:
	  ○ Coal: 0.065 US$/ton-km
	  ○ Dry and Liquid Bulk: 0.070 US$/ton-km
	  ○ Containers: 0.055 US$/ton-km

Rolling Stock Costs	• The procurement structure of the required rolling stock is assumed to be done in five-year intervals, based on the five-year forecasted annual rolling stock requirements
Debt Financing	• The project is funded 70% by debt and 30% by equity • Assumed 90% funding for infrastructure costs would come from development banks and 10% from commercial banks • For rolling stock costs, assumed 60% of the rolling stock debt would come from development banks while the remaining 40% would from commercial banks
Equity Financing	• Hurdle rate for estimating the government returns is assumed at 8% (nominal) and 5.88% (real) • Hurdle rates used in estimating project's unlevered returns is the Weighted Average Cost of Capital (WACC), estimated at 6.97% (nominal) and 4.88% (real)

Capital and Operating Cost Structure

The analysis assumes a vertically integrated procurement option. Thus, the public sector would be responsible for both building (financing) and operating the railway project.

Infrastructure Capital Expenditure

The total length of the Gaborone-Walvis Bay line is 1,926 km. The total infrastructure CAPEX is estimated to be US$6.2 billion, of which the cost of electrification is about 20% of the total infrastructure costs, approximately US$1.3 billion.

Table B-6: Gaborone-Walvis Bay Link CAPEX

Gaborone – Walvis Bay	Length (Km)	Amount* (M USD)	Unit Cost** (M USD per km)
Without Electrification	1,926	$4,873	$1.83
With Electrification	1,926	$6,205	$2.33

* The amount is in nominal term.
** It is the base year price in 2019.

Rolling Stock Capital Costs

The total rolling stock investment required to carry the base-case freight traffic for the whole network over the effective period of 57 years is US$11 billion. To serve the freight traffic of the first year in 2025, the operation would require an investment of US$710 million for the procurement of 94 new locomotives and 3,052 new assorted wagons.

The procurement structure of the required rolling stock is assumed to be done in five-year intervals, based on the five-year forecasted annual rolling stock requirements. Both locomotives and wagons need to be rebuilt in 15 years and replaced in 25 years.

Investment requirements for the rolling stock in the years from 2025 to 2081 for freight traffic are depicted in the following figure.

Figure B-10: Gaborone-Walvis Bay Link Rolling Stock Cost

Financial Results

The project's unlevered post-tax financial returns in the base-case traffic scenario show a positive FNPV of US$1.182 billion, and FIRR of 6.2%. The positive NPV indicates that the proposed railway project is able to generate sufficient revenues to recoup the investment costs and cover operating costs on its own.

While unlevered project returns (project FNPV and IRR) are estimated before financing, the government equity returns are computed taking into account the impact of financing and debt leverage. The government equity NPV and IRR in the base traffic scenario also show a positive NPV of US$474 million, and IRR of 6.9%. The government equity NPV and IRR is above the hurdle rate of 5.88%. Thus, the estimated traffic volumes are enough to enable the shareholders to recoup their investments.

The debt service is assumed to have a tenor of 20 years with a grace period of eight years. The estimated DSCR in the base case shows minimum DSCR of 0.88 and average DSCR of 6.62. The minimum DSCR greater than 1 means that the proposed railway project is able to generate sufficient cash flows to pay its debt obligations.

Economic Analysis

The objective of the economic analysis is to evaluate the economic feasibility of the proposed project. The economic analysis of the proposed railway line goes beyond the financial assessment by taking into consideration non-financial externalities and impacts on the wider range of affected parties.

CPCS has integrated a detailed economic analysis module in the financial model to estimate economic costs, benefits and returns of the proposal railway line to the various stakeholders involved. We have carried out this analysis by applying the methodologies generally accepted for economic evaluation of infrastructure projects,[47] as appropriate at a feasibility level of analysis. The basis for estimating the economic impact of the project is Cost Benefit Analysis (CBA), which is used to quantify, to the extent possible, the economic costs and benefits of projects that accrue to different project stakeholders. As with the financial evaluation, economic analysis considers a 60-year project horizon, inclusive of the construction period.

The decision metrics used are economic net present value (ENPV) of the investment, benefit cost ratio (BCR) and economic internal rate of return (EIRR). The ENPV is simply the discounted value of a cost or a benefit. The ENPV of the project is the difference between the discounted total social benefits and costs. Projects with larger ENPV are more valuable to society. The BCR resolves the issue of scalability. The BCR is the ratio of discounted total social benefits to discounted total social costs. Finally, the EIRR represents the social return on investment of the

[47] Asian Development Bank (ADB), Guidelines for the Economic Analysis of Projects (1997); Guide to Cost-Benefit Analysis of Investment Projects (EU, 2008); Notes on the Economic Evaluation of Transport Projects (World Bank Transport Note 5, 2005).

project. It also represents the discount rate at which the discounted total costs and benefits are equal (ENPV = 0).

Main Economic Assumptions

In the evaluation of projects, the Social Discount Rate (SDR) is used to express future economic costs and benefits in present value terms. We have carried out the evaluation using a 12% discount rate.

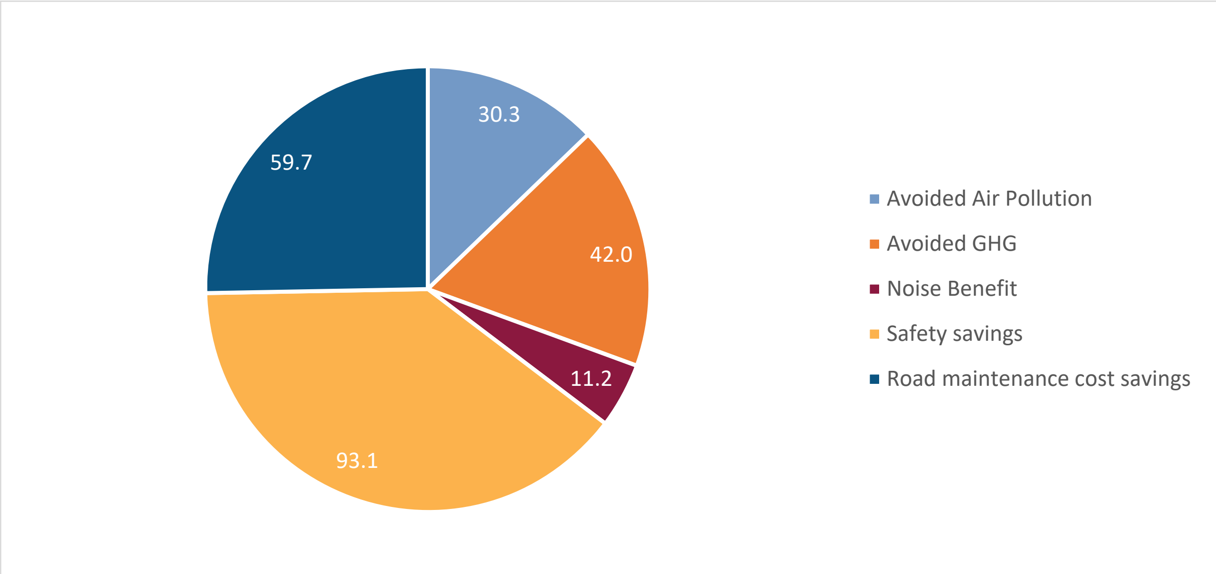
The following table presents the main assumptions used for the economic analysis.

Table B-7: Estimation of Economic Benefits Summary

Economic Benefit	Description
DIRECT BENEFITS	
Producer Surplus	The gross producer surplus equates to the revenues accruing to the project operator (the “producer”). To obtain a net measure of the producer surplus, however, we must subtract O&M costs (adjusted with appropriate conversion factors) from the total revenues.
Transport Cost Savings	Consumer Surplus for Freight Traffics: The present value of the freight consumer surplus is US$1.231 billion, discounted at 12%.
EXTERNAL BENEFITS (EXTERNALITIES)	
Reduction in Local Air Pollutant Emissions	We have applied the following unit costs in estimating the social costs of air pollution from freight transportation in this study. • Truck: 0.51 USD/1,000 tkm • Freight Rail – electrified: 0.08 USD/1,000 tkm
Reduction in Greenhouse Gas Emissions	The unit costs used in the analysis are: • Truck: 0.75 USD/1,000 tkm • Freight Rail – electrified: 0.07 USD/1,000 tkm
Improvements in Road Safety	To provide an order of magnitude of the potential benefit of road safety, the following assumptions are used, • Truck: 487 Fatalities/billion vkm • Rail: 1.50 fatalities/billion vkm • Truck: 765 injuries/billion vkm • Rail: 1.35 injuries/billion vkm With the proposal rail project, an annual average of about 374 lives saved and 587 injuries avoided in both countries, over the project’s duration.
Noise Impacts	Noise generated by transport activity has a negative effect on both health and on property values of buildings located close to transport facilities. The unit costs used in the analysis are : • Truck: 0.14/1,000 tkm • Freight Rail – electrified: 0.08 USD/1,000 tkm
Reduction in Road Maintenance Cost	The unit cost used in estimating truck maintenance cost savings 0.05 USD/km
OTHER NON-QUANTIFIABLE BENEFITS	
Increased Economic Activities and Induced Employment Creation	There is the impact on employment from the capital and operating expenditure. The effects of these expenditures on employment are captured through the shadow price of labour. Indeed, a shadow price below one suggests that the project will have beneficial impact on total employment, rather than simply displacing currently employed labour.
Road Traffic Congestion	Based on the traffic analysis, there may be some trucks and buses that can be removed from the road with the introduction of the railway project.

The present value of the avoided negative externalities are presented in the figure below. The value of avoided fatality and injuries is around US$168 million USD, accounting for 40% of the total external benefits, followed by 25% from road maintenance cost savings, 18% from avoided greenhouse gas (GHG) emissions, and 13% from avoided air pollution.

Figure B-11: PV of Externalities (Million USD)



Source: CPCS analysis.

Economic Analysis Results

The base case economic results of the project show a negative ENPV of US$162 million discounted at 12% Social discount rate, B/C ratio of 12.55 and EIRR of 11.5%

The economic results demonstrate that the Gaborone-Walvis railway project is economically not feasible. It is noteworthy that the assessment of project's economic viability is largely influenced by the choice of the SDR applied. The major development banks such as the World Bank and the African Development Bank generally use the discount rate of 12% for economic evaluation of projects.[48] This is the rate we have used in the estimation of economic NPV.

[48] J. Zuang et al, Theory and Practice in the Choice of Social Discount Rate for Cost Benefit Analysis (ADB, 2007).

Environmental Analysis

Applicable Policies and Laws

The relevant legislation of Botswana and Namibia is listed in the table below.

Table B-8: Applicable Policies and Laws

Policy/Law	Applicability/Comment
BOTSWANA	
Botswana EIA Act (2012)[49]	The Act provides for environmental impact assessment to be used to assess the potential effects of planned developmental activities, to determine and to provide mitigation measures for effects of such activities, as they may have a significant adverse impact on the environment, to put in place a monitoring process and evaluation of the environmental impacts of implemented activities. Section 9 (2) states that an environmental assessment shall identify and evaluate the environmental impact of an activity with reference to the: • Health, safety or quality of life of people; • Archaeological, aesthetic, cultural or sanitary conditions of the environment, and • Configuration, quality and diversity of natural resources
Agricultural Resources 1983 (Conservation) Act (Cap 35:06)	The Act provides for the conservation and improvement of the agricultural resources, such as water, soil, flora and fauna.
Land Control Act, (1986)	This Act controls land allocation and use. The allocation of land for the proposed railway line development should meet the requirements of this Act.
Monuments and Relics Act (59:03 of 1970 revised 2001)	This Act is particularly important regarding the notification of discoveries (Section 12 and Section 19) concerning the pre-development impact assessment, with the penalties for non-compliance detailed in Section 23.
National Museum Monuments and Art Gallery Act, 2001	This act protects objects or artefacts that are part of Botswana's cultural, social and political heritage.
National Agricultural Master Plan on Arable Agriculture and Dairy Development (NAMPAAD)	Through this policy, the Ministry of Agriculture hopes to promote the agricultural sector.
Rural Development Policy (1972 & 1973)	The primary aims of the policy are: to increase sustained production from land and from wildlife through research, coordinated extension work, and conservation planning leading to the introduction of sound land management practices; to improve marketing and credit facilities in the rural areas and to create new employment opportunities where feasible and thereby reduce the numbers of those without any means of support; and to promote industries, services and crafts in the rural areas.

[49] In Botswana the Ministry of Environment, Wildlife and Tourism, represented by the Department of Environmental Affairs (DEA) is the competent authority that regulates Environmental Impact Assessments.

Policy/Law	Applicability/Comment
Forest Act (Cap 45:08 of 1968)	The Act provides for the conservation and utilisation of forest resources. Under this Act, the Contractor is expected to protect forests that have been gazetted as forest reserves, to construct works for the mitigation and prevention of soil erosion, correct disposal and control of water including storm water and drainage water, protection of catchments, source, course, banks or feeders of any stream, etc.
Water Act (Cap 34:01 of 1968)	The Act defines ownership rights and use of public water. It also prohibits the pollution, fouling or poisoning of, interference with, or flow alteration of public water.
The Tourism Act (1992)	The Act provides for the development of tourism and related activities in the country. The Act defines tourism as enterprises that include “operations that offer facilities on and off site, such as tourist camps, lodges, caravans, hunting camps and tented tourists camps which also operate tours which require the services of professional guides or professional hunters licensed under the Wildlife Conservation and National Parks Act, 1992.
Wildlife Conservation Policy (1986)	The overall aim of the policy is that a better return be gained on land allocated to wildlife while at the same time ensuring the continuity of this resource. Rational and effective conservation and management programmes are therefore considered to be the essence of the policy. Specific objectives include the need to realize the full potential of the wildlife resource; develop a commercial wildlife industry in order to create economic opportunities, jobs and incomes for the rural population; and to increase the supply of game meat because of the further development of commercial wildlife utilisation.
Wildlife Conservation and National Parks Act No. 28 (1992)	This Act makes provision for the conservation and management of wildlife in the country, giving effect to CITES and any other international convention for protection of fauna and flora to which Botswana is, from time to time, party; to provide for the establishment, control and management of national parks and game reserves; and for matters incidental thereto or connected therewith. Also, the Act provides for the conservation of wildlife in buffer zones called Wildlife Management Areas (WMAs) outside national parks and game reserves. Although grazing and other developments are allowed in these areas, it is of limited nature especially due to lack of services and water resources.
Herbage Preservation (Prevention of Fires) Act 1977 (Cap 38:02)	The Act provides for the prevention of bush fires, in order to conserve herbage resources with Sections 4, 6 and 9 concerning fire control and firebreaks, and the penalties for contravention (Section 14) pertinent to the current project.
National HIV/AIDS Strategy (2003-2009 & 2010-2016)	The Government of Botswana has declared HIV/AIDS a national emergency and is committed to an aggressive, comprehensive and expanded multi-sectoral and multi-level response to fight the epidemic and to curb its impact on society. Not only has it become the most important public health challenge facing the country, but it also poses the most serious challenge to future socio-economic development. As a result, the proponent of this project must be aware of these challenges and approach it proactively.
Public Health Act (Cap. 63:01) of 1981	The Act provides for a wide range of public health measures, including the regulation of sanitation and camping. The proposed bridge development and operations would be affected by this Act since the workforce will have to be provided with sanitation and camping facilities.

Policy/Law	Applicability/Comment
Mines, Quarries, Works and Machinery Act (Cap.44.02 of 1978)	The project involves sourcing materials from borrow pits and other works which will have to be in accordance with this Act. The Act provides for the safety, health and welfare of persons engages in prospecting, mining and quarrying operations including any works, which are part of, and ancillary to, mining and quarrying operations (excavation of gravel).
Atmospheric (Prevention) Pollution Act (Cap 65:03 of 1971)	The Act provides for the prevention of the pollution of the atmosphere caused by industrial processes. The Act seeks to control the emission of "objectionable matter", which is defined in Section 2 as "smoke, gases including noxious or offensive gases, vapours, fumes, grit, dust or other matter capable of being dispersed or suspended in the atmosphere, which is likely to be produced by any industrial process". The Act intends amongst other things to guide and prevent atmospheric pollution. It outlines several measures intended to be undertaken to regulate and control levels of atmospheric emissions.
Botswana Strategy for Waste Management, 1998	The activities associated with the proposed development project are bound to generate both hazardous and non-hazardous waste; therefore, the developer should adhere to the waste management guidelines as stipulated in this document.
Guidelines for the disposal of waste by landfill, 1997	Chapter 9, landfill restoration and aftercare: this is applicable during disposal of different types of waste generated during the construction of the proposed railway line.
Waste Management Act (1998)	This Act provides for proper waste handling and disposal.
Road Traffic Act (Cap 69:01)	Many Sections of this Act are relevant to the proposed development just as they are to everyday life on the roads of Botswana, with general compliance clearly essential to the health and safety of all road users.
Town and Country Planning Act (1977, 2008)	General development of land in rural and urban areas.
Botswana Railway Act	The Botswana Railway Act provides for the establishment of the Botswana Railways (BR) for the provision and operation of railway services and for matters connected to railway services
NAMIBIA	
Environmental Management Act No. 7 of 2007 (EMA)[50]	The EMA is the principal legislation that guides environmental management in Namibia. It provides for stakeholder participation.
Environmental Assessment Policy for Sustainable Development and Environmental Conservation, 1995	This was the initial policy that made the need for EIA mandatory in Namibia and needs to be read with the EMA.
Local Authorities Act No. 23 of 1992	The Act provides for the establishment of local authorities and bestows administrative powers on such institutions. EIAs are a requirement under the Act.

[50] The Ministry of Environment and Tourism (MET) is the custodian of Namibia's natural environment and discharges this duty via environmental regulations, policies and legislation. The Environmental Management Act 7 of 2007 seeks to prevent and mitigate the significant effects of development activities through the EIA process.

Policy/Law	Applicability/Comment
Namibian Ports Authority Act No. 2 of 1994	Provides for the management and administration of ports in Namibia through the Ports Authority. Any developments at ports are to be subjected to comprehensive EIA according to this Act.
National Heritage Act No. 27 of 2004	Provides for the preservation and protection of national heritage. Development projects are to be subjected to archaeological impact assessments.
Atmospheric Pollution Prevention Ordinance No. 11 of 1976	Provides for the prevention of air and atmospheric pollution. Sets standards to be met by all projects with potential impacts.
Water Resources Management Act No. 24 of 2004	Provides for management and protection of water resources. Any potential adverse impacts on water emanating from the project will be managed under this Act.
National Transport Services Holding Company Act, 1998	Provides for the incorporation of a holding company to undertake, either by itself or through any subsidiary company, transport services in Namibia or elsewhere; and to provide for matters incidental thereto.

Project-Specific Areas of Concern

The feasibility of the proposed developments depends on a variety of factors broader than only environmental considerations, which were highlighted in the reviewed studies and are listed below.

The prefeasibility study of the Trans-Kalahari Rail (TKR) project has identified some environmental impacts, while the following environmental aspects should be considered during the next phase of the project.

- At the time of the prefeasibility report, Namibia's coastal zone was anticipated to be managed under a specific management plan emanating from the Namibian coastal zone management project [Namib Coast Biodiversity Conservation and Management (NACOMA)] that is being implemented with support from the World Bank. It was reported that there is a need for linkages between the EIA experts under this initiative and the NACOMA project so that all recommendations for management and mitigation of potential impacts of developments from the TKR at Walvis Bay and Lüderitz are made and implemented, within the provisions and framework of this management plan.
- An issue of concern in Botswana is the potential for the railway line route cutting across the Schwelle, which is a wildlife breeding and migration zone, between the Kalahari Gemsbok Trans-frontier Park and the Central Kalahari Game Reserve. This potential impact can be mitigated by confining the proposed railway line to the same route as the Trans Kalahari Highway. That way, no new impacts additional to those of the highway will be introduced by the development.
- A critical concern at the port terminals (Lüderitz and Walvis Bay) is the potential impact of coal handling facilities and the dredging of port terminals to enable them to handle the large vessels required to move large quantities of coal. The potential physical, biological and socio-economic impacts of these activities that have been identified in

this report will need further study at the feasibility stage. The initial environmental assessment of the TKR project has shown that the Route 1 option will have less negative environmental and socio-economic impacts while the Route 2 option is attractive from the engineering and financial perspectives. These two options could therefore be taken forward for in-depth study in the next phase of the study to ascertain their feasibility on the basis of all considerations (technical, financial, social, economic and environmental).

- An environmental issue of great concern along all three proposed routes is that of poaching, which might increase during construction and operational. The participation of the workforce in illegal hunting of wildlife will be an adverse and direct impact on project development. The construction and operation of the railway line through new areas will also improve access and open up wildlife areas to increased poaching. The magnitude of this issue will depend on the controls put in place during the construction and operation of the railway line.
- The project area is located in a high-risk area for veld fires, especially during the dry season. The contractor will need to be educated on activities that have the potential to cause veld fires and thus be able to reduce those activities. During the operational phase, fires can also be caused by diesel electric engines. Fire management strategies including fire guards will need to be put in place along the TKR route.
- The prefeasibility study does not include an Archaeological Impact Study, rather a review of previous studies conducted for other projects along the proposed routes. This review identified that archaeological data in Botswana indicates that archaeological sites dating back as far as two million years ago have been reported within the environs of the proposed TKR corridor.
- Wildlife migration corridors should be considered when reviewing possible alignments. As a rail line would risk fragmenting wildlife populations and increased mortality due to train/animal collisions, options to mitigate these issues should be reviewed. One method of dealing with wildlife migration is presented in Figure 2. By developing a simple wildlife bridge over the alignment, animals would still be able to migrate over the rail tracks. In the example provided, the road was allowed to stay at grade while animals passed overhead. This is one such example and it should be revisited during a more detailed study.
- The predominant land uses along the proposed rail routes in Namibia are cattle ranching and wildlife management. An elaborate network of wildlife-based conservancies has been established in both communal areas and commercial farming areas, especially in the area to be traversed by the Mmamabula-Gobabis-Walvis Bay route. Most of the land to be traversed by the proposed Mmamabula to Lüderitz route is probably the country's most sensitive ecological zone and has therefore been designated as predominantly conservation areas. The Fish River Canyon, Sperrgebiet and Naukluft National Parks are important conservation areas in this southern area of the country.

Project-Specific Environmental & Social Impacts

Based on the characteristics of the local study areas, the main environmental and social considerations defined for the project development are identified below.

Table B-9: Impacts Identified in the Pilot Studies

Positive Impacts	Negative Impacts
Employment opportunities	Land take
Creation of awareness on impacts of railway line	Loss of social amenities and public infrastructure • Demolishing or relocation of medical facilities • Loss of community watering points • Loss of community food storage facilities • Loss of community forest reserves • Loss of graves • Impact on religion
Market opportunities	Economic and livelihood losses
Improved local economy	Loss of forest reserves
Ease of transportation	Impacts on fauna
Regional integration	Soil erosion and drainage
Economic growth	Landslides and soil creep
Reduced pressure on tarmac roads	Generation of solid wastes
Reduction of consumer product costs	Generation of liquid wastes
Expansion of towns and centres	Contamination of soils and water
Fuel consumption reduction	Air pollution (less than trucking)
Carbon dioxide reduction and air quality improvement	Noise and vibration
	Land degradation due to open borrow pits and quarry sites
	Surface water pollution
	Groundwater contamination
	Impacts on wetlands
	Loss of archaeological and cultural sites
	Occupational health and safety concerns
	Increase of the HIV/AIDS infection rate and sexually transmitted infections
	Spread of communicable diseases and other infections
	Impacts on local landscape and visual attributes
	Forest fires
	Deterioration of community health and safety

The impacts listed below have been identified in the prefeasibility study report.

Botswana

- Areas where there are settlements (towns/villages/settlements) near the railway corridor.
- Wildlife management areas – these are buffer zones between game reserves and communal areas. These areas are rich in wildlife resources and biodiversity in general.
- Game reserves and national parks wildlife corridors (wildlife seasonal migration between the Central Kalahari Game Reserve (CKGR) and the Kgalagadi Trans Frontier Park (KTFP)).
- Ecologically sensitive Kalahari Desert sandy soils (dune topography comprising sand of variable consistency) poses potential problems for the construction and operation of the railroad. Compaction will be required along large distances and migrating dune sand will necessitate special track design and/or stabilisation of windblown sand.
- Archaeological / historic sites (near Kanye village – Livingstone Resting Place); hills near Molepolole and Thamaga villages.
- State-protected concession areas such as mining areas – Jwaneng Mine.

Namibia

- The sand dunes in the Aranos, Stampriet and Mariental areas. There are also shifting dunes further south towards Lüderitz which will cause problems for railway operations.
- The Namib-Naukluft Park and the southern edge of Sperrgebiet Park.
- The spectacular landscapes dominated by the Fish River Canyon in the south.
- Steep escarpment zone stretching north-south separating the Namibian highland and coastal plain areas.
- Mining lease areas.
- Archaeological and historic sites/rock paintings.
- Marine and coastal areas.
- Soil erosion.
- Loss of soil fertility.
- Pollution of water sources.
- Clearing of vegetation.
- Disturb or displace wildlife species.
- Displacement of settlements.
- Increase in generated waste in the project area.
- Air pollution.
- Noise and vibrations impacts.

- Archaeological finds.
- Traffic impacts.
- Increased dredging at port location.
- Impact on bird habitats.
- Resettlement.
- Impacts on local communities regarding fishing.
- Impact on tourism.
- Impacts of coal dust on the marine environment.
- Impact on mariculture (oyster farming and fish farming).
- Impact on currently contiguous land areas.

Further specialist investigations on both the biophysical and socio-economic environments should be commissioned based on the sensitivities of the site and the potential impacts of the proposed development: These studies include:

1. Full Environmental and Social Impact Assessment (ESIA)
2. Resettlement Action Plan (RAP)
3. Visual Assessment
4. Noise and Vibrations Assessment
5. Heritage including Paleontological and Archaeology Assessments
6. Botanical Assessment
7. Ecology and Terrestrial Fauna Assessment
8. Avifauna Assessment
9. Agriculture Assessment
10. Hydrology Assessment
11. Groundwater Assessment
12. Socio-Economic Assessment
13. Air Quality Assessment
14. Aerodrome Investigation
15. Topographical Survey
16. Bathymetrical and Geophysical Survey

17. Update of Hydrodynamic Studies (wind, wave and tidal)
18. Ship Motion Study
19. Geotechnical Investigation (on- and off-shore)
20. Traffic Impact Assessment
21. Accommodation Investigation

Legal and Institutional Analysis

Introduction

This section reviews the PPP and railway legislation of Botswana and Namibia in order to identify existing national laws and regional agreements which could forestall the Continental Cross-Border High Speed Railway Initiative as it pertains to the TKR line (Pilot Project 1: Gaborone-Walvis Bay).

We assume here that the infrastructure of the TKR line will be paid for and built by the Governments of Botswana and Namibia, but that the rail line will operated by one or more private party/parties by way of a concession agreement,[51] with or without government subsidies.

Three basic scenarios are possible with the concessioning of the TKR line:

- One concessionaire, having signed a concession with the Botswanan Government, operates the Botswana portion of the TKR line and interchanges traffic (passengers and goods) with another concessionaire, who having signed a concession with the Namibian Government, operates the Namibia portion of the railway. Two concessionaires, two concession agreements. This situation would be akin to two national railways operating in their respective countries but linking at the border and interchanging traffic (e.g. Botswana Railways and National Railways of Zimbabwe).
- A single concessionaire operates the entire TKR line by way of two separate concession agreements entered into with the Botswanan Government and the Namibian Government. This was the situation in Kenya and Uganda with respect to the metre-gauge Mombasa-Uganda railway from 2006-2017. Both governments had signed separate, but basically identical, concession agreements with Rift Valley Railways.

[51] Technically, since the future concessionaire/railway operator will not be responsible for the financing and construction of the rail infrastructure, the kind of PPP contract at issue here is really an "affermage." The World Bank's Public-Private Partnership in Infrastructure Resource explains the concept of an affermage as follows: "Leases and affermage contracts are generally public-private sector arrangements under which the private operator is responsible for operating and maintaining the utility but not for financing the investment." See here. This said, the term "concession" can also be used to refer to the kind of agreement at issue here: see for e.g. World Bank, *Concessioning of the Ifrikya Railway: a case study (English)*.

- A single concessionaire operates the entire TKR line by way of one single concession agreements entered into with both the Botswanan Government and the Namibian Government. This is what happened with the Dakar-Niger Railway which connects Dakar, (Senegal) with the Niger River in Mali. The concessionaire, Transrail, was granted that railway's concession through a single concession agreement entered into by both governments.

Without prejudging the matter it should be noted at this point based on what follows that:

- Neither Botswanan nor Namibian PPP legislation envision the possibility of awarding bi-national PPP projects;
- Namibia has comprehensive railway legislation, including the setting up of an economic and safety rail regulator. Botswana has neither.

Seen from that perspective, the second scenario outlined above is probably the more logical alternative. It should be noted that when the Transrail concession was awarded in 2003 neither Senegal nor Mali had any national PPP law and whatever railway law existed was rudimentary at best.

Awarding the Concession Agreement

Botswana – While the Government of Botswana is promoting the use of PPPs in developing and operating public infrastructure and related facilities,[52] Botswana does not yet have a PPP Law. What it does have, since 2009, is a PPP Policy and Implementation Framework.

The projects covered under the Botswana PPP Policy include railways.[53] A concession moreover qualifies as a PPP agreement if it satisfies the criteria set out at paragraphs (a) to (d) of section 3.1 of the PPP Policy, namely:

> A PPP involves a contractual arrangement between a governmental institution and a private party whereby the private sector party provides public infrastructure and/or infrastructure related services and where the provision of such infrastructure and/or infrastructure related services is:- (a) Based on measurable output (end result) specifications; (b) Governed by a payment mechanism that provides payment only on delivery of services at required standards; (c) Accompanied by a transfer of financial and operational risks with consequential financial effects; and (d) Demonstrates Value for Money to Government.

Namibia – PPPs in Namibia are governed by the recent Public Private Partnership Act, 2017. The Act is supplemented by the Public Private Partnership Regulations, 2018.

The projects covered by the Namibia PPP Act include "public infrastructure assets or services for use, either directly or indirectly, by the public". This certainly includes rail infrastructure. A concession moreover qualifies as a PPP agreement, the latter being defined, at section 1 of the Act, as: "a written contract recording the terms of a public private partnership project concluded between a public entity and a private entity in accordance with the provisions of this Act."

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[52] See here.

[53] See section 3.2 of the PPP Policy.

Section 20(1) of the Namibia PPP Act provides that:

> All public private partnership projects must be procured through a competitive bidding process, in the form of a two-stage process comprising a pre-qualification and a final selection stage, comprising of - (a) the request for qualification stage; and (b) the request for proposal stage.

Details as to the competitive bidding process are to be found in Part V (Public Private Partnership Project Procurement) of the *Public Private Partnership Regulations, 2018*.

No common set of bid documents – The Botswana PPP Policy and Namibia PPP Act provide sensibly similar mechanisms to procure a PPP contract/concession, namely a competitive bidding process. However, neither enactment is designed to allow the contracting authorities of the two countries to issue a common set of bid documents and award a joint concession agreement. In terms of being able to select one sole concessionaire, this can be achieved by making it a requirement that any person wishing to bid for the railway concession in one country also bid for the railway concession in the other country. This would require substantial coordination between the governments of the two countries in preparing and issuing the bid documents and in the evaluation of the bid received.

The Concession Agreement

The private partner/concessionaire – Neither the Botswana PPP Policy nor the Namibia PPP Act expressly requires that the private partner (in Botswana: "private party"; in Namibia: "private entity") be a corporate body and, more importantly, that it be incorporated in, as may be the case, Botswana or Namibia.

The legal status and country of incorporation of the concessionaire can be addressed in the RFPs. Obviously both countries need to come up with a mutually agreeable country of incorporation so that there is no need to have two legal entities incorporated in Botswana and in Namibia if the idea is to have only one concessionaire (whether under a single or under two concession agreements).

Existing company laws in Botswana and Namibia presumably allow foreign companies to do business in the host country provided they register there. Registration, unlike incorporation which creates a new company, merely allows a foreign existing company to carry out its business also in the country where it has registered. So in that sense it does not matter if the concessionaire is incorporated in Botswana or Namibia.

Contents – Both the Botswana PPP Policy and the Namibia PPP Act have provisions which enumerate the contents/contractual clauses that need to be included in a PPP contract.[54] None of this is problematic. Existing templates and precedents with respect to railway concessions will cover all the listed matters.[55]

[54] Botswana: Annexure B (Summary of Standardised Contract Provisions for PPPs) to the PPP Policy and Implementation Framework; Namibia: section 40(1)(c) of the PPP Act.

[55] E.g. World Bank, *Concessioning of the Ifrikya Railway: a case study (English)* at pp. 17 and following. This is an English translation of the French original.

Concession agreements need moreover to take into account the legal and regulatory framework that exist with respect to the railway sector in any given country. This will be discussed separately in what follows.

Railway Legislation

Botswana – Botswana Railways was established in 1987. It carries passengers and freight within Botswana and connects with National Railways of Zimbabwe and Transnet Freight Rail (South Africa).

The relevant rail legislation is the Botswana Railways Act, 1989 (supplemented by the Botswana Railways Bye-Laws). While the Act contemplates the possibility of private sidings, section 13(1) confers a monopoly to Botswana Railways in terms of operating railways services within Botswana. The Botswana Railways Act, 1989 would need to be amended to allow a private concessionaire to operate railways services.[56]

Namibia – Rail service in Namibia is provided by TransNamib. (TransNamib Holdings Limited is a wholly owned parastatal of the Government of Namibia and was established in terms of the National Transport Services Holding Company Act, and is the successor of former TransNamib Limited.) The relevant legislation is the National Transport Services Holding Company Act, 1998 (supplemented by General Railway Regulations 1937). Unlike Botswana Railways, TransNamib is given the right to operate railway services only over its own lines. It has no in-country monopoly. Moreover, pursuant to section 13(3) of the Act:

> The Holding Company may, after consultation with the Minister, grant a concession to any person to conduct the business [of transporting passengers or goods on or by means of the railway] on any part of the railway.

Protocol on Transport, Communications and Meteorology, 1996

Member states of the Southern African Development Community (SADC) entered in 1996 into a Protocol on Transport, Communications and Meteorology. (SADC is made up of 16 countries, including Botswana and Namibia.) Some of the Protocol's provisions relate to railway transport and they include, at Article 7, provisions with respect to:

- Objectives
- Railway Policy
- Infrastructure
- Operational Areas of Cooperation
- Technical Standards
- Transportation of Hazardous Materials
- Human Resources Development

[56] A precedent for this type of amendment can be found at section 11A (*Concessioning of the railways*) of the Kenya Railways Corporation Act.

- Regional Cooperation

Cross-Border Movements of Goods and Persons by Rail

Because Botswana and Namibia are member states of AU, the Southern African Development Community (SADC) and the Southern African Customs Union there is already substantial harmonisation in the general trade laws of these two States, including customs, the movement of persons and goods, etc.

What follows is a brief review of the two main treaties which govern this area of the law.

Goods – Botswana and Namibia, together with Swaziland (eSwatini), Lesotho and South Africa, are members of the Southern African Customs Union, the oldest existing customs union in the world (established 1910).

The relevant treaty is the *Southern African Customs Union Agreement 2002* (last amended in 2013). As stated in Article 2 of the Treaty: “The objectives of this Agreement are [among others]: to facilitate the cross-border movement of goods between the territories of the Member States…” Article 27 of the Treaty moreover contains provisions dealing specifically with rail and road transport.

Persons – For the relevant provisions designed to facilitate the cross-border movement of persons between Botswana and Namibia one needs to refer to the Treaty of the Southern African Development Community 1992 (last amended in 2009), and in particular the SADC Protocol on the Facilitation of Movement of Persons 2005.

Protocol on Transport, Communications and Meteorology – Finally we should also note that the member states of SADC entered in 1996 into the Protocol on Transport, Communications and Meteorology which has already been referred to above.

Appendix C. Detailed Scoping of Accelerated Pilot Project: Dar es Salaam-Kigali

Introduction

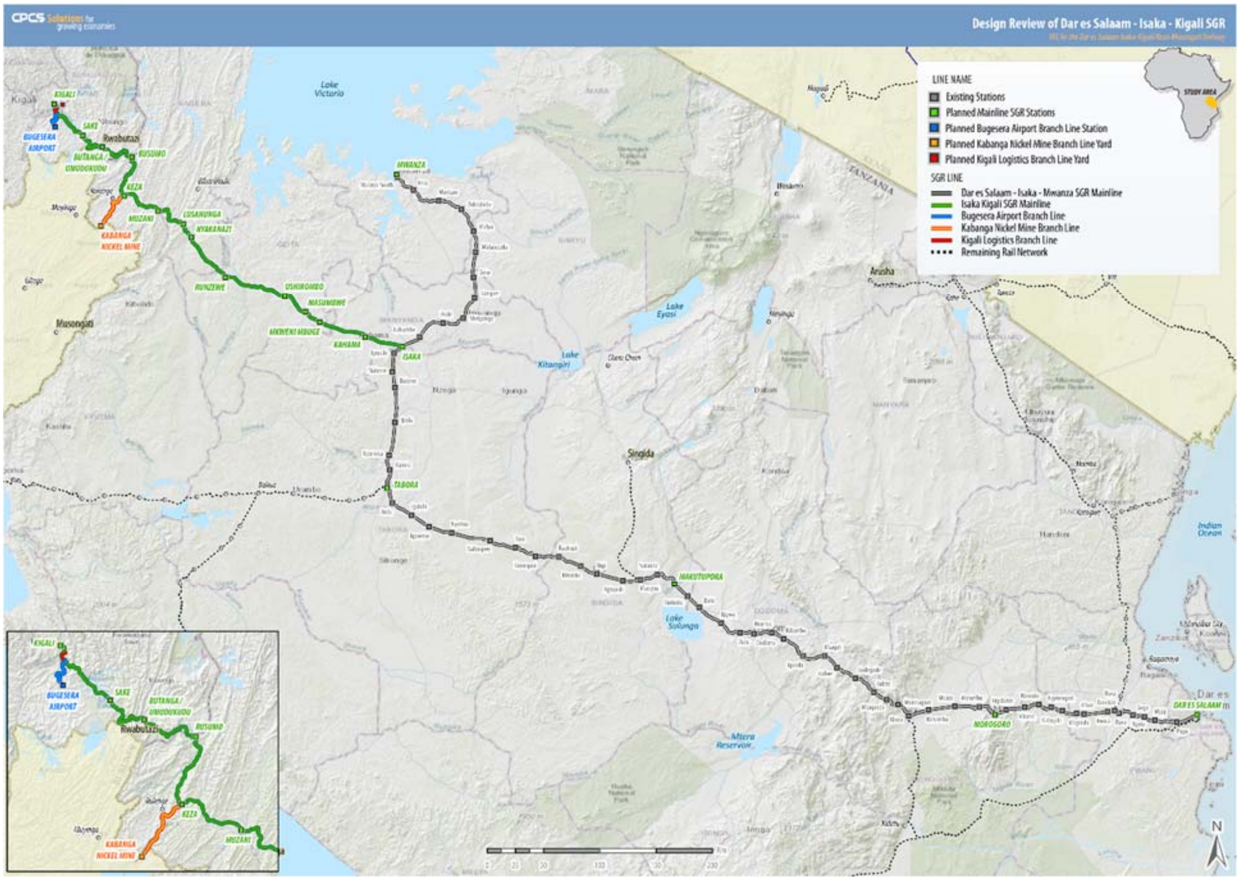
A feasibility study update was recently conducted for the Dar es Salaam-Kigali link.[57] The study included, in addition to the Dar es Salaam-Kigali link, a line to Mwanza and a line to Kabanga nickel mine.

The following map presents the location and the alignment of the planned railway. Sections of Dar es Salaam-Morogoro-Makutupora are currently under construction.

The total length of the Dar es Salaam-Kigali Link (with a branch line to Kabanga Mine) is 1,515 km.

[57] Conducted by CPCS in 2018-2019.

Figure C-1: Location of Dar es Salaam-Kigali Line



Note: The map includes the NBIA and Mwanza lines.
Source: CPCS.

Route and Cost Analysis

As the feasibility study for this link was conducted by us (CPCS) in 2019, including preliminary design, no further route and cost analysis was conducted. The financial and economic analyses presented below utilise the route and the costs from the feasibility study.

Design Parameters

The railway is designed for semi-high speed of maximum 160 km/h for passenger, 120 km/h for freight, electrified. The full details of design parameters are presented below.

Table C-1: Dar es Salaam-Kigali Link Design Parameters

Design Parameter/Element	Design Parameters/Number/Length
Design speed (Passenger trains)	160 km/h (moderate terrain) 130 km/h (extreme terrain)
Design speed (Freight trains)	120 km/h (moderate terrain) 90 km/h (extreme terrain)
Railway corridor width	60 m
Horizontal curve radius	1,300 m (moderate terrain)

Design Parameter/Element	Design Parameters/Number/Length
	800 m (extreme terrain)
Maximum vertical grade	1.6% ruling 2.2% exceptional (short lengths)
Vertical curve length	L=(D x V2) / (A x K)
Maximum rail Cant	120 mm
Cant deficiency	100 mm to 130 mm (speed dependant)
Distance between reverse curves	40 m
TPSS	2x25 kV AC Auto-transformer
Tonne Axle Load	35
Sleeper Types	Mono-block pre-stressed concrete sleepers
Turnouts	1:9 (Yards and Stations) and 1:24 (Mainline)
Rail	CEN 60

Source: CPCS

Traffic Review and Update

Freight Traffic

This section presents the review and update of the freight traffic forecasts moving along the proposed Dar es Salaam to Kigali Standard Gauge Railway (aka Dar-Kigali line). The analysis is based on the detailed traffic study that was recently conducted by CPCS as part of a detailed feasibility study update for the Dar es Salaam-Kigali link.[58] The study included, in addition to the Dar es Salaam-Kigali link, a line to Mwanza, a line to Kabanga nickel mine, and a line to the New Bugesera International Airport (NBIA, the new Kigali international airport).

This updated study removes the NBIA line and Mwanza line in order to tailor the study to the focus rail line connecting Dar es Salaam and Kigali. A short branch to Kabanga Mine has been kept in the analysis as it is a source of substantial potential traffic for the Dar es Salaam-Kigali link. The total length of the Dar es Salaam-Kigali Link (with a branch line to Kabanga Mine, but excluding the NBIA and Mwanza lines) is 1,515 km.

Traffic Composition

There are three main categories of freight forecasted: general cargo, dry bulk and liquid bulk. General cargo itself is comprised of two distinct categories: containerised cargoes and breakbulk cargoes. The market for freight within/ between the impact area countries of Tanzania, Burundi, Rwanda, DRC (eastern) and Uganda (western), is derived from the intra-country trade, direct inter-country trade and maritime transit trade, primarily reliant on the Ports of Dar es Salaam or Mombasa. In particular, intra-country and direct inter-country trade is primarily comprised of commodities, with cement, processed wheat and maize comprising the lion’s share. Maritime transit trade amongst the impact area countries through the Ports of Dar es Salaam and Mombasa is comprised of an assortment of cargoes.

[58] Conducted by CPCS in 2018-2019.

Main Traffic Assumptions

Following consultations with stakeholders and a detailed review of the composition of freight for each Origin-Destination pairing, the following key assumptions were made:

- Breakbulk forms anywhere between 0-15% of total general cargo.
- Mining outputs contemplated in this study are always containerised, with each TEU weighing approximately 21 tonnes;
- Cement is always containerised, with each TEU weighing approximately 20 tonnes.
- Using the 2017 freight market size data, GDP growth rates for each respective impact area country were applied to imported cargoes, while global GDP growth rates were applied for each country's exported cargoes. The growth rates applied in the base case forecasts to estimate the overall freight volumes within the project's catchment are presented in the table below.

Table C-2: Projected Real GDP Growth Rate for Impact Area Countries by Year(s)

Country	2017	2018	2019	2020	2021-2049	2050-2079
Burundi	0.5	1.9	2.3	2.5	3.2	3.8
DRC	3.7	3.8	4.1	4.4	4.0	4.1
Rwanda	6.1	6.8	7.1	7.5	3.6	3.1
Tanzania	7.1	6.6	6.8	7.0	4.8	4.4
Uganda	4.0	5.5	6.0	6.5	4.4	4.2
Global	3.2	3.1	3.0	2.9	2.8	2.8

- Assumptions on planned mining ventures in Tanzania, DRC and Burundi were also conservatively taken into account in the analysis.

Diversion assumptions were also factored in, driven by the extent to which cargoes moving between various OD pairings along the Northern and Central Corridor could divert to the proposed Dar es Salaam-Kigali railway.

The traffic forecast under the base case scenario is presented in the following sections.

Freight Traffic Forecasts

While freight from Dar es Salaam to Kigali passes through all other nodes, it is not included in the pairings involving those nodes (i.e. there is no double counting, and traffic is mutually exclusive across each origin-destination pairing). This is because each origin-destination pairing is solely assessed for the freight it carries as a result of that specific pairing. It is worth noting that Kigali will serve as a transhipment point on the railway line for cargoes destined to/from eastern DRC.

Based on the key assumptions summarised above, the traffic volumes for the Dar-Kigali railway are forecasted over a 54-year operating period, with operations expected to start in year 2025. Container traffic (measured by weight) is expected to growth the most from 3 million tonnes in 2019 to 20 million tons in 2063, with an annual growth rate of 4.5%. Coal and copper traffic will remain constant due to the assumptions on the maximum production capacity reached in 2025, and no further expansion is envisaged.

General cargo is the major freight traffic commodity expected to be transported on the Dar to Kigali rail line, starting at projected traffic level of 1.8 million tonnes, and is expected to grow to 22.8 million tonnes by end of operations in 2078. Dry and liquid bulk commodities are also expected to grow steadily over the projected period.

The following figures present summary freight traffic forecasts for the Dar es Salaam to Kigali Railway, as measured in both tonnes and ton-km, over the projected operating period.

Figure C-2: Annual Traffic Forecasts by Weight (Tonnes)

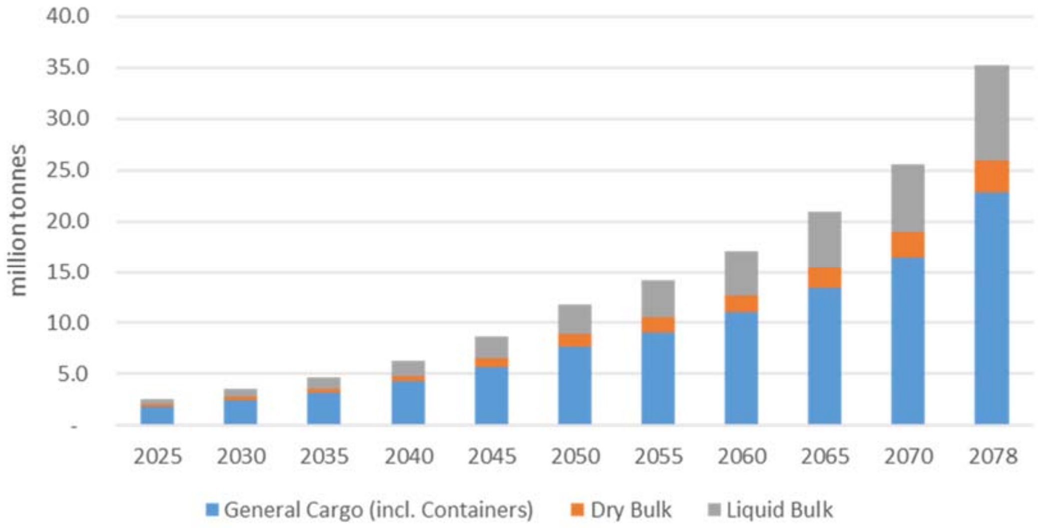


Figure C-3: Annual Traffic Forecasts in Ton-Kilometres

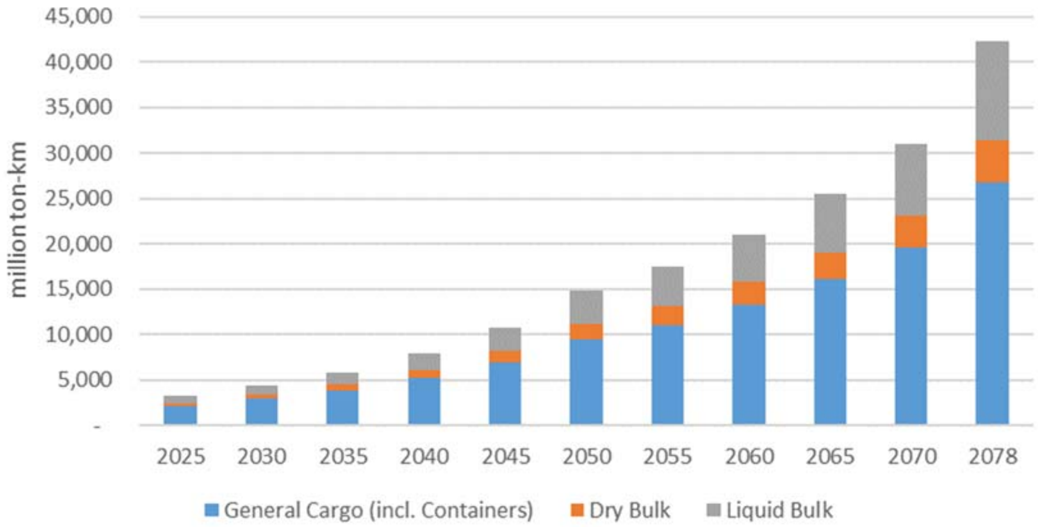


Table C-3: Dar es Salaam-Kigali Link Traffic Forecast Summary

Scenario	2025	2035	2045	2078
Total Traffic in Tonnes (By Weight)	2,605,806	4,686,290	8,663,045	35,220,581
Total Traffic in Tonne-Km	3,223,515,413	5,822,777,891	10,773,993,300	42,207,755,931

Source: CPCS analysis.

Passenger Traffic

Traffic Overview

The starting point for passenger traffic analysis was material generated by Canarail in the Phase II Dar es Salaam-Isaka-Kigali/Keza-Musongati Railway Project Study; specifically, the Final Report – Volume 1 – Traffic and Operations, dated November 2013. The report was largely used as a starting point for traffic projections as well as for passenger train scheduling. Traffic projections were updated to account for the passage of time and for the change in routing. The passenger train schedules were updated to reflect higher speeds being envisaged than at the time of the Canarail study.

Passenger Traffic Forecasts

It is anticipated that in 2025, the number of passenger trips will be in the range of 685,700 per direction, as detailed in the origin-destination pairings in Table C-4 below. Further, the figure indicates the passengers per link for westbound traffic. The link with the greatest traffic levels is Morogoro to Kilosa (364,000 passengers per year per direction), though all links between Morogoro and Tabora are approximately the same.

It is important to note we have included all passengers travelling on the Central Corridor including passengers destined for or starting rail travel between Tabora and Kigoma and between Isaka and Mwanza. As such, passengers embarking and disembarking at Tabora include passengers who carry on by rail to or have arrived from Kigoma (or points in between). The same is said of passengers arriving from or destined for Mwanza embarking and disembarking at Mwanza.

To convert annual traffic projections into peak daily, we needed to estimate the variance in weekly traffic and maximum variance in daily traffic across the week. We used the following thresholds:

- Maximum variance in daily travel – 20%
- Maximum variance in weekly travel – 15%

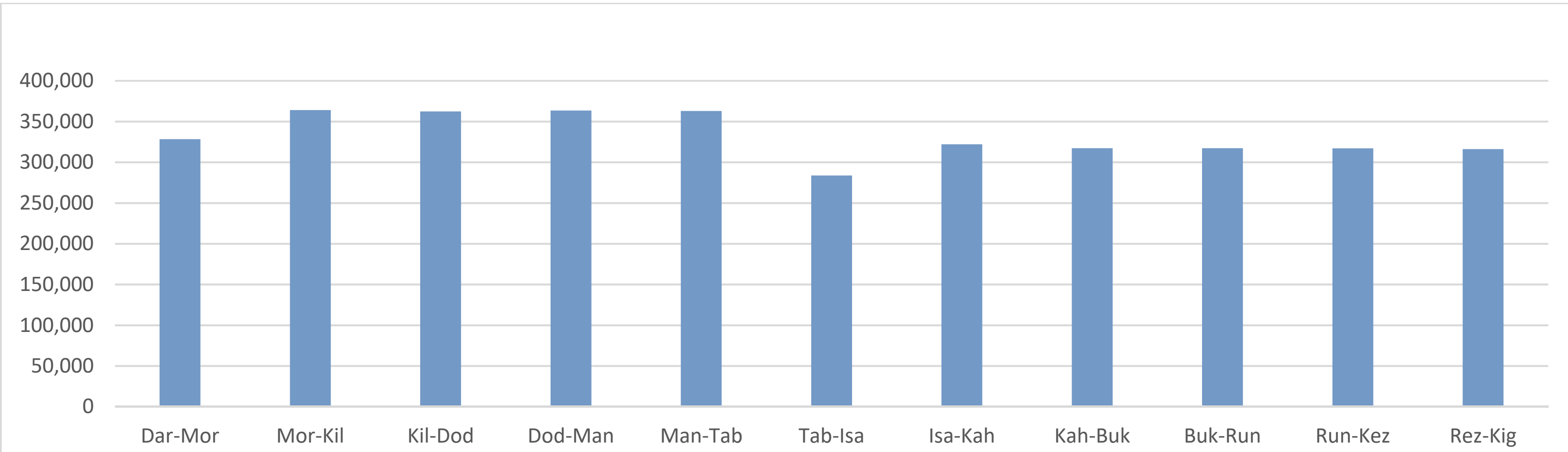
Using the peak annual flow per direction of 364,000 passengers and 365 operating days per year, we determined the peak daily flow to be 1,377 passengers. This approach was used in 2025 and beyond to determine the design capacity of trains.

For traffic projections beyond 2025, we assumed that traffic levels would continue to increase with steady-state tariffs driven by continued modal shift, new trip generation, population increase and economic growth. Year-over-growth in our analysis was 8% for 2026 to 2030; 6% for 2031 to 2035; and 4% for 2036 to 2050.

Table C-4: Origin-Destination Pairs for 2025

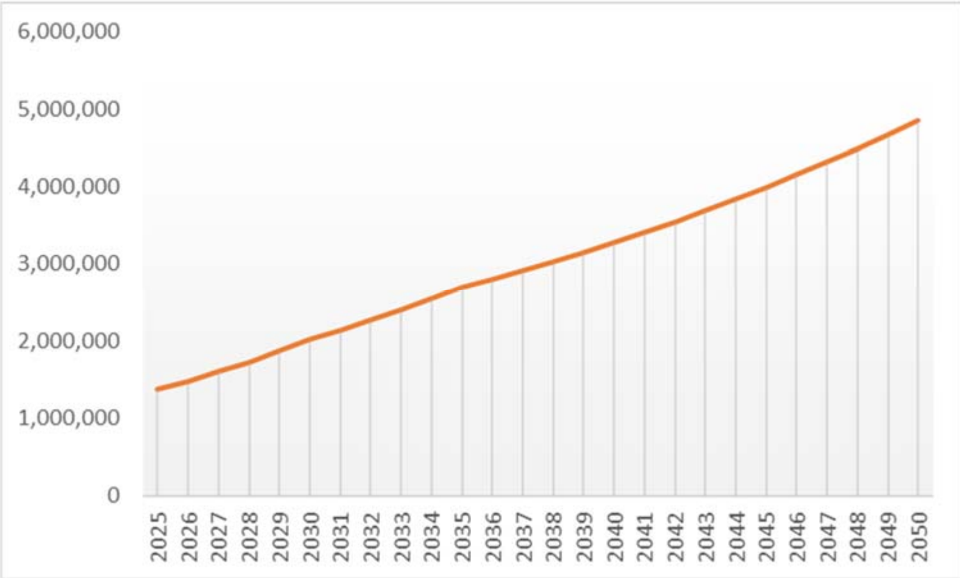
		TO										
FROM		Dar es Sala	Morogoro	Kilosa	Dodoma	Manyoni	Tabora	Isaka	Kahama	Bukombe	Runzewe	Keza	Kigali
	Dar es Salaam		33,400	1,800	33,900	600	168,200	35,500	7,400	300	300	4,300	42,700
	Morogoro	33,400		0	0	0	38,400	0	0	0	0	0	30,700
	Kilosa	1,800	0		0	0	0	0	0	0	0	0	0
	Dodoma	33,900	0	0		0	0	0	0	0	0	0	35,100
	Manyoni	600	0	0	0		0	0	0	0	0	0	0
	Tabora	168,200	38,400	0	0	0		45,400	0	0	0	0	82,000
	Isaka	35,500	0	0	0	0	45,400		0	0	0	0	119,300
	Kahama	7,400	0	0	0	0	0	0		0	0	0	2,600
	Bukombe	300	0	0	0	0	0	0	0		0	0	200
	Runzewe	300	0	0	0	0	0	0	0	0		0	200
	Keza	4,300	0	0	0	0	0	0	0	0	0		3,400
	Kigali	42,700	30,700	0	35,100	0	82,000	119,300	2,600	200	200	3,400	

Figure C-4: Westbound Passengers by Link 2025



The following figure shows the forecasts of annual passengers per direction from 2025 until 2050.

Figure C-5: Annual Passengers per Direction



Financial Analysis

The principal tool used to perform the financial analysis is the financial model developed by CPCS. The total length of the projection period used in the financial model is 60 years, inclusive of a six-year construction period. The results are expressed in terms of IRR, NPV and DSCR.

The financial analysis has been conducted at a project feasibility study level, based on a detailed feasibility study update for the Dar es Salaam-Kigali railway recently conducted by CPCS. Therefore, the financial returns are estimated at the project level as well as from the perspective of the potential financiers (i.e. equity and debt providers).

Key Assumptions

The following table presents the main assumptions used for the financial analysis.

Table C-5: Key Assumptions

Assumption	Description
Evaluation Period	▪ Project Evaluation Period: 60 years ▪ Effective Operations Period: 54 years ▪ DAR-Morogoro construction: 2017-2019 ▪ Morogoro-Makutupora construction: 2018-2021 ▪ Makutupor-Isaka construction: 2019-2024 ▪ Isaka-Mwanza construction: 2019-2024

Assumption	Description
	▪ Isaka-Kigali-Kabanga construction: 2019-2024
Macroeconomic Factors	▪ Inflation Rate: 2% ▪ Model is developed in USD
Tax Structure	▪ Assumes that the equity providers and shareholders of the operating company will most likely be the two governments, Rwanda and Tanzania jointly ▪ No payment of corporate income taxes ▪ VAT and import duties have been excluded in the estimation of CAPEX, operating costs and revenues of the railway project
Depreciation and Residual Values	▪ Straight-line depreciation method used ▪ Rolling stock investments are depreciated over an average of 25 years ▪ Infrastructure CAPEX are depreciated over different periods according to the asset type
Dividend Distribution	▪ 100% of any surplus cash will be distributed as dividends to the equity holders
Freight and Passenger Tariffs	▪ Average rail transport charges for general and containerised cargo along the proposed railway route is estimated at US$0.055 per ton-km ▪ Average freight tariff for dry bulk and Liquid bulk is estimated at US$0.070 per ton-km ▪ Freight tariff estimates are assumed to grow at a small annual real price escalation factor of 0.75% per year to take into account improved reliability and transit time ▪ For rail passenger fare; we used only two class of passenger; Sleeper using a tariff of US$0.0352/km and Day Seat at a tariff of US$0.0129/km in 2025 prices. These tariffs were conservatively kept constant with no adjustments to inflation or real price increase during the projected period
Ancillary Revenues	▪ Assumed average ancillary revenue assumption of 3.5% of total passenger revenues
Rolling Stock Costs	▪ The procurement structure of the required rolling stock is assumed to be done in five-year intervals, based on the five-year forecasted annual rolling stock requirements
Debt Financing	▪ Debt:Equity Ratio of 70:30 has been used for the infrastructure and rolling stock investment costs – in line with the industry standards[59] ▪ Debt is assumed to be sourced from IFIs and Export-Credit Agencies (ECA), with an average tenor of 20 years, inclusive of up to eight years of grace. ▪ Interest rate on debt is a six-month USD LIBOR rate of 2.54% plus a margin of 3.2% (for development banks) and 7.54% (for commercial banks). This is in addition to the applicable debt fees.
Equity Financing	▪ Equity is assumed to be provided by the public sector (i.e. the two governments).

[59] The 2012 study by the World Bank and the PPIAF, titled "Government Support to Public Private Partnerships: 2011 Highlights", found that over 57% of the 80 PPP railway projects had a debt/equity ratio of 70/30.

Assumption	Description
	▪ Hurdle rate for estimating the government equity returns is assumed at 8% (nominal) and 5.88% (real) ▪ Hurdle rates used in estimating the project's unlevered returns is WACC, estimated at 7.01% (nominal) and 4.91% (real)
Hurdle Rate for Project FNPV	▪ The hurdle rate used in estimating project's unlevered returns is WACC, estimated at 7.01% (nominal) and 4.91% (real).

Source: CPCS analysis.

Capital and Operating Cost Structure

The analysis assumes that the public sector would be responsible for both financing and constructing the railway project. Operations would potentially be carried out by the private sector, depending on the government's ultimate choice of the operating model and its adoption of the affermage structure.

Infrastructure Capital Expenditure

The total CAPEX is expected to be US$9 billion, with an average per-km cost of US$6 million. Of that, the cost of electrification is about 6.4% of total infrastructure costs, or approximately US$584 million.

Table C-6: Dar es Salaam-Kigali Link CAPEX

Section	Length (Km)	Amount (M USD)	Unit Cost (M USD per km)
Dar es Salaam-Morogoro	205	$1,215	$5.93
Morogoro-Makutopora	336	$1,924	$5.73
Makutopora-Tabora	294	$1,700	$5.78
Tabora-Isaka	133	$758	$5.70
Isaka-Kigali	547	$3,509	$6.42
Total	**1,515**	**$9,106**	**$6.00**

Passenger Station Capital Costs

In addition to the infrastructure assets, we have identified 12 stations for passengers; five are designated as major stations, seven medium stations and we have allowed for 10 whistle (or flag) stops. The estimated total initial capital outlay for passenger stations is US$34.5 million and the future capital outlay is US$43 million.

Major stations will be of sufficient size for passenger forecasts for 15 years; and will include all amenities expected in a modern rail passenger station. They will include one track for passenger embarkation and disembarkation and one additional track for designated passenger use. Both tracks will include provisions for coach cleaning and inspection and light maintenance of coaches and locomotives. Estimated cost to construct major stations is US$5 million and we have included for upgrades of US$1 million in 15 years.

Medium stations will be designed to accommodate anticipated traffic levels for 15 years. Each station will include a track for passenger embarkation and disembarkation. In 15 years, we have included for the stations to be re-developed into major stations. Estimated construction cost of medium stations is US$1 million and we have included an additional US$4 million to upgrade stations to major stations in 15 years.

Flag (or whistle) stops will not have regularly scheduled service. Trains will stop only when they have been advised in advance of embarking or disembarking passengers. Trains will stop on the mainline and facilities will include only a passenger platform and small building for ticket sales. In 15 years, we have budgeted for flag stops to be upgraded to medium stations and 10 new flag stops implemented. Flag stops are estimated to cost US$250,000 to construct and we have included for US$750,000 in 15 years to upgrade to medium stations.

Rolling Stock Capital Costs

The total rolling stock investment requirement to carry the base case freight and passenger traffic for the whole network is US$6.2 billion. Rolling stock requirements were projected based on traffic projections for 60 years and using assumptions included in the following table.

Table C-7: Rolling Stock Assumptions

Equipment	Procurement Costs	Years before Capital Rebuild	Cost of Capital Rebuild	Life of Equipment
Locomotives	$3.5M	15 years	$1.4M	25 years
Wagons	$125 K	15 years	$50 K	25 years
Passenger coaches	$850 K	15 years	$ 340 K	25 years

Source: CPCS

The total 54-year investment in rolling stock was determined to be US$2.456 billion for locomotives (an average of US$45 million per year), US$2.851 billion for wagons (US$52 million per year), US$708 million for passenger coaches (an average of US$13 million per year). However, it is important that this investment is very much back loaded as traffic in later years is significantly higher than in early years as evident by the following graph.

Figure C-6: Locomotive Requirements and Annual Capital Investment

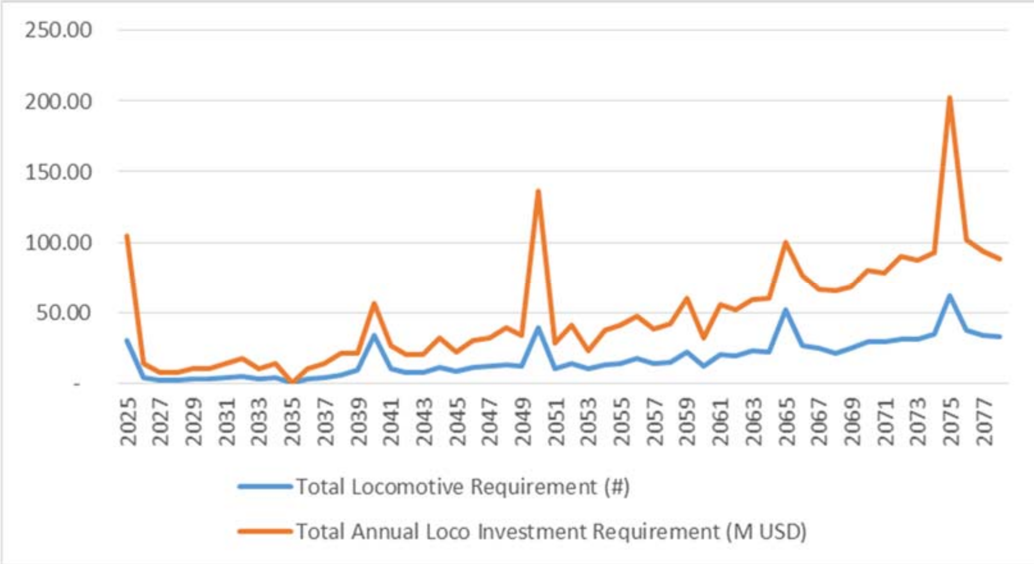


Figure C-7: Wagons Requirements and Annual Capital Investment

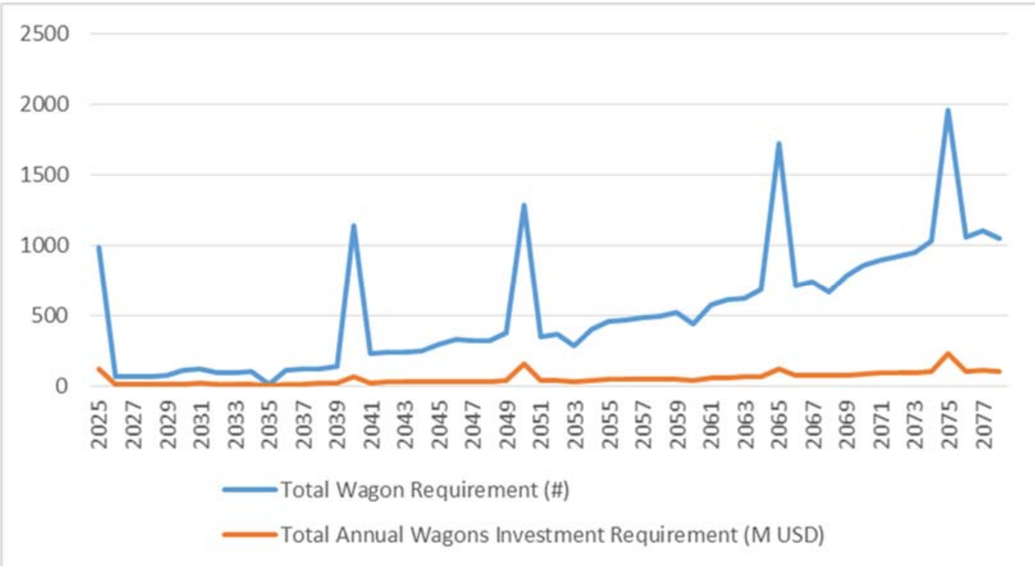
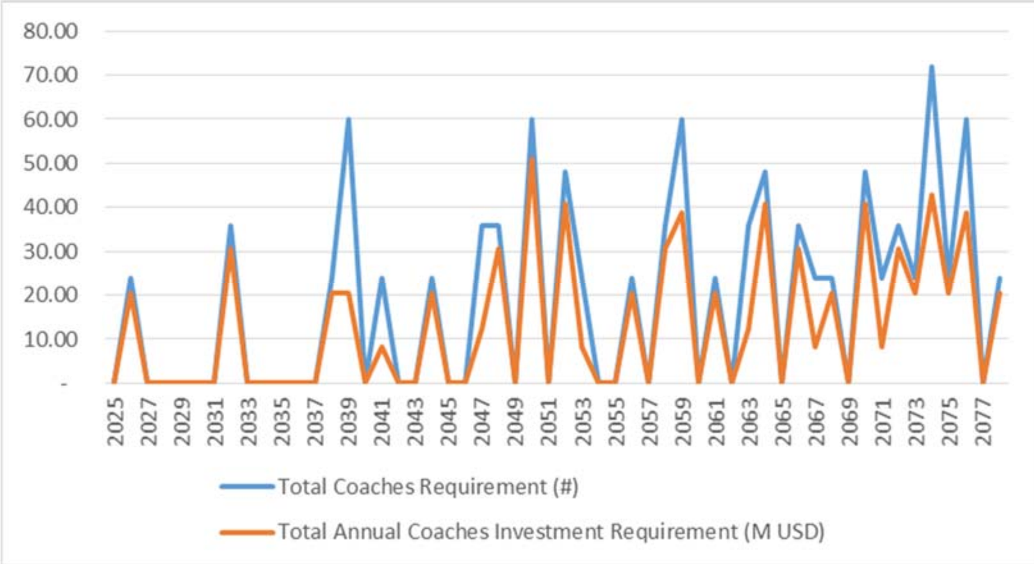


Figure C-8: Coaches Requirements and Annual Capital Investment



The procurement structure of the required rolling stock is assumed to be done in five-year intervals, based on the five-year forecasted annual rolling stock requirements.

Financial Results

The project unlevered post-tax financial returns in the base case scenario shows a negative FNPV of USD 4,322 million, and FIRR of 3.10%.

The government equity FNPV and equity FIRR in the base case scenario shows a negative NPV of USD 4,486 million, and IRR of 2.67%

The above base case results indicate that the proposed railway project is not generating sufficient revenues to recoup the investment costs and cover operating costs on its own. The government equity IRR is way below the hurdle rate of 5.88%, implying that the generated cash flows is not sufficient to enable the shareholders recoup their investments. The results therefore demonstrate that the proposed railway project will require continued financial support by the two governments to be financially sustainable.

The estimated Debt Service Coverage Ratios (DSCRs) for the first 12 years of operations is below 1.00, ranging from 0.10 in year 1 to 0.24 in year 12, with the minimum DSCR occurring in the first year of operations, 2025.

The DSCRs significantly improve from year 13 onwards, with an average DSCR of 5.40 during the repayment period. The indicated low levels of DSCR during the first 12 years of operations show that the proposed railway project is not able to generate sufficient cash flows to fully service its debt obligations during this period of cash shortfall.

Economic Analysis

The economic analysis of the proposed railway project expands on the financial analysis by taking into account non-financial externalities and impacts on the wider range of affected parties. To this effect, CPCS has developed a detailed economic model to estimate economic costs, benefits and returns of the proposed railway line to the various stakeholders involved.

The purpose of the economic analysis is to allow decision-makers to evaluate the economic feasibility of the proposed project, taking into account various project operating scenarios. We have carried out this analysis by applying the methodologies generally accepted for economic evaluation of infrastructure projects,[60] as appropriate at a feasibility level of analysis. The basis for estimating the economic impact of the project is Cost Benefit Analysis (CBA), which is used to quantify, to the extent possible, the economic costs and benefits of projects that accrue to different project stakeholders. As with the financial evaluation, economic analysis considers a 60-year project horizon, inclusive of the construction period.

The decision metrics used are economic net present value (ENPV) of the investment, benefit cost ratio (BCR) and economic internal rate of return (EIRR). The ENPV is simply the discounted value of a cost or a benefit. It measures the difference between the discounted total social benefits and costs. Projects with ENPV greater than zero are more valuable to society. The BCR is the ratio of discounted total social benefits to discounted total social costs. Finally, the EIRR represents the social return on investment of the project. It also represents the discount rate at which the discounted total costs and benefits are equal (ENPV = 0).

Main Economic Assumptions

In the evaluation of projects, the Social Discount Rate (SDR) is used in order to express future economic costs and benefits in present value terms. We have carried out the evaluation using a 12% discount rate, consistent with the recommended SDR by the AfDB and World Bank.

Economic costs are calculated by deducting taxes, duties and other distortions from the financial cost values used in the financial analysis, through application of appropriate Conversion Factors (CFs). The estimation of CFs is necessary to transform the estimated financial costs in the financial analysis into their respective economic values. The Ministry of Finance and Economic Planning of the Republic of Rwanda (MINECOFIN) developed a database containing Commodity Specific Conversion Factors (CSCFs) for more than 5,000 tradable commodities and non-tradable goods and services in Rwanda.[61] We have used the CSCFs for Rwanda as provided by the MINECOFIN database as a proxy for estimating economic values of the capital as well as operating costs for this railway project.

Below we present a table of CSCFs estimates provided by MINECOFIN; these are the values that have been used to derive average CFs applied to the railway project.

[60] Asian Development Bank (ADB), Guidelines for the Economic Analysis of Projects (1997); Guide to Cost-Benefit Analysis of Investment Projects (EU, 2008); Notes on the Economic Evaluation of Transport Projects (World Bank Transport Note 5, 2005).

[61] User Manual – Commodity Specific Conversion Factors Database for the Republic of Rwanda (dad.minecofin.gov.rw).

Table C-8: Commodity Specific Conversion Factors

Rwanda Commodity Specific Conversion Factors	CSCF Value
Equipment	0.8724
Electricity	0.8731
Construction	0.8840
Telecommunication	0.8622
Rail locomotives powered from external electricity source or electric accumulators	0.8924
Railway rolling stock maintenance (wagons, locos)	0.8924
Railway electro-mechanical (signal/traffic control etc.)	0.8924

Source: MINECOFIN Database - Rwanda's Ministry of Finance and Economic Planning.

Additionally, the estimated average labour CF assumption is 0.78 for skilled labour and 0.39 for unskilled. These CFs are applied for estimating economic cost of labour for the project.

The economic benefits comprise direct benefits and external effects (also known as externalities). Direct economic benefits are derived through higher income or lower costs for the railway producers and users (i.e. operators and passengers). They include producer surplus, freight consumer surplus, passenger consumer surplus and terminal value (asset residual values).

In addition to the direct benefits to producers and users, the project is expected to generate a number of benefits to society as a whole (external effects or externalities), as a result of diverting traffic from road transport to modern rail transport. The external effects include:

- Reductions in emissions of local air pollutants;
- Reductions in emissions of greenhouse gases;
- Improvements in road safety; and
- Reduction in expenditures on road maintenance.

The following table provides the key assumptions used for the estimation of direct economic benefits and externalities.

Table C-9: Estimation of Economic Benefits Summary

Economic Benefit	Description
DIRECT BENEFITS	
Producer Surplus	The gross producer surplus equates to the revenues accruing to the project operator (the "producer"). To obtain a net measure of the producer surplus, the total revenues are subtracted from the total O&M costs (adjusted with appropriate conversion factors). The Present Value (PV) of producer surplus is estimated at US$983 million.
Transport Cost Savings	▪ The user benefits to shippers (also known as the freight consumer surplus) is estimated at US$204 million, in PV terms, discounted at 12%. The benefits are derived from the difference in the cost of transporting freight through trucks (current mode of transport that the diverted freight consumers are using) vs. rail. The trucking rate is compared to the rail tariff to estimate the average cost

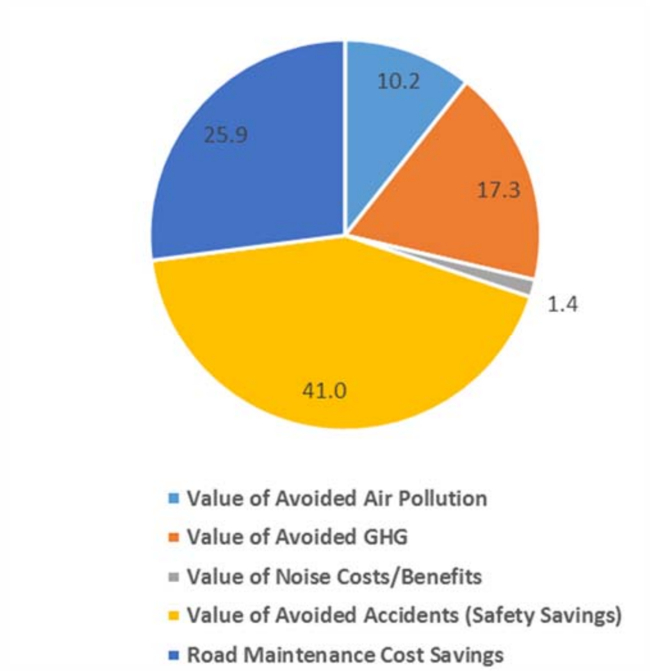
<table>
<tr><th>Economic Benefit</th><th>Description</th></tr>
<tr><td></td><td>advantage of rail over trucks. The rail cost advantage, therefore, reflects the ultimate economic benefit (consumer surplus) to shippers.

▪ The total consumer surplus resulting from savings in bus operating costs and passenger travel time is estimated at US$246 million for the base case.</td></tr>
<tr><td>Residual Values</td><td>In the base case, the NPV of the salvage value for the assets is estimated at US$3 million.</td></tr>
<tr><td colspan="2">EXTERNAL BENEFITS (EXTERNALITIES)</td></tr>
<tr><td>Reduction in Local Air Pollutants Emission</td><td>We have applied the following unit costs in estimating the social costs of air pollution in this study.
<table>
<tr><th>Mode</th><th>Rwanda</th><th>Tanzania</th></tr>
<tr><td>Bus*</td><td>0.40</td><td>0.49</td></tr>
<tr><td>Truck§</td><td>0.44</td><td>0.53</td></tr>
<tr><td>Passenger Rail*</td><td>0.17</td><td>0.21</td></tr>
<tr><td>Freight Rail§</td><td>0.07</td><td>0.08</td></tr>
</table>
*US$2,017 per 1,000 pkm
§ US$2,017 per 1,000 tkm
Source: CPCS analysis based on “Update of the Handbook on External Costs of Transport: Final Report”, Ricardo-AEA, 2014.</td></tr>
<tr><td>Reduction in Greenhouse Gas Emission</td><td>The unit costs used in the analysis are indicated in the table below.
<table>
<tr><th>Mode</th><th>Rwanda</th><th>Tanzania</th></tr>
<tr><td>Bus*</td><td>0.61</td><td>0.74</td></tr>
<tr><td>Truck§</td><td>0.66</td><td>0.78</td></tr>
<tr><td>Passenger Rail*</td><td>0.10</td><td>0.12</td></tr>
<tr><td>Freight Rail§</td><td>0.06</td><td>0.07</td></tr>
</table>
* US$2,017 per 1,000 pkm
§ US$2,017 per 1,000 tkm
Source: CPCS analysis based on “Update of the Handbook on External Costs of Transport: Final Report”, Ricardo-AEA, 2014.</td></tr>
<tr><td>Improvements in Road Safety</td><td>In order to provide an order of magnitude of the potential benefit using base case assumptions above, about 6% of all road traffic accidents will be avoided because of the introduction of the rail project, with similar avoidance rates for fatalities, based on the recently available data. This represents an annual average of about 227 lives saved and 383 injuries avoided in both countries, over the project’s duration.</td></tr>
<tr><td>Noise Impacts</td><td>Noise generated by transport activity has a negative effect on both health and on property values of buildings located close to transport facilities. The unit costs used in the analysis are indicated in the table below.
<table>
<tr><th>Mode</th><th>Rwanda</th><th>Tanzania</th></tr>
<tr><td>Bus*</td><td>0.10</td><td>0.13</td></tr>
<tr><td>Truck§</td><td>0.12</td><td>0.14</td></tr>
<tr><td>Passenger Rail*</td><td>0.08</td><td>0.10</td></tr>
<tr><td>Freight Rail§</td><td>0.07</td><td>0.08</td></tr>
</table>
* US$2,017 per 1,000 pkm
§ US$2,017 per 1,000 tkm
Source: CPCS analysis based on “Update of the Handbook on External Costs of Transport: Final Report”, Ricardo-AEA, 2014.</td></tr>
</table>

<table>
<tr><th>Economic Benefit</th><th>Description</th></tr>
<tr><td>Reduction in Road Maintenance Cost</td><td>The unit costs used in estimating road maintenance cost savings are shown in the table below (Maintenance costs per kilometre, 2017 USD)
<table>
<tr><th>Mode</th><th>Rwanda</th><th>Tanzania</th></tr>
<tr><td>Bus</td><td>0.014</td><td>0.008</td></tr>
<tr><td>Truck</td><td>0.067</td><td>0.037</td></tr>
</table></td></tr>
<tr><td colspan="2">OTHER NON-QUANTIFIABLE BENEFITS</td></tr>
<tr><td>Increased Economic Activities and Induced Employment Creation</td><td>There is the impact on employment from the capital and operating expenditure. The effects of these expenditures on employment are captured through the shadow price of labour. Indeed, a shadow price below one suggests that the project will have beneficial impact on total employment, rather than simply displaced currently employed labour.</td></tr>
<tr><td>Road Traffic Congestion</td><td>Based on the traffic analysis, there may be some trucks and buses that can be removed from the road with the introduction of the railway project.</td></tr>
</table>

The figure below presents a summary of the estimated value of externalities generated by the Dar es Salaam-Kigali railway.

Figure C-9: PV of Externalities (Million USD)



Source: CPCS analysis.

Economic Analysis Results

The base case economic results of the project show a negative ENPV of US$3.196 billion discounted at 12% Social discount rate, BCR of 0.32 and EIRR of 6.449%

The economic analysis results are slightly higher than the financial cash flows on an annual basis, taking into account the externalities that can be monetised such as reduced emissions and reduced road accidents. It is noteworthy that the assessment of the project's economic viability is largely influenced by the choice of the Social Discount Rate (SDR) applied. The major development banks such as the World Bank and the African Development Bank generally use the discount rate of 12% for economic evaluation of projects.[62] This is the rate we have used in the estimation of economic NPV.

[62] J. Zuang et al, Theory and Practice in the Choice of Social Discount Rate for Cost Benefit Analysis (ADB, 2007).

Environmental Analysis

Applicable Policies and Laws

The relevant legislation of Tanzania and Rwanda is listed in the table below.

Table C-10: Applicable Policies and Laws

Policy/Law	Applicability/Comment
TANZANIA	
The National Environmental Policy, Tanzania (URT, 1997)	This policy emphasises the need to integrate environmental issues in all sectors of the economy and in decision-making, planning and implementation activities. The Environmental Policy is guided by the principles of the Rio Declaration on Environment and Development.
The National Forest Policy, Tanzania (URT, 1998);	The objectives of the policy are to ensure sustainable supply of forest products and services by maintaining sufficient forest area under effective management, increased employment and foreign exchange earnings through sustainable forest-based industrial development and trade, ensured ecosystem stability through conservation of forest biodiversity, water catchments and soil fertility, and enhanced national capacity to manage and develop the forest sector in collaboration with other stakeholders.
The National Water Policy, Tanzania (URT, 2002)	The objective of the policy for Water Resources Management is to develop a comprehensive framework for promoting the optimal, sustainable and equitable development and use of water resources for the benefit of all Tanzanians, based on a clear set of guiding principles.
Environmental Management Act, 2004, Tanzania (Act No. 20/2004)[63]	An Act to provide for legal and institutional framework for sustainable management of environment; to outline principles for management, impact and risk assessments, prevention and control of pollution, waste management environmental quality standards, public participation, compliance and enforcement.
Environmental Management (Fee and Charges) (Amendment) Regulations, 2016 (GN 191 of 3/6/2016)	These regulations contain a schedule that sets out the fees and charges payable for undertaking an Environmental Impact Assessment, assessing information, review of Environmental Impact Assessment and Audit, Environmental Experts registration fees, Environmental compliance monitoring and audit, and fees for various permits.
The Water Resource Management Act, 2009, Tanzania (Act No. 12/2009)	An Act to provide for institutional and legal framework for sustainable management and development of water resources; to outline principles for water resources management; to provide for the prevention and control of water pollution; to provide for participation of stakeholders and the general public in implementation of the National Water Policy, repeal of the Water Utilization (Control and Regulation) Act and to provide for related matters.
National Agriculture and Livestock Policy, Tanzania (1997)	Agriculture is critically dependent on environmental resources such as land, water, forest, air, etc. However, the use of these resources can affect directly or indirectly other natural resources, through dynamic and complex

[63] In Tanzania the competent authority that regulates Environmental Impact Assessments is the National Environmental Management Council (NEMC)

Policy/Law	Applicability/Comment
	interrelationships existing in the natural systems. This implies that wrong use of land, water and forest in the production of crops and livestock can have some far-reaching effects on the environmental integrity. To avoid such consequences, agricultural sector policies must fit in the overall environmental policy.
The Wildlife Conservation Act, Cap 283 (Tanzania)	The objectives of this Act and to which all persons exercising powers, applying or interpreting this Act are to - (a) protect and conserve and administer areas with great biological diversity, including wetlands which are representative of the major wildlife habitats by also giving special conservation status to endemic, rare or endangered wildlife species and to enable Tanzania to effectively contribute and benefit from international efforts and measures to protect and enhance global bio-diversity; (b) protect and conserve wildlife resources and its habitats in game reserves, wetland reserves, game-controlled areas, wildlife management areas, dispersal areas, migratory route corridors, buffer zone and all animals found in areas adjacent to these areas, by putting in place appropriate infrastructure, sufficient personnel and equipment. (c) promote and enhance the contribution of the wildlife sector to the sustainable development of Tanzania and the conservation and management of wildlife and natural resources for the benefit of present and future generations.
The Land Act, Cap 113 (Tanzania)	The Act provides for the basic law in relation to land other than the village land, the management of land, settlement of disputes and related matters.
RWANDA	
National Environmental Policy, Rwanda (2003)	The overall objective of the Environmental Policy is the improvement of man's wellbeing, the judicious utilisation of natural resources and the protection and rational management of ecosystems for a sustainable and fair development.
National Water Resources Management Policy (Rwanda)	The policy defines ownership rights and use of public water. It also prohibits the pollution, fouling or poisoning of, interference with, or flow alteration of public water.
The Land Policy (Rwanda)	The policy provides for the basic law in relation to land other than the village land, the management of land, settlement of disputes and related matters.
Organic Law Determining the Modalities of Protection, Conservation and Promotion of Environment in Rwanda, Law No. 04/2005[64]	This law aims at: conserving the environment, people and their habitats; setting up fundamental principles related to protection of environment, any means that may degrade the environment with the intention of promoting the natural resources, to discourage any hazardous and destructive means; promoting the social welfare of the population considering equal distribution of the existing wealth; considering the durability of the resources with an emphasis especially on equal rights on present and future generations; guarantee to all Rwandans sustainable development which does not harm the environment and the social

[64] In Rwanda the Rwanda Environment Management Authority (REMA) is the competent authority that regulates Environmental Impact Assessments.

Policy/Law	Applicability/Comment
	welfare of the population; setting up strategies of protecting and reducing negative effects on the environment and replacing the degraded environment.

Project-Specific Areas of Concern

The feasibility of the proposed developments depends on a variety of factors broader than only environmental considerations, which were highlighted in the reviewed studies and are listed below.

- A lack of environmental management policies and plans for the management of environmental components of the railway system, and guidance documents for environmental management;
- Spillage of fuel, oil and grease at main railway stations, diesel sheds, locomotive repair sheds and civil engineering yards;
- Lack of licences for storage of fuels and oils and lack of tank inspection schedules to check leaks;
- Use of solar panels, where they have been erected at stations, is not optimised, as some of such stations lack electricity supply;
- Lack of documented waste management systems in place. Solid wastes generated from railway activities should be segregated before disposal into public waste disposal facilities as some of the wastes are contaminated with oils and grease;
- A general inadequacy in water supply to the operational areas.
- Lack of proper management structures for waste water, despite the toxicity of most of the waste water from railway activities. Water is released to nearby drains untreated and storm water drains are blocked and/or broken in some sections, leading to pooling of water at different points in the workplace;
- Sanitation is generally poor, with most stations lacking or having severely dilapidated latrines.
- Some railway stations, workshop and residential buildings and other places of work are roofed using asbestos-containing substances, yet there is no Asbestos Management Plan in place.

Safety and Security Management

- Although some premises are registered as companies, no registration certificates were available for all the stations, workshops and depots;
- Some stations don't have either health and safety committees or designated health and safety representatives;
- Asbestos, kerosene, diesel oils, grease and heavy metals are used and stored on some sites. However, there is a lack of Material Safety Data Sheets (MSDS) available for these substances. In some instances, substances such as kerosene are stored together with

other equipment and facilities, exposing the staff to hazardous fumes and likely fire accidents;

- Adequate PPE is not always available to the staff, exposing them to accident and injury risks;
- Not all facilities and operational areas have fully stocked first aid kits;
- Lack of fire safety plans; available fire extinguishers are sometimes empty and are not inspected regularly;
- Lack of documented emergency response plans at some facilities and few of the staff are trained in emergency response;
- Not many facilities are manned by security personnel and some are exposed to theft and vandalism;
- Some facility areas have leaking roofs, shattered windows, cracked walls, worn out floors and dirty walls; and
- Lack of documented risk assessment plan in place in the railway system.

Project-Specific Environmental & Social Impacts

Based on the characteristics of the local study areas, the main environmental and social considerations defined for the project development are identified below.

Table C-11: Impacts identified in the Pilot Studies

Positive Impacts	Negative Impacts
Employment opportunities	Land take
Creation of awareness on impacts of railway line	Loss of social amenities and public infrastructure • Demolishing or relocation of medical facilities • Loss of community watering points • Loss of community food storage facilities • Loss of community forest reserves • Loss of graves • Impact on religion
Market opportunities	Economic and Livelihood Losses
Improved local economy	Loss of forest reserves
Ease of transportation	Impacts on fauna
Regional integration	Soil erosion and drainage
Economic growth	Landslides and soil creep
Reduced pressure on tarmac roads	Generation of solid wastes
Reduction of consumer product costs	Generation of liquid wastes
Expansion of towns and centres	Contamination of soils and water
Fuel consumption reduction	Air pollution (less than trucking)

Positive Impacts	Negative Impacts
Carbon dioxide reduction and air quality improvement	Noise and vibration
	Land degradation due to open borrow pits and quarry sites
	Surface water pollution
	Groundwater contamination
	Impacts on wetlands
	Loss of archaeological and cultural sites
	Occupational health and safety concerns
	Increase of the HIV/AIDS infection rate and sexually transmitted infections
	Spread of communicable diseases and other infections
	Impacts on local landscape and visual attributes
	Forest fires
	Deterioration of community health and safety

The following environmental impacts were identified in the various project development stages including Feasibility and ESIA studies undertaken for the development. Development stages include site selection, mobilisation and construction and operational.

- Loss/disturbance of biodiversity and threatened species.
- Loss/disturbance to protected areas.
- Accelerated erosion due to loss of ground cover.
- Atmospheric emissions.
- Dust and noise pollution.
- Impaired air quality.
- Impacts on local landscape and visual attributes.
- Impact on agriculture.
- Impact on water sources.
- Impact on flora and fauna.
- Loss of wetlands.
- Generation of waste.
- Land degradation.
- Contamination of soils and water.

- Surface water pollution.
- Groundwater contamination.
- Loss of archaeological and cultural sites.
- Sedimentation of rivers, lakes.
- Leakage of sewer lines.
- Spread of invasive species due to destruction of trees and shrubbery.
- Ecosystem disturbance.
- Disturbance or loss of foraging habitat.

Legal and Institutional Analysis

Introduction

This section reviews the PPP and railway legislation of Rwanda and Tanzania to identify existing national laws and regional agreements which could forestall the Continental Cross-Border High Speed Railway Initiative as it pertains to Pilot Project 2: Dar es Salaam-Kigali.

We will assume here that the infrastructure of the Dar es Salaam-Kigali rail line will be paid for and built by the Governments of Rwanda and Tanzania, but that the rail line will operated by one or more private party/parties by way of a concession agreement,[65] with or without government subsidies.

Three basic scenarios are possible with the concessioning of the Dar es Salaam-Kigali rail line:

- One concessionaire, having signed a concession with the Rwanda Government, operates the Rwanda portion of the Dar es Salaam-Kigali rail line and interchanges traffic (passengers and goods) with another concessionaire, who having signed a concession with the Tanzania Government, operates the Tanzania portion of the railway. Two concessionaires, two concession agreements. This situation would be akin to two national railways operating in their respective countries but linking at the border and interchanging traffic (e.g. Botswana Railways and National Railways of Zimbabwe).
- A single concessionaire operates the entire Dar es Salaam-Kigali rail line by way of two separate concession agreements entered into with the Rwanda Government and the Tanzania Government. This was the situation in Kenya and Uganda with respect to the

[65] Technically, since the future concessionaire/railway operator will not be responsible for the financing and construction of the rail infrastructure, the kind of PPP contract at issue here is really an "affermage." The World Bank's Public-Private Partnership in Infrastructure Resource explains the concept of an affermage as follows: "Leases and affermage contracts are generally public-private sector arrangements under which the private operator is responsible for operating and maintaining the utility but not for financing the investment." See here. This said, the term "concession" can also be used to refer to the kind of agreement at issue here: see for e.g. World Bank, *Concessioning of the Ifrikya Railway: a case study (English)*.

metre-gauge Mombasa-Uganda railway from 2006-2017. Both governments had signed separate, but basically identical, concession agreements with Rift Valley Railways.

- A single concessionaire operates the entire Dar es Salaam-Kigali rail line by way of one single concession agreements entered into with both the Rwanda Government and the Tanzania Government. This was what happened with the Dakar-Niger Railway which connects Dakar (Senegal), with the Niger River in Mali. The concessionaire – Transrail – was granted that railway's concession through a single concession agreement entered into by both governments.

Without prejudging the matter it should be noted at this point based on what follows that:

- Neither Rwanda nor Tanzania PPP legislation envision the possibility of awarding bi-national PPP projects;
- Tanzania has comprehensive railway legislation, including the setting up of an economic and safety rail regulator. Rwanda has neither.

Seen from that perspective, the second scenario outlined above is probably the more logical alternative. It should be noted that when the Transrail concession was awarded in 2003 neither Senegal nor Mali had any national PPP law and whatever railway law existed was rudimentary at best.

Awarding Concession Agreement

Rwanda – Rwanda has recently enacted a PPP law (Law nº 14/2016 of 02/05/2016 governing public private partnerships), PPP regulations[66] and PPP Guidelines.

The projects covered under the Rwanda PPP Law include railways as one of the potential sectors for PPPs.[67]

The Rwanda PPP Law (at article 3) identifies only four types of PPP arrangements: (1) management contract; (2) "Build-Operate-Own"; (3) "Build-Operate-Transfer", and (4) "Lease-Operate-Develop".

While, generally speaking, management contracts and concession agreements are two distinct types of contractual arrangements, the definition of management contract at section 3[68] is broad enough to allow a concession agreement to be deemed a management contract.

In any event the last paragraph of article 3 of the Rwanda PPP Law allows the Prime Minister, by way of an Order, to prescribe any other type of PPP arrangement.

All PPP projects[69] are to be procured through a competitive procedure aimed at ensuring competition, transparency, fairness and non-discrimination, efficiency and effectiveness,

[66] The Guidelines refer to regulations issued under the Rwanda PPP Law, however none could be found online.
[67] Article 5, item 1.
[68] "Management contract, whereby a Contracting Authority awards a partner the right to manage and perform a specific service with respect to an infrastructure facility or other asset for an agreed time period."
[69] Except for PPP projects arising out of unsolicited proposals, see Chapter V of the Rwanda PPP Law.

protection of public property and public interest and accountability.[70] Interested parties need to be prequalified.[71] The competitive procurement procedure **c**an be in one or two stages.[72]

Tanzania – PPPs in Tanzania are governed by the Public Private Partnership Act, 2010. The Tanzania PPP Act has been amended a number of times: in 2013, 2014 and most recently in 2018.[73] The Act is supplemented by the Public Private Partnership Regulations, 2015.

The projects covered by the Tanzania PPP Act include "infrastructure".[74] A concession certainly qualifies as a PPP agreement, the latter being defined at section 2 as "a written contract defining terms of the public private partnership agreement concluded between a contracting authority and one or more private parties." (Section 2 moreover provides an exhaustive definition of "public private partnership".)

Section 15(1) of the Tanzania PPP Act provides that:

> All public-private partnership projects under this Act[75] shall be procured through open and competitive bidding process.

Details as to the competitive bidding process are to be found in Part VI (*Procurement of Solicited Public Private Partnership Project*) of the Public Private Partnership Regulations, 2015.

No common set of bid documents – The Rwanda PPP Law and the Namibia PPP Act provide sensibly similar mechanisms to procure a PPP contract/concession, namely a competitive bidding process. However, neither enactment is designed to allow the contracting authorities of the two countries to issue a common set of bid documents and award a joint concession agreement. In terms of being able to select one sole concessionaire, this can be achieved by making it a requirement that any person wishing to bid for the railway concession in one country also bid for the railway concession in the other country. This would require substantial coordination between the governments of the two countries in preparing and issuing the bid documents and in the evaluation of the bid received.

The Concession Agreement

The private partner/concessionaire – Neither the Rwanda PPP Law nor the Tanzania PPP Act expressly require that the private partner be a corporate body and, more importantly, that it be incorporated in, as may be the case, Rwanda or Tanzania.

The legal status and country of incorporation of the concessionaire can be addressed in the RFPs. Obviously both countries need to come up with a mutually agreeable country of incorporation so that there is no need to have two legal entities incorporated in Rwanda and in

[70] Article 15 of the Rwanda PPP Law.
[71] Article 16 of the Rwanda PPP Law.
[72] Article 20 of the Rwanda PPP Law.
[73] The various amendments can be found here (2013) and here (2014) and here (2018). The version of the 2018 bill found here on the website of the National Assembly is incomplete.
[74] See section 4(3)(b). Before it was passed the original bill specifically included railways as an example of infrastructure.
[75] Section 15(2), as amended in 2018, empowers the Minister (responsible for investment) to exempt some unique unsolicited PPP projects from being the object of a competitive bidding process.

Tanzania if the idea is to have only one concessionaire (whether under a single or under two concession agreements).

Existing company laws in Rwanda and Tanzania allow foreign companies to carry business in the host country provided they register there.[76] Registration, unlike incorporation which creates a new company, merely allows a foreign existing company to carry out its business also in the country where it has registered. So in that sense it does not matter if the concessionaire is incorporated in Rwanda or Tanzania.

Contents – Both the Rwanda PPP Law and the Tanzania PPP Act have provisions which enumerate the contents/contractual clauses that need to be included in a PPP contract.[77] None of this is problematic. Existing templates and precedents with respect to railway concessions will cover all the listed matters.[78]

Concession agreements need moreover to take into account the legal and regulatory framework that exists with respect to the railway sector in any given country. This will be discussed separately in what follows.

Railway Legislation

Rwanda – Rwanda has no railways. It has no railway legislation either. It does have elements of a railway policy.[79] The policy is very general. It does allow however for the possibility of "a PPP financing option" in the form of an "integrated concession regulated by an independent regulator".

Two bodies in Rwanda have powers over rail infrastructure and rail transport, namely the Ministry of Infrastructure[80] and the Rwanda Transport Development Agency.[81]

Tanzania – A new Railways Act, 2017 was enacted by the National Assembly on September 13, 2017, and assented by the President on October 13, 2017. The regulations made under the earlier Railways Act, 2002, insofar as they are not inconsistent with the new Act, remain in force until expressly revoked.[82]

There are two main rail carriers in Tanzania:

[76] Rwanda: Article 322 of Law N° 07/2009 of 27/04/2009 relating to companies; Tanzania: Section 433 of the Companies Act, 2002. See also the East African Community Common Market (Right of Establishment) Regulations.

[77] Section 12 of the Rwanda PPP Law and more comprehensively section 12(2) of the Tanzania PPP Act.

[78] E.g. World Bank, *Concessioning of the Ifrikya Railway: a case study (English)* at pp. 17 and following. This is an English translation of the French original. Reference can also be made to the 2007 RAHCO-Tanzania Railway Limited Concession Agreement and to the two 2006 Concession Agreements signed by Rift Valley Railways with respectively the Tanzania Government and the Uganda Government.

[79] Republic of Rwanda, Ministry of Infrastructure, Public Transport Policy and Strategy for Rwanda (Kigali: October 2012), at paragraph 4.6.6.

[80] Official website here with its mission and purpose here.

[81] Organic Law No. 02/2010 of 20/01/2010 establishing Rwanda Transport Development Agency (RTDA) and determining its mission, structure and functioning. Official website here.

[82] Section 114(2) of the Railways Act, 2017.

- The Railways Act, 2017 establishes a new corporation to be known as the Tanzania Railways Corporation (TRC). In practice Tanzania Railways Limited and Reli Assets Holding Company (RAHCO) have been merged into the new corporation;[83] and
- The Tanzania-Zambia Railway Authority (TAZARA)84 continues to exist and is not affected by the new Act.85

The Railways Act, 2002 provided that no person, except with rail regulator's written consent, should manage railway infrastructure or provide railway transport services without a railway operator's licence.[86]

Under the Railways Act, 2017 TRC is authorised by virtue of the Act itself to manage rail infrastructure and provide rail transport services. No licence from the rail regulator is required. Any third party can manage rail infrastructure and/or provide rail transport services by virtue of a PPP/concession agreement entered into with TRC. No licence from the rail regulator is required either.

The key provision is section 5(d) which provides as follows:

> The objects of [TRC] shall be to –
>
> (d) enter into contractual agreements with other persons in order to secure the provision of rail transport services, whether by means of concession, joint venture, public private partnership or other means, and to this end to delegate its functions of developing or maintaining rail infrastructure services.

Cross-Border Movements of Persons and Goods by Rail

Because Rwanda and Tanzania are member states of the East African Community (EAC) there is already substantial harmonisation in the general trade laws of these two States, including customs, the movement of persons and goods, etc. This harmonisation will increase over time as all the commitments made by the two States under the Customs Union Protocol and a Common Market Protocol of the EAC Treaty are fully implemented.

The whole issue of harmonisation in rail transport among EAC member states was dealt with extensively in CPCS' Final Report for the *EAC Railway Sector Enhancement Project* (July 13, 2016) at chapter 9 ("Harmonization Framework").[87]

What follows is therefore merely a reminder of the main texts which govern this area of the law.

[83] The Citizen, *RAHCO, TRL merged to form new corporation* (September 14, 2017). See also sections 115, 117 and 118 of the Railways Act, 2017.
[84] Official website of TAZARA here.
[85] Section 2(2) of the Railways Act, 2017 provides that: "This Act shall not apply to the undertaking of the Tanzania Zambia Railway Authority."
[86] Section 24(4) of the Railways Act, 2002.
[87] The whole report can be found here on the EAC website.

EAC Treaty - Rwanda and Tanzania, together with Burundi, Kenya, South Sudan and Uganda, are member states of the EAC.[88] The EAC was set up under the Treaty for the Establishment of the East African Community.

The objectives of the EAC Treaty are set out at Article 5 thereof, which reads in part as follows:

> 1. The objectives of the Community shall be to develop policies and programmes aimed at widening and deepening cooperation among the Partner States in political, economic, social and cultural fields, research and technology, defence, security and legal and judicial affairs, for their mutual benefit.
>
> 2. In pursuance of the provisions of paragraph 1 of this Article, the Partner States undertake to establish among themselves and in accordance with the provisions of this Treaty, a Customs Union, a Common Market, subsequently a Monetary Union and ultimately a Political Federation in order to strengthen and regulate the industrial, commercial, infrastructural, cultural, social, political and other relations of the Partner States to the end that there shall be accelerated, harmonious and balanced development and sustained expansion of economic activities, the benefit of which shall be equitably shared.

Article 89 of the EAC Treaty ("Common Transport and Communications Policies") provides in part that:

> In order to promote the achievement of the objectives of the Community as set out in Article 5 of this Treaty, the Partner States undertake to evolve coordinated, harmonised and complementary transport and communications policies; improve and expand the existing transport and communication links; and establish new ones as a means of furthering the physical cohesion of the Partner States, so as to facilitate and promote the movement of traffic within the Community.

Additionally, article 91 is entirely devoted to railways and rail transport.

EAC Treaty Protocols – The EAC Treaty contains two protocols to carry out the Partner States' goal to establish, among other things a Customs Union and a Common Market, namely:

- Protocol on the Establishment of the East African Community Customs Union;[89] and
- Protocol on the Establishment of the East African Community's Common Market.[90]

Article 38(1) of the Common Market Protocol ("Co-ordination of Transport Policies") provides in particular that:

[88] Official website of the EAC here.
[89] This Protocol was signed by the Heads of State of Kenya, Tanzania and Uganda on 2 March 2004 in Arusha, Tanzania. Rwanda joined the Customs Union in 2008 and started applying its instruments in July 2009.
[90] This Protocol entered into force on 1 July 2010, following ratification by all the then five Partner States: Burundi, Kenya, Rwanda, Tanzania and Uganda.

The Partner States undertake to evolve coordinated and harmonized transport policies to provide for adequate, reliable, safe and internationally competitive transport infrastructure modes and services for the development and consolidation of the Common Market.

Appendix D. Financing Strategy for Accelerated Pilot Projects: Gaborone-Walvis Bay and Dar es Salaam-Kigali

Introduction

We applied the three-step approach delineated in Chapter 5.

1. The first step includes analysis of the project's public benefit, financial feasibility, government capacity and private sector willingness to assess **which delivery options would best suit the project**.

2. The next step examines **which financing mechanisms are available** for each of these projects.

3. The last step considers **which funding options** might be appropriate.

Each of these steps was performed in sequence; the assessment at each step affects the examination and result of the next steps. For instance, if we found in the first step that the sovereign government is not willing to allow private investment, the next step was amended to only consider publicly available financing options, or provide guidelines for encouraging private finance, however, with certain conditions that would need to be met.

Project Delivery Analysis

In this section we assess which delivery mechanism, i.e. should the project be procured through public finance, or via PPP. This preliminary analysis feeds into the next step where we examine the degree of the PPP that may be applicable to each of the pilots, if applicable. After this we shall assess the degree of available financing mechanisms and recognise the funding sources. The following table summarises our findings on the four key questions that we will assess in this section.

Table D-1: Projects' Public Benefit, Financial Feasibility, Government Capacity and Private Sector

	Mmamabula – Gaborone – Walvis Bay	Dar es Salaam – Kigali
Is there a Public Benefit? (Economic return discounted at 12% social return)	**Base Case:** ENPV* = (162) million USD EIRR = 11.5%	**Base Case:** ENPV = (3,196) million USD EIRR = 6.45%
Is the Project Financially Feasible? (NPV discounted at 4.91% real return**)	**CAPEX: 6.2 billion USD (1.3 for electrification)** **Rolling Stock: 11.0 billion USD** **Base Case:** NPV = 1182 million USD IRR = 6.2% Equity IRR = 6.9%	**CAPEX: 9.1 billion USD (590 million for electrification)** **Rolling Stock: 6.2 billion USD** **Base Case:** NPV = (4,322) million USD IRR = 3.1% Equity IRR = 2.67%
Is/Are the Government(s) committed to Private Sector Participation	**Commitment: Yes** **Capacity: No** **Botswana**: The government has had a history of PPPs since the adoption of the privatisation policy in 2000. In 2016 it established a PPP Unit for full implementation of its PPP policy. **Namibia:** The government capacity to implement PPPs remains low; In June 2019, it only had two PPP projects, both of them in feasibility stage of development.	**Commitment: Yes** **Capacity: No** **Rwanda:** The government has issued PPP Guidelines and recognised the need of private capital in the country's development. However, only known example of PPP is in the water sector with total cost of 61 million USD. **Tanzania:** The government revised the national PPP policy in 2018. However, the capacity of government to implement PPPs remains unknown.
Does the Private Sector have the Capacity to deliver?	It may be possible to engage the private sector in part of the project as Equity IRR of ~7% is close to the total Equity Return demanded by international investors (Equity Risk Premium + Risk free Rate) for Botswana i.e. 9.68%. However, this is not true for Namibia where minimum total equity return should be 11.97%. See analysis below. Also, private sector absorption capacity is unknown at this stage.	The Equity Risk Premium is too high for respective countries for the private sector to invest.

* The Economic NPV (Net Present Value) is calculated as the value of benefits less costs, discounted at the economic rate of return of 12%. The economic rate of return is a recommended rate applied by the World Bank in evaluating projects' economic returns. The economic return is calculated as the financial return plus the returns accrued from allied economic impacts, such as job creation.

** Financial rate of 4.91% is the 10-year US Government bond rate plus US Prime rate.

The public benefits and financial feasibility of both projects are discussed in Appendix B and Appendix C in detail. While both the public benefit, evaluated as economic return, and the financial return are low, it is needless to say that both these lines represent major infrastructure needs under AIHSRN. These lines have been selected after a detailed screening analysis as presented in section 2 of the report. We discuss each of these in this section.

Public Benefit

For both lines, we find that public benefit does exist, albeit with an economic IRR of less than 12%, which is the prescribed rate by the World Bank. At a discount of 12%, the project provides negative benefit, and thus warrants a rethinking in terms of its use. For the base case of the Dar es Salaam-Kigali line, the economic IRRs are 6.45%. Adequate public benefit is better for the Mmamabula-Walvis Bay line which has an economic IRR of 11.5% in the base case. Nevertheless, for both projects additional safeguards should to be put in place to increase the public benefit from the development of the railway lines. For instance, the low carbon footprint of railways vis-à-vis trucks helps decrease total emissions. In such case, a truck tax or gas tax could be applied to encourage movement of goods over rail.

Financial Feasibility

Financial feasibility refers to a project's ability to generate the financial returns desired by the investor. The desired financial return is also known as the expected rate of return. The expected rate of return for the project is low if the investor is the public sector, and high if the investor is a private company. This is because many of the risks pertaining to the project, for instance land risk, are better controlled by the public sector, and also the cost of financing is lower for the public sector.

In case of the Dar es Salaam-Kigali line, we find that the project is infeasible in the best case scenario. The projections are made with a debt to equity ratio of 70:30. The debt is sourced from International Financial Institutions and commercial banks with a return rate of 5.74% and 9.79% respectively. Further the cost of government equity is considered as 8% for a 30% share in the project. It should be noted that the financial analysis is represented in hard currency, i.e. US dollars, and not in the local currency of countries that will benefit from this project. In such case, we should note that any exchange rate risk is getting passed on to the developer, or is being absorbed by the exchange rate risk guarantee facility. We discuss this ahead in the next section. In case the base case assumptions are not met, the project would require large public support. The next step would be to assess whether the governments of these countries are supportive of private sector participation and if the private sector may be willing to play a role in the development of these projects.

For the Mmamabula-Walvis Bay Rail line, we find that while the project has adequate equity return for the project to have private sector interest, the equity IRR of 6.9% is low for the private sector to fully take on the project. A structuring of the project with concessional loans from the MDBs could potentially make the project more feasible allowing it to attract private sector participants. For this section, we recommend that the project level feasibility is increased by concessional loans.

Government Commitment to PPPs

For each of the governments except for Botswana, we find that their experience in PPPs to be weak. For instance, in Rwanda there has only been one known PPP project – the government published in June 2018 the guidelines on public-private partnerships subsequent to which it became the first country in Africa to successfully launch a water PPP project to provide 40,000 cubic metres of water to its residents.[91] However, the success of PPPs in Rwanda is relatively unknown. It can be said that the government recognises the need of private sector participation but lacks the capacity to carry out the procurement of a rail PPP or for parts of it at the moment. Similarly, Namibia has had only two projects in its PPP pipeline, both of which are under feasibility assessment. It is therefore doubtful that except for Botswana, other countries would be able to attract private investment at the scale that is required for a rail PPP. Therefore, we discuss the possibility of PPP for the Walvis Bay-Mmamabula Rail Line ahead.

Private Sector Capacity to Engage in AIHSRN Projects

Instead of evaluating whether adequate number of firms exist or may be interested in investing in these projects, we begin our analysis by assessing the equity risk premium that may be demanded by a hypothetical investor. The hypothetical investor may invest in all of the project or part of the project. The current analysis is conducted for all of the project. It is possible the governments will be able to segregate profitable parts of the rail network, including rail services, in order to attract private investment in parts of the projects. For example, once the infrastructure is built, the governments may be able to find interest in the private sector for finance, operations and maintenance of the rolling stock, which includes locomotives and wagons. However, our analysis reveals that at current projections these projects as a whole are not viable for the private sector to invest in as the equity risk premium exceeds the return being generated from these projects. Further, our research on equity risk premium also shows that international investors will demand very high risk premiums if they were to invest in such large projects, i.e. risk premium increases with higher investment need.

For instance, in Rwanda, the country presently does not have a sovereign rating, and the estimated risk premium is as high as 22.6%.[92] In such case, the total return demanded by private sector would be 22.6% + 2.54%, or 25.14%. This is significantly higher than the equity return of 8% we have assumed in the financial model. The same issue is applicable to other countries where the equity risk premium is too high for the project to accommodate a major private partner.

Table D-2: Countries' Equity Risk Premium

Rail Line	Country	Equity Risk Premium*	Moody's Country Rating
Mmamabula-Gaborone-Walvis Bay	Namibia	9.43%	Ba1
	Botswana	7.14%	A2
Dar es Salaam-Kigali	Rwanda	22.61%	N/A**
	Tanzania	12.21%	B1

*Equity Risk Premium is the rate that investors expect over the risk free rate; risk free rate for modelling is assumed as 6-month USD LIBOR, which currently trades at 2.54%
** N/A means that the country does not have a sovereign rating.

[91] Kigali Water: Lessons from one of sub-Saharan Africa's first water PPPs, World Bank Blogs, March 2018
[92] Equity Risk Premiums by Country, Aswath Damodaran, NYU Stern School of Business

At present the financial model for Dar es Salaam-Kigali reveals that up until year 20 (including the period of construction), the project would run in negative cash flows, even with its low cost of capital. However, if a private participant can procure locomotives and wagons at cheaper cost and lease those to the operator, or the financial situation of the rail project changes (the level of low-cost debt increases), then private sector participation may become feasible. Until then the likelihood of PPP remains low. On the contrary, the financial analysis for Walvis Bay-Mmamabula reveals that a potential for PPP does exist, and perhaps a vertical segregation may be possible.

The table below summarises our findings from this section, and details the preferred procurement strategy. In the next section we discuss the degree of financing that is available for both lines. In the case of Dar es Salaam-Kigali, public procurement options are considered. For Mmamabula-Walvis Bay, we consider both public procurement and private sector participation.

Table D-3: Suggested Procurement Strategy

	Mmamabula – Gaborone – Walvis Bay	Dar es Salaam – Kigali
Is there a Public Benefit?	YES	YES
Is the Project Financially Feasible (generates adequate returns for private participation)?	YES	NO
Is/Are the Government(s) committed to Private Sector Participation	Commitment: YES Capacity: NO or Unknown Overall: NO	Commitment: YES Capacity: NO or Unknown Overall: NO
Would the Private Sector have the Capacity to deliver?	Possibly YES	NO
Suggested Procurement Type	**Public/PPP**	**Public**

Financing Mechanisms Analysis

The following table analyses the key considerations we take for recommending the financing mechanism for the two rail lines. Based on this assessment, we are able to identify the degree to which public sector investment can be sustained, or to what degree can the private sector be engaged for the project.

Table D-3: Financing Mechanism Analysis

	Mmamabula – Gaborone – Walvis Bay	Dar es Salaam – Kigali
The degree of financial feasibility of the project	**Moderate** (acceptable equity return)	**Low**

	Mmamabula – Gaborone – Walvis Bay	Dar es Salaam – Kigali
The project's size, schedule and geographical footprint	**Large** (US$6.2 billion for upfront CAPEX and $11 billion for rolling stock over 60 years)	**Large** (US$9.1 billion for upfront CAPEX and $6.2 billion for rolling stock over 60 years)
The project's operating revenue risk, including potential public long-term contributions	**High** Due to the long time horizon, there are inherent modelling risks and assumption risks. There cannot be a 60-year certainty about the project or the political environment.	**High** Due to the long time horizon, there are inherent modelling risks and assumption risks. There cannot be a 60-year certainty about the project or the political environment.
The depth of financial markets	**Low to Moderate**; mostly publicly owned commercial banks **Namibia –** Low to Moderate. The market cap of the stock exchange is US$2.5 billion only. With respect to banking sector, there are 10 banks in Namibia, with the top four holding 98% of the assets. But there is a vibrant non-banking financial institution (NBFI) sector with assets of about 70% of the GDP, managing funds on behalf of the Government Institutions Pension Scheme. **Botswana –** Low to Moderate. The market cap of the stock exchange is US$4.6 billion only. As for banking and NBFI sector, the total assets held by 11 commercial banks and 202 NBFIs only amounted to US$20 billion. After commercial banks, pensions funds and life insurance, NBFIs held most assets.	**Low** in Rwanda; **moderate** depth in Tanzania with potential of private sector banking loans. **Rwanda –** Low. Only eight stocks listed on the stock exchange. Little or no securities market depth. On the banking front, Rwanda has 16 commercial banks and micro-finance banks, and additional 439 savings credit and co-operative banks. The top five commercial banks manage 76% of the assets, and the state-owned Bank of Kigali holds over 30% of total financial assets of the country. **Tanzania –** Moderate. The Dar es Salaam stock exchange has a market capitalization of US$19 billion; the financial markets, including the banking sector, represent 36% of the country's GDP. Of this, banks hold 72% of assets, and pension funds hold 26%. There are 18 domestic and 29 foreign banks, with the top five banks holding 54% of the assets. However, the country faces a series of non-performance asset issues; therefore lending for infrastructure sector may not find many lenders.
IFI and DFI appetite	The IFI and DFI market is mostly crowded out by the African Development Bank and the World Bank. They are the prominent investors. Smaller scale projects do find assistance from other IFI and DFI's such as the European Commission. The other noted exceptions for large project development include Japan International Cooperation Agency, and bilateral loans from Chinese state-owned enterprises, or the Chinese Government.	
The budgetary situation/ Debt sustainability analysis	**Botswana –** Botswana's fiscal space as of 2015 remains relatively unconstrained due to the low level	**Rwanda –** The existing debt sustainability of the country is deemed sustainable by the IMF,

	Mmamabula – Gaborone – Walvis Bay	**Dar es Salaam – Kigali**
	of public debt and publicly guaranteed debt (22.3% of GDP). The acceptable statutory level for middle income countries is 40%. However, since the economy is highly volatile and subject to coal, soda ash and diamond exports, the country remains susceptible to macroeconomic vulnerabilities, especially if the government decides to increase public debt. **Namibia:** Due to the recent contraction in the Namibian economy in 2017, the IMF has suggested fiscal adjustment efforts for the country. It is estimated that Namibia's public debt ratio will be 70% of GDP by 2022. In light of this situation, the country presents very low fiscal room for investments in High Speed Rail.	even though external public debt increased to 37.5% of GDP in 2017 from 16.4% in 2012. Note that Rwanda GDP stood at US$9.5 billion in 2018. Therefore, a large HSR project of this magnitude will add massively to Rwanda's external borrowing, but it may be possible to take on this additional debt given the high GDP growth rate. **Tanzania –** As per the IMF, the chance of external debt distress for Tanzania remains low. Its external debt-GDP ratio stood at 19.1%, which included an increasing share of commercial borrowing vis-à-vis concessional loans. In comparison to its neighbour, Tanzania's GDP stood at US$57.4 billion in 2018, allowing it more room for raising external public debt to finance the HSR.
The quality of tax administration and governance (Tax Revenue as % of GDP)	World – 15.2% OECD members – 15.8%	
	Botswana – 22.1% **Namibia –** 30.1% The tax revenue as percent of GDP above indicates that the quality of tax collection in both Namibia and Botswana is highly satisfactory. Thus alternate sources of revenues such as truck tax or carbon tax maybe explored.	**Rwanda** – 13.6% **Tanzania –** 11.6% The tax revenue as percent of GDP indicates that the quality of tax administration is inadequate in both Rwanda and Tanzania, and therefore new taxes such as gas tax, carbon tax, truck tax and others may not be easily implementable.

Source: Sustainable Stock Exchange Initiative, Namibian Stock Exchange; Namibia, Financial System Stability Assessment, International Monetary Fund, March 2018; Sustainable Stock Exchange Initiative, Botswana Stock Exchange; Botswana, Selected Issues, International Monetary Fund, August 2017; Rwanda Stock Exchange; Rwanda, Banking System, Exprot.gov, Government of United States of America, July 2019; Dar es Salaam Stock Exchange PLC; United Republic of Tanzania, Financial System Stability Assessment, International Monetary Fund, Nov 2018; Fiscal Space for Children, An Analysis of Options in Botswana, UNICEF, April 2018; "IMF Sees Government Debt Grow to 70% of GDP by 2022", The Economist (Namibia), Mar 2018; Rwanda, Ninth Review Under the Policy Support Instrument – Debt Sustainability Analysis, International Monetary Fund, May 2018; World Bank; United Republic of Tanzania, Seventh Review under the Policy Support Instrument – Debt Sustainability Analysis, Dec 2017; and the World Bank Database.

Mmamabula-Gaborone-Walvis Bay Rail Line

Based on the above research, we present our assessment below:

- **Sovereign Funding –** While Botswana may be able to finance the project with public debt (internal or external), Namibia may not be in the same position due to high economic volatility since 2017. The Government of Namibia has low headroom to raise further public debt to finance such a large infrastructure project.
- **Public Institutional Finance (Pension and Insurance Funds) –** For both countries, contributions from pension funds and life insurance funds may contribute significantly. Since the equity IRR is reasonably high at 6.9%, the pension funds may be willing to take an equity stake in the projects. However, due to restrictions on the amount of risk they can take,[93] they may only be able to provide debt financing.
- **Alternative Public Finance** – Both countries present a positive case of tax revenue collections. However, in Namibia, additional tax revenues, i.e. levying new taxes or increasing the existing ones, may not be feasible given the economic downturn at the moment. These are recommended for Botswana.
- **Private Sector Equity** – While Botswana meets the country risk premium requirement for private sector participation, it is unlikely that a private participant will show interest during the CAPEX stage due to the large upfront investment required in the project and also its transnational status with Namibia. A vertically segregated structure could be explored where the upfront capital investment is financed with public and IFI loans, and the rolling stock is purchased and managed by the Sponsor. We discuss this ahead.
- **IFI and DFIs** – International Financial Institutions are crucial for the success of this project. It is expected that they will provide concessional lending, grants, credit guarantees, and currency risk management mechanisms. In absence of public or private funding, the IFIs such as the African Development Bank and the World Bank are needed to plug the infeasibility gaps.

The table below summarises the financing mechanisms that may be explored for the Mmamabula-Walvis Bay Rail line.

Table D-4: Financing Mechanism for Mmamabula-Walvis Bay

	Botswana	Namibia
Sovereign Funding	External Commercial Borrowing	Unlikely
Public Institutional Finance	Pension Funds and Life Insurance	Pension Funds and Life Insurance
Alternate Public Finance	Gas Tax, Truck Tax, Carbon Tax, Road Tax and others	Unlikely
Private Sector Equity	YES (Only rolling stock with credit and exchange rate guarantees)	
IFIs and DFIs	Concessional Loans, grants, credit guarantees, exchange rate risk management	

[93] Pension funds and social security funds are usually regulated by sovereign governments. These are not allowed to take very high risk as their funds are finally meant for retirement income of a country's citizens. Hence, they are not expected to be a source of high risk equity investment.

Dar es Salaam-Kigali Rail Line

Based on the above research, we present our assessment below:

- **Sovereign Funding –** Both countries are in a comfortable position to issue external public debt to finance the project. However, the cost of external borrowing maybe very high due to their country risk premiums. Yet, this remains the most viable source of funding after IFI and DFI investments.
- **Public Institutional Finance (Pension and Insurance Funds) –** Like the Mmamabula-Walvis Bay project, the pension funds and life insurance funds would be in a position to provide significant finance to the project. However, due to low IRR and also a restriction on the amount of risk they can take,[94] they may only be able to provide debt investment.
- **Alternative Public Finance** – The low tax collection rate (tax revenue as a percent of GDP) indicates that alternative sources of revenues may not be feasible, or implementable. Further given the small size of the economies vis-à-vis the project cost, alternative sources of finance may not significantly impact the project financing structure even if there were any exceptions.
- **Private Sector Equity** – Due to the low financial feasibility of the project, it is unlikely that private sector equity would be available for this project. However, private sector participation may be secured later during the operations phase under an affermage contract.
- **IFIs and DFIs** – IFIs and DFIs would represent significant source of capital for this project. The projects' financial return is low, so large amounts of concessional finance will be needed to see this through to completion. Additionally, other instruments such as grants, credit guarantees and currency risk management mechanisms will be required.

The table below summarises the financing mechanisms that may be explored for the Dar es Salaam-Kiglai line.

Table D-5: Financing Mechanism for Dar es Salaam-Kigali

	Rwanda	Tanzania
Sovereign Funding	External Commercial Borrowing	External Commercial Borrowing
Public Institutional Finance	Pension Funds and Life Insurance	Pension Funds and Life Insurance
Alternate Public Finance	None	None
Private Sector Equity	None	
IFIs and DFIs	Concessional Loans, grants, credit guarantees, exchange rate risk management	

[94] Pension funds and social security funds are usually regulated by sovereign governments. These are not allowed to take very high risk as their funds are finally meant for retirement income of a country's citizens. Hence, they are not expected to be a source of high risk equity investment.

Funding Options Analysis

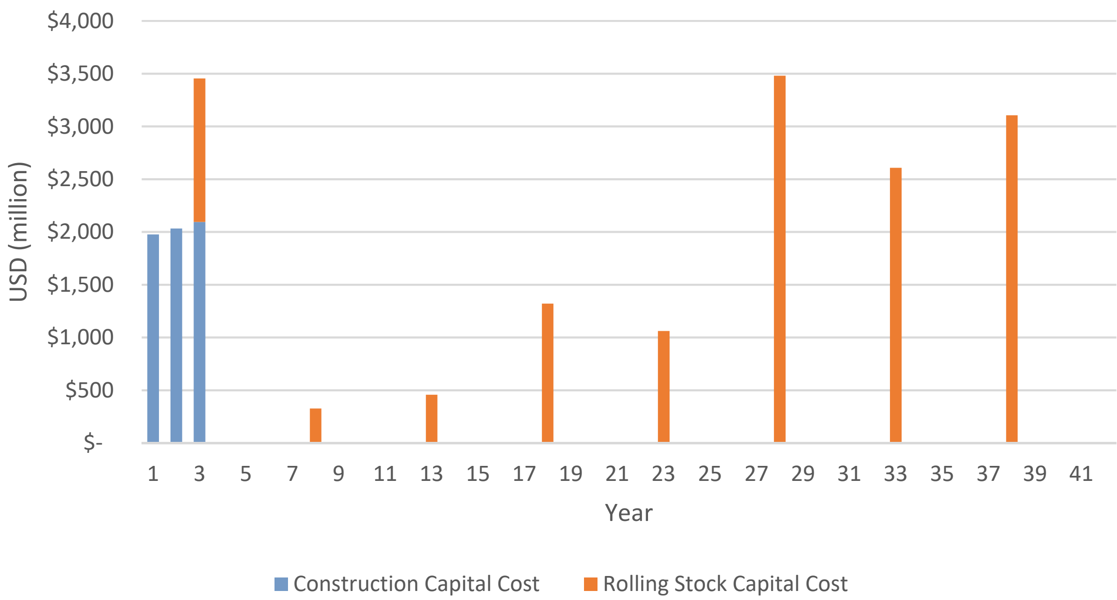
Here we analyse the funding options available for each of the lines. For each line, the operating expenses are covered with operating revenues, whereas the capital expenditures, which include construction costs and rolling stock costs, are purchased with debt and equity financing. The debt and equity is then paid back through operating revenues. Thus, this section is primarily concerned with capital cost funding sources.

To assess the sources of funds for capital costs, we divide the project into construction phase and operations phase. The construction phase capital costs include the cost of building the physical infrastructure, and the operations phase capital costs include the cost of purchasing rolling stock. This is called the rolling stock Capital Cost.

Mmamabula-Gaborone-Walvis Bay Rail Line

The figure below depicts the timing of the capital expenditure for the Mmamabula-Walvis Bay line. As seen, the majority of the capital expenditure is incurred at the beginning of the project; this includes construction of the rail line, development of the railway stations and sidings, and installation of electrical, signalling and telecom infrastructure.

Figure D-1: Mmambula-Walvis Bay Capital Costs



Following from the previous section, while the funding for the construction capital is expected to come from non-private sector sources, the rolling stock may include inclusion of private capital in the form of public private partnership to share the risk of finance, operations and maintenance of the rolling stock. The table below discusses the potential sources of funds for the Mmamabula-Walvis Bay Rail Line.

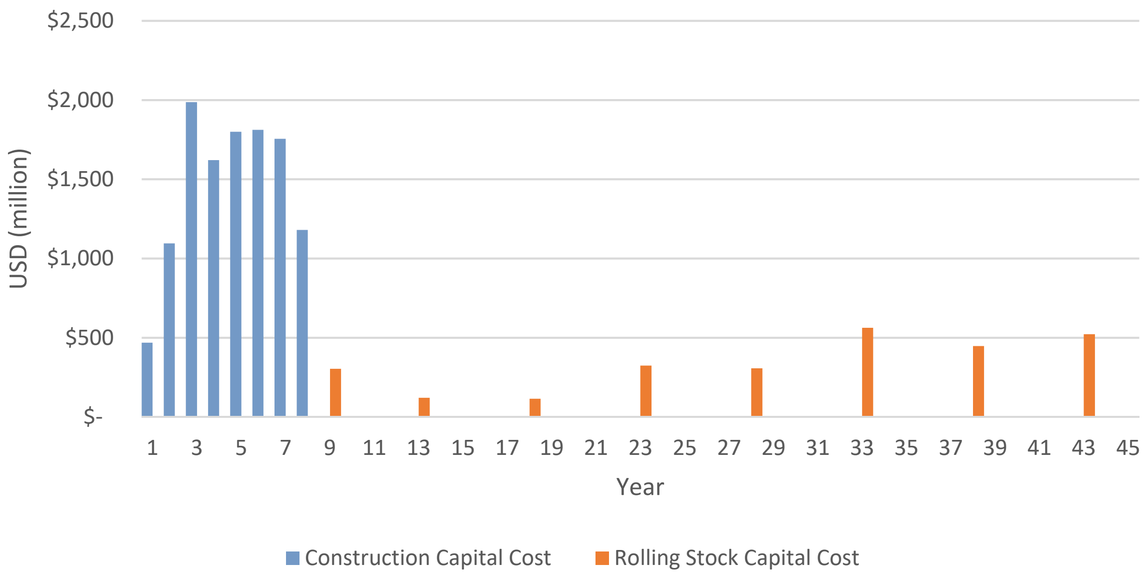
Table D-6: Potential Sources of Funds for Mmamabula-Walvis Bay

	Construction Capital Cost	Rolling Stock Capital Stock
Sovereign Funding	→ External Commercial Borrowing (local currency or USD bonds) → Budgetary allocations	
Public Institutional Finance	→ Pension Funds/ Social Security Funds (high yield debt) → National Development Banks → Public Banks	
Alternate Public Finance	→ One-time development charges → Tax Increment Finance (Industrial property tax increment finance)	→ Carbon tax on Gas vehicles → Gas Tax → Motor Vehicle Cess → Coal Mines Cess
Private Sector Equity	N/A	→ Large Global Rail Operators → Rolling Stock Manufacturers → Private Equity Investors with an operating partner → Sovereign Wealth Funds
IFIs and DFIs	→ Sovereign Guarantee Loans → Local Currency and USD Loans → Exchange rate hedge → Climate Change and Adaptation Fund	→ Sovereign and Non-Sovereign Guarantee Loans → Credit Guarantee Facility → Exchange rate hedge → Fund for African Private Sector Assistance

Dar es Salaam-Kigali Rail Line

The figure below depicts the timing of the capital expenditure for the Dar es Salaam-Kigali HSR line. Similar to the Mmamabula-Walvis Bay project, the construction capital cost is the major cost of the project, followed by rolling stock investment over periodic intervals.

Figure D-2: Dar es Salaam-Kigali Capital Costs



In case of the Dar es Salaam-Kigali project, since the project is not financially feasible from the equity holder's perspective, we do not expect private sector participation. Further, we also do not expect alternate sources of finance as the taxation capacity of the governments is low. Thus, we recommend a publicly financed and IFI-aided structure for this project, and list the funding sources that are available for its finance.

Table D-7: Potential Sources of Funds for Dar es Salaam-Kigali

<table>
<tr><th></th><th>Construction Capital Cost</th><th>Rolling Stock Capital Stock</th></tr>
<tr><td>Sovereign Funding</td><td colspan="2">→ External Commercial Borrowing (local currency or USD bonds) Low
→ Budgetary allocations Low</td></tr>
<tr><td>Public Institutional Finance</td><td colspan="2">→ Pension Funds/ Social Security Funds (high yield debt)
→ National Development Banks
→ Public Banks</td></tr>
<tr><td>Alternate Public Finance</td><td colspan="2">N/A</td></tr>
<tr><td>Private Sector Equity</td><td>N/A</td><td>→ Possible Affermage in later stages of operations</td></tr>
<tr><td>IFI and DFIs</td><td>→ Grants
→ Sovereign Guarantee Loans
→ Local Currency and USD Loans
→ Exchange rate hedge
→ Risk Management Facility
→ Climate Change and Adaptation Fund</td><td>→ Sovereign and Non-Sovereign Guarantee Loans
→ Credit Guarantee Facility
→ Exchange rate hedge</td></tr>
</table>

Appendix E. TOR for Feasibility Study for Johannesburg-Gaborone-Walvis Bay

The TOR presented in the following pages adds a Johannesburg-Gaborone rail link to the Gaborone-Walvis Bay link at the request of AUDA-NEPAD.

Consultancy Services for Feasibility Study for Johannesburg-Gaborone-Windhoek-Walvis Bay Railway Line

Terms of Reference

Project Background

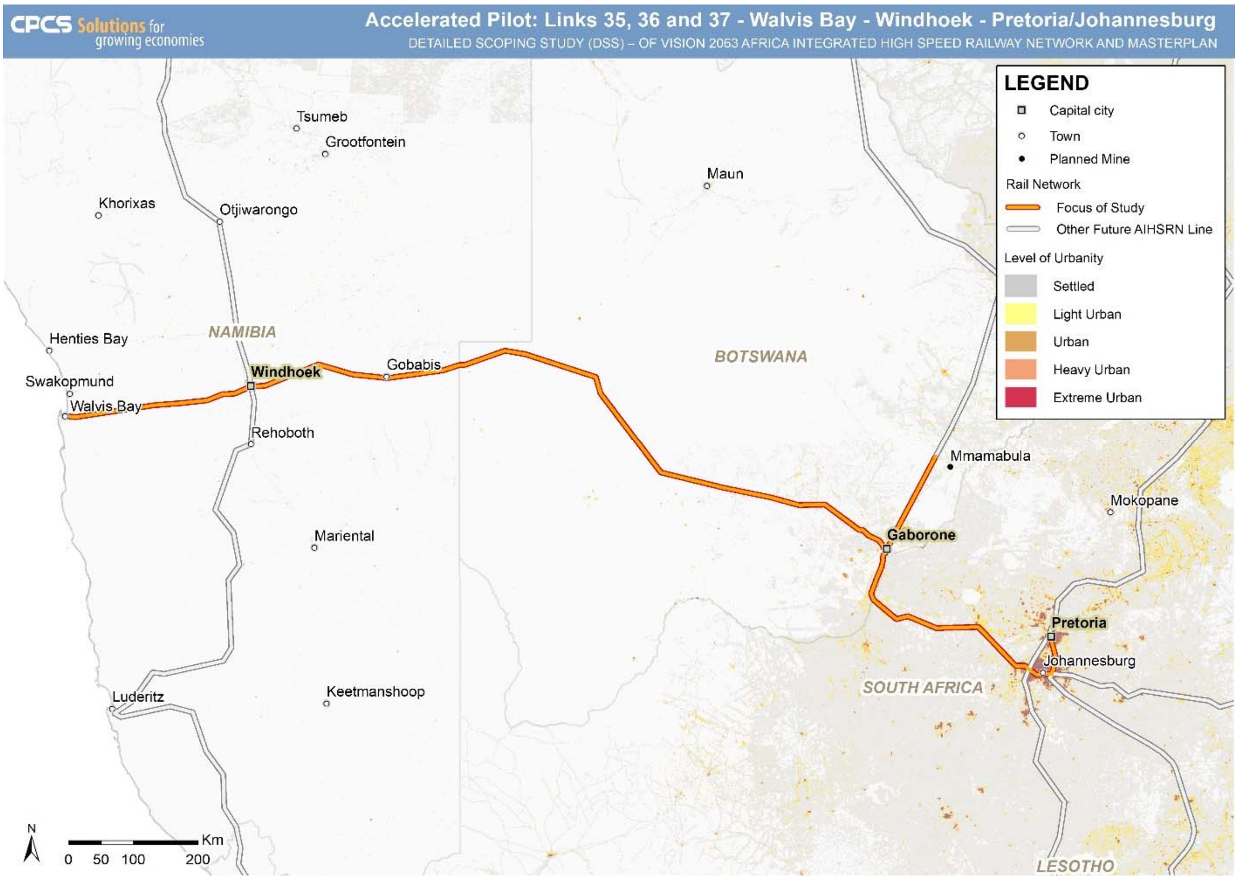
The Johannesburg-Gaborone-Windhoek-Walvis Bay Railway Line is envisaged to connect Johannesburg and Pretoria in the South with Gaborone in Botswana through to Windhoek and the port of Walvis Bay in Namibia. In addition, a branch line is to run from near Gaborone northwest to the Mmamabula coal fields. Coal exports are anticipated to be a major commodity moved on the railway. Other traffic will include export, import and domestic commodities including containerised traffic

Rail tourism does appear to hold possibilities as the line would provide access to unspoiled habitats of the Kalahari Desert. In addition, the line would provide the most direct link between Swakopmund (a beach resort near Walvis Bay that is a frequent destination for rail tourism excursions) and Pretoria (a frequent starting point for rail tourism excursions).

The governments of Namibia and Botswana signed a Memorandum of Understanding (MOU) in March 2014 to start the joint development of the railway line; and some work has been done in setting the ground work for the feasibility study and project roll-out.

It is also important to note that the Johannesburg-Gaborone-Windhoek-Walvis Bay Railway Line would be one of the first of the Africa Integrated High Speed Railway Network (AIHSRN). Railways recently constructed and operating in Ethiopia, Morocco, Kenya and Nigeria, the railway line under construction in Tanzania, as well as the existing lines in Egypt and those in development throughout the continent will also form key parts of the continental network.

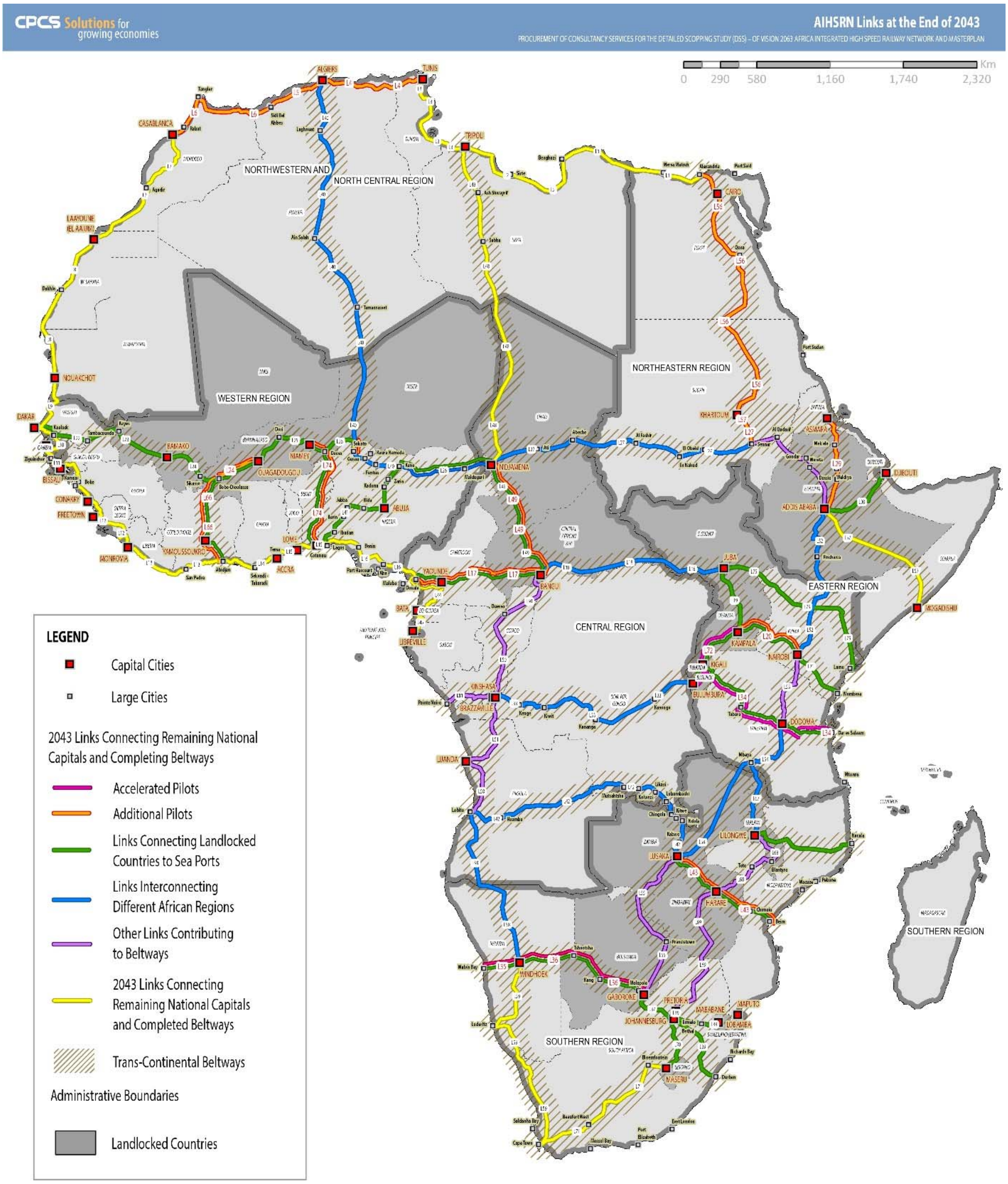
Figure 1: Johannesburg-Gaborone-Windhoe-Walvis Bay Railway Line



The four main objectives of AIHSRN in the long term are as follows:

1. Connect all landlocked countries to sea ports;
2. Provide interconnections between different regions/parts of African continent;
3. Establish "Trans-Africa Beltways", similar to Trans-African Highways (TAH), while also filling transport infrastructure gaps in key transport corridors; and
4. Connect all political and economic capitals.

Figure 2: Africa Integrated High Speed Rail Network (AIHSRN) Master Plan 2043



In order to assure interoperability across the network, key parameters of design and operation are to be standardised as per the following table.

Table 1: Design Standards

Parameter	Standard
Gauge	Standard (1,435 mm)
Design (and permissible) axle load	30 tonnes
Passenger Train Length	600 metres
Freight Train Length	2,000 metres
Design Standards	AREMA or UIC as determined by Consultants
Structure Gauge	AAR plate C
Diesel versus Electrification	To be determined by Consultants
Electrification Traction Voltage (if electric traction is opted for)	25 kV 50 Hz AC.
Signalling & Control System	ETCS with the level determined by the specific operating requirements and environment
Communications System	GSM-R complemented by fibre-optic, VHF or UHF radio and microwave systems
Couplers	Janney (AAR) couplers
Train Brakes	Compressed Air

Each line that will eventually form AIHSRN has been categorised into one of three categories depending on the mix of passenger and freight trains. Design (or maximum operating) speeds should be set in accordance to the intended purpose of the link and the terrain that it traverses, as follows:

- **Category A** – High speed, passenger trains only
  - Speed up to 320 km/h (or 330 km/h)
  - Gradient max. 35‰, Radius min 10,000 m
- **Category B** – Semi-high speed, mix of passenger and freight trains
  - Speed up to 240 km/h for Passenger Service and up to 120 km/h for Freight
  - Gradient max. 12.5‰, Radius min 5,000 m
- **Category C** – Mainly or only freight trains
  - Speed up to 120 km/h
  - Gradient max. 12.5 ‰, Radius depending on speed and terrain

Objectives of the Study

The objective of this study is to determine the technical, financial and economic feasibility of the railway line. Work to be carried out as part of this study will include, but will not be limited to, the following tasks:

1. Development of freight traffic, passenger ridership and railway revenue projections;
2. Identification of electric or diesel operation and estimates of rolling stock requirements;
3. Preliminary design of fixed infrastructure;

4. Identification of best-suited systems and technologies to operate and maintain the railway;
5. Preparation of an Environmental and Social Impacts Assessment (ESIA) and a Resettlement Action Plan (RAP);
6. Project structuring for government and private sector participation;
7. Legal and regulatory analysis;
8. Assessment of the institutional capacity;
9. Financial and economic feasibility assessment; and
10. Preparation of a roadmap for project execution and tender documents for the next phases of the project.

Task Descriptions

Task 1: Projections of freight traffic, passenger ridership and railway revenues

Consultant will by way of consultations, surveys, modelling and analysis generate annual projections of freight traffic, passenger ridership and railway revenues under three scenarios (base, optimistic and pessimistic scenarios) for an operating period of 40 years.

Task 2: Identification of electric or diesel operation and estimates of rolling stock requirements

Based on the estimated freight and passenger traffic (as developed in Task 1) and using operating parameters provided above, the Consultant will develop an operating model for the 40-year projected period for each of the three scenarios. Based on projections of traffic as well as estimates of capital and operating expenditures, the Consultant will undertake an analysis to determine the most cost-effective option between diesel and electric operation for the 40-year projection period. Based on this, the Consultant will make a justifiable recommendation for one over the other; and this will be the basis of the following tasks.

Task 3: Preliminary design of fixed infrastructure

This task will encompass four subtasks, as follows:

Subtask 3.1: Preliminary design of alignment

Starting with the proposed route for the rail line (as shown in Figure 1) and operating and design parameters as shown in Table 1, the Consultant will design the alignment of the railway to within 500 millimetres horizontally and to within 100 mm vertically of final locations.

The Consultant will acquire geometric data by way of LiDAR survey of the full route at a width of 1,200 metres. The discrete point capture density of the LiDAR points will be approximately 3 points per square metre. The relative vertical accuracy of the DTM will be better than 8 cm and the relative horizontal accuracy of the DTM will be better than 10 cm. The Consultant must include the full amount of the LiDAR survey as a separate item within the project budget. The Consultant may also identify an alternative means to gather geometric data to the required detail and completeness and submit a price for this as an alternative to LiDAR survey.

Plan and Profile drawings will be developed to a horizontal scale of 1:5000 and a vertical scale of 1:500 and will include significant railway infrastructure (curves, bridges, viaducts, tunnels, culverts, turnouts, passing loops, stations, electric catenary and substations (if applicable) etc.) as well as major physical features (road crossing, major cuts and fills, waterways, etc.)

Subtask 3.2: Field data collection and testing

As needed, the Consultant will need to undertake the necessary field collection of data to be able to design all railway infrastructure to within 25% of actual requirements. This could include and is not necessarily limited to:

- Soil sampling and rock testing
- Bathymetric and ground surveys
- Hydrological testing and mapping

It will be incumbent on bidders in their proposal to clearly define data needed for preliminary designs and explain how they will acquire necessary data by way of field data collection and testing. The Consultant must include these amounts as a separate item within the project budget.

Subtask 3.3: Preliminary design of fixed infrastructure

The Consultant will start by preparing categorised inventories of fixed infrastructure including but not limited to:

- Bridges, viaducts, and tunnels - categorised by length and type;
- Drainage culverts - categorised by type and diameter and length (or design flows);
- Road crossing – categorised by rail and road traffic levels and speeds;
- Curves - categorised by radius;
- Cuts – categorised by depth and material;
- Fills – categorised by depth;
- Turnouts – categorised by type and track location (tangent, spiral or curved track);
- Maintenance facilities used for the inspection, maintenance, cleaning and servicing (include fuelling if applicable) of locomotives, wagons, coaches and track maintenance/testing equipment – categorised by facility function and equipment type.

For each category of fixed infrastructure, the Consultant will prepare representative drawings to an accuracy of 25% of actual requirements. The drawings should be comprehensive of all key elements of the infrastructure. In the case of fills and cuts, it will be necessary to prepare cross-sectional drawings showing the track structure, formation and drainage for tangents, curves and spirals. In addition, where needed, typical drawings should be prepared for double track including passing loops and station tracks.

(It will be incumbent on bidders in their proposal to clearly define the drawings they will produce and the scale they will be produced to).

In addition, as part of this task, the Consultants will develop a detailed Bill of Quantities for each category of infrastructure. This will be provided within a deliverable and will be used as the basis of capital cost estimates.

Subtask 3.4: Projections of capital costs of fixed infrastructure

The Consultants will estimate annual capital costs of fixed infrastructure for railway development and implementation as well as for sustained operation for the 40-year projection period. Capital costs are to include fixed infrastructure under the three scenarios identified in Task 1.

<u>Task 4: Identification of best-suited systems and technologies to operate and maintain the railway</u>

This tasks will consist of the two subtasks:

Subtask 4.1: Development of an Operating and Maintenance Plan (OMP)

The OMP will identify:

- Locations, staff and plans for crewing, marshalling and fuelling (if applicable) of trains;
- Locations, staffing, facilities, major equipment and service/inspection schedules for the maintenance of locomotives, freight wagons and passenger equipment;
- Staffing, crew location, facilities, major equipment and schedules for the inspection, testing, monitoring and maintenance of track and other fixed infrastructure as well as for systems (such as signals and control telecommunication, and electric traction and distribution (if applicable);
- Processes, systems and staffing for train dispatching, locomotive and coach management, car control, marketing and revenue collection, and overall management of railway activities.

In preparing the OPM, the Consultant should identify international best practices and make recommendations on which should be implemented (and why) as well as how they will be implemented.

Subtask 4.2: Identification of rolling stock requirements

The Consultant will estimate the rolling stock (locomotives, wagons, coaches, etc.) requirements for 40 years of operations under the base, optimistic and pessimistic scenarios. In addition, the Consultant is to confirm all design and operating parameters for each type of locomotive, wagon and coach.

Subtask 4.3: Identification and specifications for systems and major equipment

The Consultant will specify systems and major equipment and prepare preliminary designs of infrastructure to be used for the following:

- Signalling and train control systems for control of the movements of trains and maintenance personnel (in line with standards included in Table 1);
- Telecommunications systems for communications between trains, dispatchers and maintenance employees (in line with standards included in Table 1);
- Electric traction and distribution systems for trains (if applicable and in line with standards of Table 1);
- Any other systems used to assign, monitor and schedule servicing of rolling stock, collect revenue and monitoring the financial health of the railway;
- Major equipment for the inspection, testing, monitoring and maintenance of track and other fixed infrastructure as well as for systems (as above);
- Major equipment used in the maintenance and inspection of locomotives, wagons and rolling stock.

In each, the Consultant is to identify no less than three options for each of the categories and undertake options analysis to identify and justify the preferred option for each.

Subtask 4.4: Projections of capital costs

The Consultant will estimate annual capital costs of rolling stock, systems, equipment and tools under the three scenarios identified in Task 1 for railway development and implementation as well as for sustained operation for the 40-year projection period.

Subtask 4.5: Projections of operating revenues and costs

The Consultant is to project operating annual revenues (from freight and passenger operations as well as other sources of revenue) and annual operating costs under the three scenarios identified in Task 1. Operating costs to include all costs to operate and maintain the railway for 40 years of operation.

<u>Task 5 - Environmental and Social Impacts Assessment (ESIA) and Resettlement Action Plan (RAP)</u>

The Consultant will prepare a full Environmental and Social Impacts Assessment (ESIA), including an Environmental Management Plan, Resettlement Policy Framework (RPF) and Resettlement Action Plan (RAP).

The work undertaken as part of this task will need to be in accordance to all relevant laws and policies of South Africa, Botswana and Namibia, including but not limited to:

South Africa:

- National Environmental Management Act (NEMA), 1998 (as amended);
- National Environmental Management Laws Second Amendment Act, 2013;
- National Environmental Management Act, EIA Regulations, 2014

Botswana:

- Botswana EIA Act (2012)
- Agricultural Resources 1983 (Conservation) Act
- Land Control Act, (1986)
- Monuments and Relics Act (revised 2001)

Namibia:

- Environmental Management Act No. 7 of 2007 (EMA)
- Environmental Assessment Policy for Sustainable Development and Environmental Conservation, 1995
- Local Authorities Act No. 23 of 1992

In addition, the work should also comply with the environmental and social safeguard policy requirements of [*insert the relevant funding agency's name*]. Where discrepancies are found between national requirements and those of [*insert the relevant funding agency's name*], the stricter of the two will apply. [*Delete this paragraph if no funding agency is involved*.]

<u>Task 6: Project structuring for government and private sector participation</u>

Based on international practices for railway development, the Consultant will identify and describe all possible structures for participation of the government and private sector entities in the development and operation of the railway. In each case, the Consultant will identify:

- Examples of how the structures have been successfully and not successfully used;
- The pros and cons of the structure;
- How the structure would be applied in the case of the Johannesburg-Gaborone-Windhoek-Walvis Bay Railway Line;
- How well the structure serves the governments' mandate for the railway;
- How well the structure serves the long-term development objectives of the Africa Integrated High Speed Rail Network.

The Consultant will then rank the structures and make a justifiable recommendation as to which should be implemented. At least three options should be subjected to legal and regulatory analysis (Task 7) and financial and economic feasibility assessment (Task 9).

Task 7: Legal and regulatory analysis

The Consultant will identify all national and international laws and regulations that will impact the development and operation of the railway with full consideration of plans for physical development of infrastructure and operation of the railway (as developed in Tasks 1-5) under all structures identified in Task 6. For the three highest-ranked structures, the Consultants will identify how railway development and operation will be structured to conform to laws and regulations. In the event that the existing regulations and laws do not permit the implementation of the structure as envisaged in Task 6, the Consultant will identify the gap and recommend how the laws would need to be modified to permit the structure.

Task 8: Assessment of the institutional capacity

For the three structures identified in Task 6, the Consultant will identify the government entities that will participate in railway development and operation. In each case, the Consultant will identify the role of each entity in the railway development and operations and its current capacity to execute its mandates. Where shortcomings are identified, the Consultant is to recommend measures necessary to remedy the shortfall in capacity.

Task 9: Financial and economic feasibility assessment

This tasks will consist of the four subtasks, as follows:

Subtask 9.1: Assessment of financial viability

Based on the forecasted annual streams of revenues and costs, the Consultant will estimate the financial internal rate of return (FIRR) and financial net present value (FNPV) of the project and of the project participants (government and private sector) under the three scenarios (developed in Task 1) with each of the three structures (identified in Task 6).

Subtask 9.2: Assessment of economic viability

The Consultant will conduct economic cost benefit analysis (CBA) to estimate the economic internal rate of return (EIRR) and economic net present value (ENPV) of the project for the three scenarios identified in Task 1. This will involve converting the financial costs and revenues to economic costs and benefits applying an appropriate set of conversation factors and taking into account monetisable externalities. In addition, the Consultant should provide qualitative discussions of externalities that may not be monetisable for inclusion in CBA.

Subtask 9.3: Undertake sensitivity analysis

The Consultants are to identify key drivers of financial and economic viability and to analyse impacts of the drivers on forecasted financial and economic returns. This should include but not be limited to future coal prices and international demand; development of other regional railways in standard gauge (in particular those forming part of the AIHSRN); and increased congestion and delays in the South African rail network.

Subtask 9.4: Make clear recommendations as to moving forward

Based on all the foregoing analysis and assessment, the Consultant is to make clear, justified recommendations for moving the project. If there is a recommendation for moving ahead, the recommendation should include the structure that should be used.

(The Consultant is to move ahead with Task 10 only after it has received direction from the Client to do so).

Task 10: Preparation of roadmap for project execution and tender documents for the next phases of the project

This task will consist of the two subtasks, as follows:

Subtask 10.1: Roadmap

The Consultant is to clearly identify the steps that must be taken by the Clients and other government stakeholders (as identified by the Client) to execute this project from development through to sustained operations. For each step, the Consultant must identify the responsible party, funding and other resource requirements, and timelines.

Subtask 10.2: Tender documents

The next phase of the project will depend on the structure adopted by the Client based on the Consultant's recommendations made in Task 9. The Consultant is to prepare tender documents for the next phases of the project. As a minimum, tender documents must be for detailed design of fixed infrastructure. Depending on the selected structure, tender documents may also need to be prepared for construction of fixed infrastructure, procurement of rolling stock and systems, and railway commissioning and operations.

Key Staff

Position	Qualifications
Team Leader	▪ Master degree in engineering, economics, business administration or similar ▪ At least 15 years of experience in the rail sector ▪ Experience leading and managing a multidisciplinary team on at least five rail projects on the African continent ▪ Fluent in English
Transport Economist	▪ Master degree in economics or similar ▪ At least 15 years of experience developing traffic and revenue forecasts and conducting economic assessments ▪ Experience working on at least five rail projects, with at least one in Africa ▪ Fluent in English
Railway Operations Expert	▪ Bachelor degree in engineering ▪ At least 15 years of experience in a railway operating and/or consulting ▪ Experience on at least five rail projects in Africa or five years of experience in the rail sector in Africa

Position	Qualifications
	▪ Fluent in English
Railway Civil Engineer	▪ Bachelor degree in engineering ▪ At least 15 years of experience of experience in the operation or design of railway infrastructure ▪ Experience on at least five rail projects in Africa or five years of experience in the rail sector in Africa ▪ Fluent in English
Railway Systems Engineer	▪ Bachelor degree in engineering ▪ At least 15 years of experience in the design or operations of railways signals, telecommunications or controls systems ▪ Fluent in English
Environmental Expert	▪ Master degree in environmental management, environmental law, economics, engineering, or similar ▪ At least 15 years of experience conducting environmental impact assessments ▪ Experience on at least five rail projects in Africa or five years of experience in the rail sector in Africa ▪ Fluent in English
Social/Resettlement Expert	▪ Master degree in environmental management, social sciences, economics, engineering, or similar ▪ At least 15 years of experience conducting social impact assessments and preparing resettlement action plans ▪ Experience on at least five rail projects in Africa or five years of experience in the rail sector in Africa ▪ Fluent in English
Project Finance Expert	▪ Bachelor degree along with Chartered Financial Analyst (CFA) accreditation, Master degree in Finance or Business Administration, or similar ▪ At least 15 years of experience in financial consulting or in railway management ▪ Experience on at least three projects assessing the financial viability of a railway ▪ Fluent in English
Institutional Expert	▪ Bachelor degree ▪ At least 15 years of experience in institutional capacity assessment and institutional development, preferably in the transport sector ▪ At least three projects leading the evaluation and strengthening of an organisation in advance of a railway project with at least one project in Africa ▪ Fluent in English
Legal Expert	▪ Master degree in law or a lawyer ▪ At least 15 years of experience in transport law and PPP ▪ Experience on at least three rail projects on the African continent, advising on the legal and regulatory framework for the rail sector ▪ Fluent in English
Procurement Expert	▪ Bachelor degree ▪ Experience in preparing tender documents for the design, design-construction or construction of five transport projects with at least one being a railway project ▪ Fluent in English

Deliverables

Deliverable	Contents and Tasks	Due Date
Inception Report	Findings, clarifications and major issues from first month of project	Week 6
Traffic and Revenue Report	1	Week 14
Preliminary Design and Technical Report	2, 3, 4	Week 20
Interim Report	6, 7, 8	Week 26
Environmental and Social Report	5	Week 38
Feasibility Report	9	Week 45
Road Map	10.1	Week 49
Tender Documents	10.2	Week 52
Final Report	Compendium of all key elements of prior submissions	Week 52

Appendix F. TOR for Feasibility Study for Kampala-Bujumbura

The TOR presented in the following pages is for the Kampala-Bujumbura portion of the Dar es Salaam-Kigali / Kampala-Bujumbura because the Dar es Salaam-Kigali section has been studied at the full feasibility study level as of 2019.

Consultancy Services for Feasibility Study for Kampala-Kigali-Bujumbura Railway Line

Terms of Reference

Project Background

East Africa is leading an African railway renaissance. The Mombasa-Nairobi standard gauge railway (SGR) line was completed in 2017 and an extension from Nairobi to Naivasha was completed in October 2019. Plans are to eventually extend it to Kampala and in due course beyond.

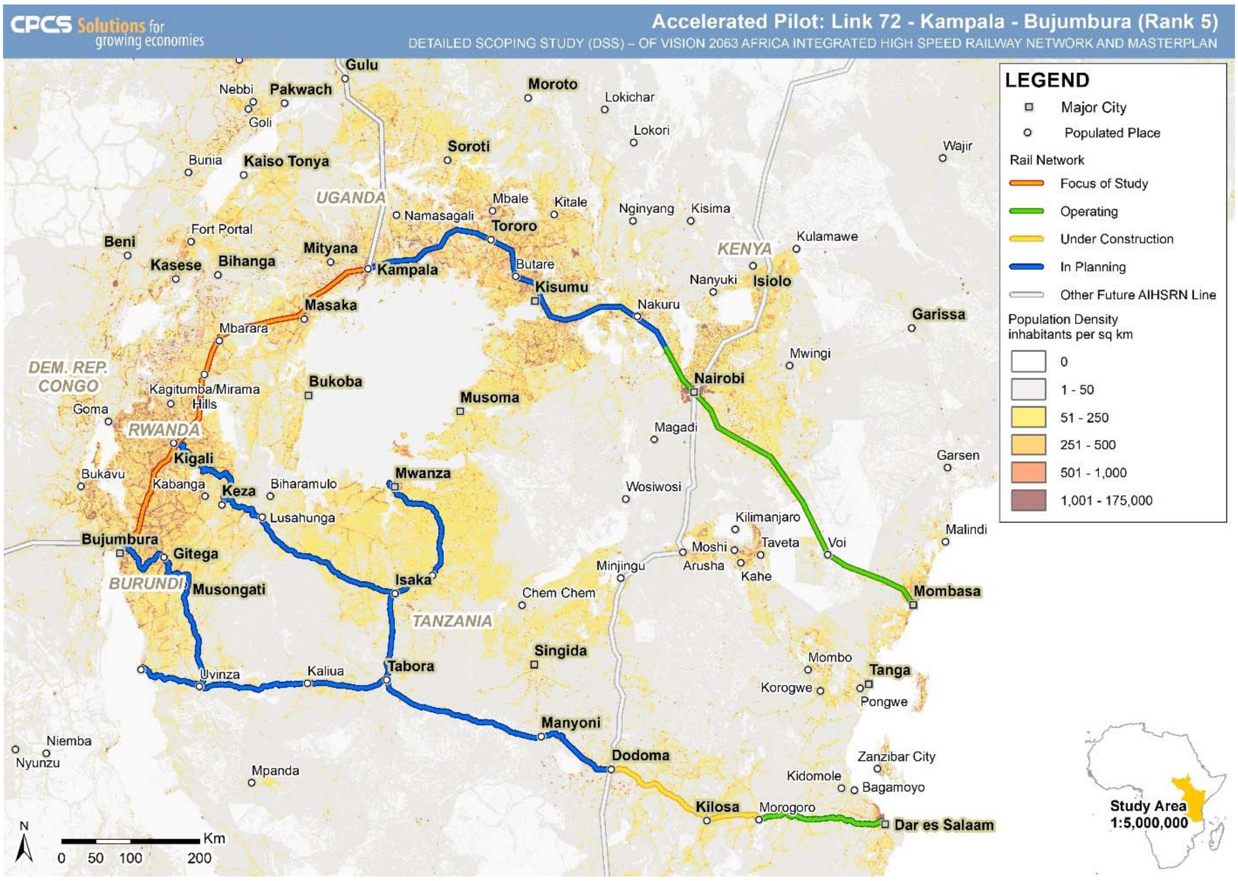
In Tanzania, plans are well in place for its SGR network. The trunk line between Dar es Salaam and Morogoro is scheduled to be complete by the end of 2019, and construction is started on the Morogoro-Makutopora section. In addition, feasibility has been assessed and preliminary designs complete on the line between Makutopora to Isaka and onwards to Kigali in Rwanda. Tanzania has plans to extend its SGR network to Mwanza on Lake Victoria and to Kigoma on Lake Tanganyika.

In December 2019, it was announced that Tanzania signed an agreement to link its SGR network to Burundi and the Democratic Republic of Congo (DRC). The link to Burundi will start at Uvinza (near Kigoma) extending to Gitega, via Msongati and then onwards to Bujumbura and eastern DRC.

The focus of this study is a line connecting Kampala and Bujumbura via Kigali. In due course, the line will provide shippers with three rail route options to sea ports (Kampala-Mombasa, Kigali-Dar es Salaam, and Bujumbura-Dar es Salaam). In addition, the line will reduce transport costs and improve transit times and reliability leading to higher levels of trade between Uganda, Rwanda and Burundi as well as with neighbouring Kenya, Tanzania and DRC. The line will also lead to improved mobility of citizens within the region.

The Kampala-Kigali-Bujumbura Railway Line will be a critical link in the Africa Integrated High Speed Railway Network (AIHSRN) as it will connect three hinterland countries and will greatly improve their access to sea ports. In addition, it provides a solid basis for increasing railway reach into hinterland countries as well as connecting eastern and western Africa by rail.

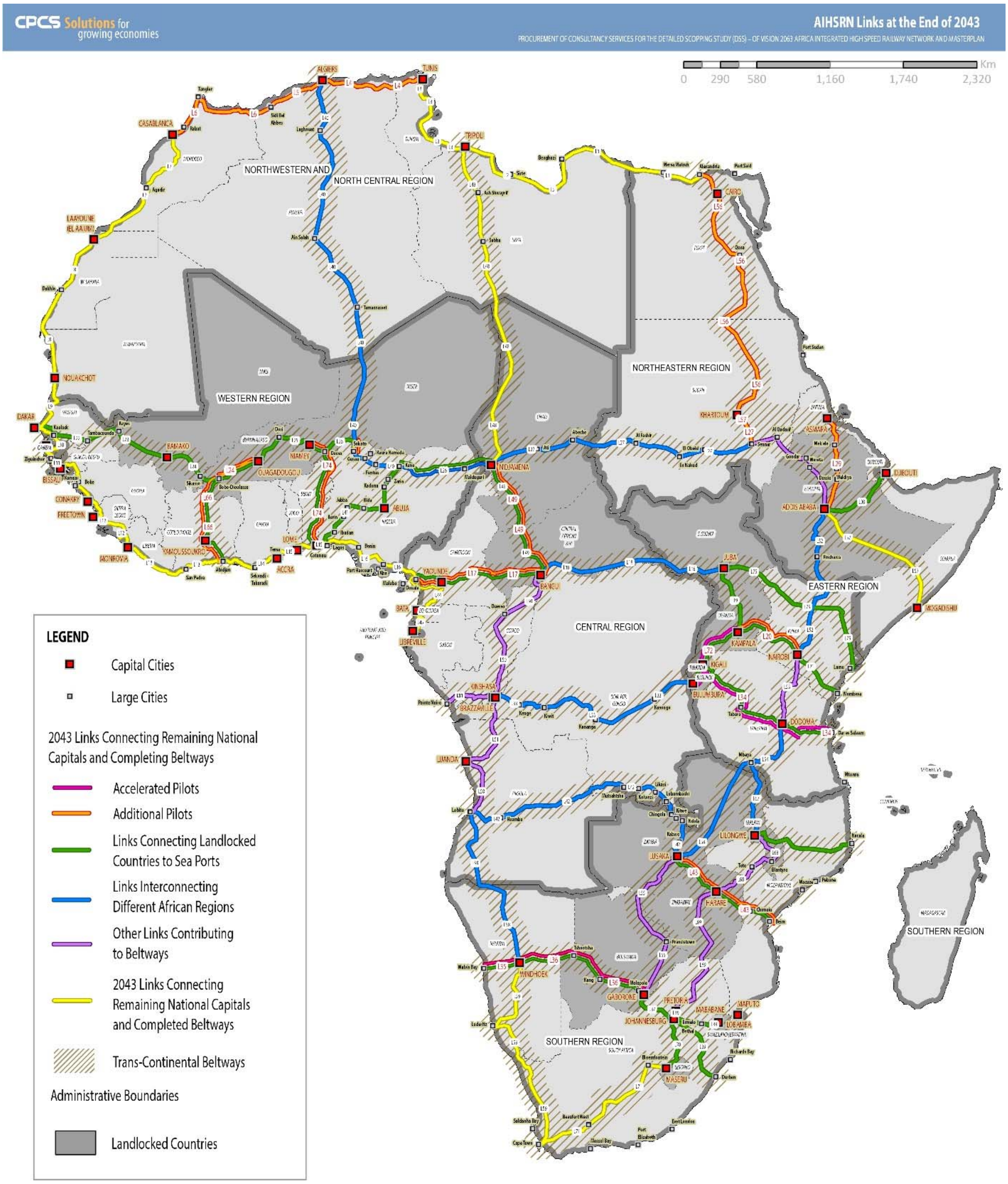
Figure 1: Kampala-Kigali-Bujumbura Railway Line



The four main objectives of AIHSRN in the long term are as follows:

1. Connect all landlocked countries to sea ports;
2. Provide interconnections between different regions/parts of African continent;
3. Establish "Trans-Africa Beltways", similar to Trans-African Highways (TAH), while also filling transport infrastructure gaps in key transport corridors; and
4. Connect all political and economic capitals.

Figure 2: Africa Integrated High Speed Rail Network (AIHSRN) Master Plan 2043



In order to assure interoperability across the network, key parameter of design and operation are to be standardised as per the following table.

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Signalling & Control System	ETCS with the level determined by the specific operating requirements and environment
Communications System	GSM-R complemented by fibre-optic, VHF or UHF radio and microwave systems
Couplers	Janney (AAR) couplers
Train Brakes	Compressed Air

Each line that will eventually form AIHSRN has been categorised into one of three categories depending on the mix of passenger and freight trains. Design (or maximum operating) speeds should be set in accordance to the intended purpose of the link and the terrain that it traverses, as follows:

- **Category A** – High speed, passenger trains only
  - Speed up to 320 km/h (or 330 km/h)
  - Gradient max. 35 ‰, Radius min 10,000 m
- **Category B** – Semi-high speed, mix of passenger and freight trains
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  - Gradient max. 12.5 ‰, Radius min 5,000 m
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Objectives of the Study

The objective of this study is to determine the technical, financial and economic feasibility of the railway line. Work to be carried out as part of this study will include, but will not be limited to, the following tasks:

1. Development of freight traffic, passenger ridership and railway revenue projections;
2. Identification of electric or diesel operation and estimates of rolling stock requirements;
3. Preliminary design of fixed infrastructure;

4. Identification of best-suited systems and technologies to operate and maintain the railway;
5. Preparation of an Environmental and Social Impacts Assessment (ESIA) and a Resettlement Action Plan (RAP);
6. Project Structuring for government and private sector participation;
7. Legal and regulatory analysis;
8. Assessment of the institutional capacity;
9. Financial and economic feasibility assessment; and
10. Preparation of a roadmap for project execution and tender documents for the next phases of the project.

Task Descriptions

Task 1: Projections of freight traffic, passenger ridership and railway revenues

Consultant will by way of consultations, surveys, modelling and analysis generate annual projections of freight traffic, passenger ridership and railway revenues under three scenarios (base, optimistic and pessimistic scenarios) for an operating period of 40 years. As part of this analysis, the Consultant is to assess the impact of various scenarios of development for the three links connecting to sea ports (Kampala-Mombasa, Kigali-Dar es Salaam, and Bujumbura-Dar es Salaam). Specifically, the Consultant is to estimate the impact on freight traffic, passenger ridership and railway revenues in the event one, two and three links are in place.

Task 2: Identification of electric or diesel operation and estimates of rolling stock requirements

Based on the estimated freight and passenger traffic (as developed in Task 1) and using operating parameters provided above, the Consultant will develop an operating model for the 40-year projected period for each of the three scenarios. Based on projections of traffic as well as estimates of capital and operating expenditures, the Consultant will undertake an analysis to determine the most cost-effective option between diesel and electric operation for the 40-year projection period. Based on this, the Consultant will make a justifiable recommendation for one over the other; and this will be the basis of following tasks.

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This task will encompass four subtasks, as follows:

Subtask 3.1: Preliminary design of alignment

Starting with the proposed route for the rail line (as shown in Figure 1) and operating and design parameters as shown in Table 1, the Consultant will design the alignment of the railway to within 500 millimetres horizontally and to within 100 mm vertically of final locations.

The Consultant will acquire geometric data by way of LiDAR survey of the full route at a width of 1,200 metres. The discrete point capture density of the LiDAR points will be approximately 3 points per square metre. The relative vertical accuracy of the DTM will be better than 8 cm and the relative horizontal accuracy of the DTM will be better than 10 cm. The Consultant must include the full amount of the LiDAR survey as a separate item within the project budget. The Consultant may also identify an alternative means to gather geometric data to the required detail and completeness and submit a price for this as an alternative to LiDAR survey.

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- Bridges, viaducts, and tunnels – categorised by length and type;
- Drainage culverts – categorised by type and diameter and length (or design flows);
- Road crossing – categorised by rail and road traffic levels and speeds;
- Curves - categorised by radius;
- Cuts – categorised by depth and material;
- Fills – categorised by depth;
- Turnouts – categorised by type and track location (tangent, spiral or curved track);

- Maintenance facilities used for the inspection, maintenance, cleaning and servicing (include fuelling if applicable) of locomotives, wagons, coaches and track maintenance/testing equipment – categorised by facility function and equipment type.

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(It will be incumbent on bidders in their proposal to clearly define the drawings they will produce and the scale they will be produced to).

In addition, as part of this task, the Consultants will develop a detailed Bill of Quantities for each category of infrastructure. This will be provided within a deliverable and will be used as the basis of capital cost estimates.

Subtask 3.4: Projections of capital costs of fixed infrastructure

The Consultants will estimate annual capital costs of fixed infrastructure for railway development and implementation as well as for sustained operation for the 40-year projection period. Capital costs are to include fixed infrastructure under the three scenarios identified in Task 1.

<u>Task 4: Identification of best-suited systems and technologies to operate and maintain the railway</u>

This tasks will consist of the two subtasks:

Subtask 4.1: Development of an Operating and Maintenance Plan (OMP)

The OMP will identify:

- Locations, staff and plans for crewing, marshalling and fuelling (if applicable) of trains;
- Locations, staffing, facilities, major equipment and service/inspection schedules for the maintenance of locomotives, freight wagons and passenger equipment;
- Staffing, crew location, facilities, major equipment and schedules for the inspection, testing, monitoring and maintenance of track and other fixed infrastructure as well as for systems (such as signals and control telecommunication, and electric traction and distribution (if applicable);

- Processes, systems and staffing for train dispatching, locomotive and coach management, car control, marketing and revenue collection, and overall management of railway activities.

In preparing the OPM, the Consultant should identify international best practices and make recommendations on which should be implemented (and why) as well as how they will be implemented.

Subtask 4.2: Identification of rolling stock requirements

The Consultant will estimate the rolling stock (locomotives, wagons, coaches, etc.) requirements for 40 years of operations under the base, optimistic and pessimistic scenarios. In addition, the Consultant is to confirm all design and operating parameters for each type of locomotive, wagon and coach.

Subtask 4.3: Identification and specifications for systems and major equipment

The Consultant will specify systems and major equipment and prepare preliminary designs of infrastructure to be used for the following:

- Signalling and train control systems for control of the movements of trains and maintenance personnel (in line with standards included in Table 1);
- Telecommunications systems for communications between trains, dispatchers and maintenance employees(in line with standards included in Table 1);
- Electric traction and distribution systems for trains (if applicable and in line with standards of Table 1);
- Any other systems used to assign, monitor and schedule servicing of rolling stock, collect revenue and monitoring the financial health of the railway;
- Major equipment for the inspection, testing, monitoring and maintenance of track and other fixed infrastructure as well as for systems (as above);
- Major equipment used in the maintenance and inspection of locomotives, wagons and rolling stock.

In each, the Consultant is to identify no less than three options for each of the categories and undertake options analysis to identify and justify the preferred option for each.

Subtask 4.4: Projections of capital costs

The Consultant will estimate annual capital costs of rolling stock, systems, equipment and tools under the three scenarios identified in Task 1 for railway development and implementation as well as for sustained operation for the 40-year projection period.

Subtask 4.5: Projections of operating revenues and costs

The Consultant is to project operating annual revenues (from freight and passenger operations as well as other sources of revenue) and annual operating costs under the three scenarios identified in Task 1. Operating costs to include all costs to operate and maintain the railway for 40 years of operation.

Task 5 - Environmental and Social Impacts Assessment (ESIA) and Resettlement Action Plan (RAP)

The Consultant will prepare full Environmental and Social Impacts Assessment (ESIA), including an Environmental Management Plan, and Resettlement Policy Framework (RPF) and Resettlement Action Plan (RAP).

The work undertaken as part of this task will need to be in accordance with all relevant laws and policies of Uganda, Rwanda and Burundi, including but not limited to:

Uganda:

- National Environment Act CAP 153, 1995
- The National Environment (Environmental Impact Assessment) Regulations, 1998
- The Water Act Cap, 152, 1997
- The National Environment (Wetlands, River Banks and Lakeshores Management) Regulations, 2000 under the National Environment Act Cap 153, 1995

Rwanda:

- Organic Law No 04/2005 of 08/04/2005 on Environment Protection and Management
- Organic Law N° 08/2005 of 14/07/2005 determining the use and management of land in Rwanda
- Law N°24/2012 of 15/06/2012 relating to the planning of land use and development in Rwanda
- Law N° 18/2007 of 19/04/2007 relating to expropriation in the public interest
- Ministerial order N°002/2008 of 01/4/2008 determining modalities of land registration
- The Land Law in Rwanda

Burundi:

- Law No 1/010 of 30th June 2000 on the Code of Environment and Article 4
- Law No 1/010 of 30th June 2000 on the Code of Environment
- Law No 1/02 of 26 March 2012 on Water Code
- Law No 1/07 of 15 July 2016 on Revision of the Forest Code
- Law No 1/10 of 30 May 2011 on Establishment and Management of Protected Areas
- Law No 1/21 of 15 October 2013 on Mining Code
- Law No 1/13 of 9 August 2011 Revising the Burundi Land

- Decree-Law No 1/037 of 7th July 1993 on Labour Code
- Decree No 100/22 of 7th October 2010 on the Procedure for Environmental Impact Assessment
- Ministerial Decision No. 770/083 of 9th January 2013 on the Procedure for Conducting Scoping

In addition, the work should also comply with the environmental and social safeguard policy requirements of [*insert the relevant funding agency's name*]. Where discrepancies are found between national requirements and those of [*insert the relevant funding agency's name*], the stricter of the two will apply. [*Delete this paragraph is there is no funding agency is involved*.]

Task 6: Project structuring for government and private sector participation

Based on international practices for railway development, the Consultant will identify and describe all possible structures for participation of the government and private sector entities in the development and operation of the railway. In each case, the Consultant will identify:

- Examples of how the structures has been successfully and not successfully used;
- The pros and cons of the structure;
- How the structure would be applied in the case of the Kampala-Kigali-Bujumbura Railway Line;
- How well the structure serves the government's mandate for the railway;
- How well the structure serves the long-term development objectives of the Africa Integrated High Speed Rail Network.

The Consultant will then rank the structures and make justifiable recommendations as to which should be implemented. At least three options should be subjected to legal and regulatory analysis (Task 7) and financial and economic feasibility assessment (Task 9).

Task 7: Legal and regulatory analysis

The Consultant will identify all national and international laws and regulations that will impact the development and operation of the railway with full consideration of plans for physical development of infrastructure and operation of the railway (as developed in Tasks 1-5) under all structures identified in Task 6. For the three highest ranked structures, the Consultants will identify how railway development and operation will need to be structured to conform to laws and regulations. In the event that the existing regulations and laws do not permit the implementation of the structure as envisaged in Task 6, the Consultant will identify the gap and recommend how the laws would need to be modified to permit the structure.

Task 8: Assessment of the institutional capacity

For the three structures identified in Task 6, the Consultant will identify the government entities that will participate in railway development and operation. In each case, the Consultant will identify the role of each entity in the railway development and operations and its current capacity to execute its mandates. Where shortcomings are identified, the Consultant is to recommend measures necessary to remedy the shortfall in capacity.

Task 9: Financial and economic feasibility assessment

This tasks will consist of the four subtasks, as follows:

Subtask 9.1: Assessment of financial viability

Based on the forecasted annual streams of revenues and costs, the Consultant will estimate the financial internal rate of return (FIRR) and financial net present value (FNPV) of the project and of the project participants (government and private sector) under the three scenarios (developed in Task 1) with each of the three structures (identified in Task 6).

Subtask 9.2: Assessment of economic viability

The Consultant will conduct an economic cost benefit analysis (CBA) to estimate the economic internal rate of return (EIRR) and economic net present value (ENPV) of the project for the three scenarios identified in Task 1. This will involve converting the financial costs and revenues to economic costs and benefits applying appropriate set of conversation factors and taking into account monetisable externalities. In addition, the Consultant should provide qualitative discussions of externalities that may not be monetisable for inclusion in CBA.

Subtask 9.3: Undertake sensitivity analysis

The Consultants are to identify key drivers of financial and economic viability and to analyse impacts of the drivers on forecasted financial and economic returns. This should include but not be limited to future coal prices and international demand; development of other regional railways in standard gauge (in particular those forming part of the AIHSRN); and increased congestion and delays in the South African rail network.

Subtask 9.4: Make clear recommendations as to moving forward

Based on all the foregoing analysis and assessment, the Consultant is to make a clear, justified recommendations for moving the project. If there is a recommendation for moving ahead, the recommendation should include the structure that should be used.

(The Consultants are to move ahead with Task 10 only after they have received direction from the Client to do so).

Task 10: Preparation of roadmap for project execution and tender documents for the next phases of the project

This tasks will consist of the two subtasks, as follows:

Subtask 10.1: Roadmap

The Consultant is to clearly identify the steps that must be taken by the Clients and other government stakeholders (as identified by the Client) to execute this project from development through to sustained operations. For each step, the Consultant must identify the responsible party, funding and other resource requirements, and timelines.

Subtask 10.2: Tender documents

The next phase of the project will depend on the structure adopted by the Client based on the Consultant's recommendations made in Task 9. The Consultant is to prepare tender documents for the next phases of the project. As a minimum, tender documents must be for detailed design of fixed infrastructure. Depending on the selected structure, tender documents may also need to be prepared for construction of fixed infrastructure, procurement of rolling stock and systems, and railway commissioning and operations.

Key Staff

Position	Qualifications
Team Leader	▪ Master degree in engineering, economics, business administration or similar ▪ At least 15 years of experience in the rail sector ▪ Experience leading and managing a multidisciplinary team on at least five rail projects on the African continent ▪ Fluent in English and French
Transport Economist	▪ Master degree in economics or similar ▪ At least 15 years of experience developing traffic and revenue forecasts and conducting economic assessments ▪ Experience working on at least five rail projects, with at least one in Africa ▪ Fluent in English and French
Railway Operations Expert	▪ Bachelor degree in engineering ▪ At least 15 years of experience in a railway operating and/or consulting ▪ Experience on at least five rail projects in Africa or five years of experience in the rail sector in Africa ▪ Fluent in English ▪ Knowledge of French is an advantage
Railway Civil Engineer	▪ Bachelor degree in engineering ▪ At least 15 years of experience of experience in the operation or design of railway infrastructure ▪ Experience on at least five rail projects in Africa or five years of experience in the rail sector in Africa ▪ Fluent in English ▪ Knowledge of French is an advantage
Railway Systems Engineer	▪ Bachelor degree in engineering ▪ At least 15 years of experience in the design or operations of railways signals, telecommunications or controls systems ▪ Fluent in English ▪ Knowledge of French is an advantage
Environmental Expert	▪ Master degree in environmental management, environmental law, economics, engineering, or similar ▪ At least 15 years of experience conducting environmental impact assessments ▪ Experience on at least five rail projects in Africa or five years of experience in the rail sector in Africa ▪ Fluent in English and French

Position	Qualifications
Social/Resettlement Expert	▪ Master degree in environmental management, social sciences, economics, engineering, or similar ▪ At least 15 years of experience conducting social impact assessments and preparing resettlement action plans ▪ Experience on at least five rail projects in Africa or five years of experience in the rail sector in Africa ▪ Fluent in English and French
Project Finance Expert	▪ Bachelor degree along with Chartered Financial Analyst (CFA) accreditation, Master degree in Finance or Business Administration, or similar ▪ At least 15 years of experience in financial consulting or in railway management ▪ Experience on at least three projects assessing the financial viability of a railway ▪ Fluent in English ▪ Knowledge of French is an advantage
Institutional Expert	▪ Bachelor degree ▪ At least 15 years of experience in institutional capacity assessment and institutional development, preferably in the transport sector ▪ At least three projects leading the evaluation and strengthening of an organisation in advance of a railway project with at least one project in Africa ▪ Fluent in English and French
Legal Expert	▪ Master degree in law or a lawyer ▪ At least 15 years of experience in transport law and PPP ▪ Experience on at least three rail projects on the African continent, advising on the legal and regulatory framework for the rail sector ▪ Fluent in English and French
Procurement Expert	▪ Bachelor degree ▪ Experience in preparing tender documents for the design, design-construction or construction of five transport projects with at least one being a railway project ▪ Fluent in English and French

Deliverables

Deliverable	Contents/ Tasks	Due Date
Inception Report	Findings, clarifications and major issues from first month of project	Week 6
Traffic and Revenue Report	1	Week 14
Preliminary Design and Technical Report	2, 3, 4	Week 20
Interim Report	6, 7, 8	Week 26
Environmental and Social Report	5	Week 38
Feasibility Report	9	Week 45
Road Map	10.1	Week 49
Tender Documents	10.2	Week 52
Final Report	Compendium of all key elements of prior submissions	Week 52

Appendix G. Draft Multinational Treaty / Cooperation Agreement for Accelerated Pilot: Gaborone-Walvis Bay

TREATY

ON THE ESTABLISHMENT OF THE GABORONE-WALVIS BAY RAIL CORRIDOR

BETWEEN

THE GOVERNMENTS OF

THE REPUBLIC OF BOTSWANA, THE REPUBLIC OF NAMIBIA, AND THE REPUBLIC OF SOUTH AFRICA

The Government of the Republic of Botswana

The Government of the Republic of Namibia, and

The Government of the Republic of South Africa.

Hereinafter referred to as "the Contracting Parties"

PREAMBLE

ANIMATED by the desire to maintain, further develop and strengthen friendly relations and cooperation among themselves;

BEING OF THE VIEW that no country, whether landlocked or not should be isolated from the rest of the world;

DESIROUS TO ENSURE the smooth and rapid movement of goods and persons originating from or destined to a Contracting Party in transit through the territories of other Contracting Parties as well as the smooth and rapid movement of goods and persons between their respective territories;

RECALLING the Treaty establishing the African Economic Community (Abuja 1991) and the Treaty of the Southern African Development Community (Windhoek, 1992) to which all Contracting Parties have subscribed;

TAKING INTO ACCOUNT the principles formulated and the rules agreed upon in the Agreement establishing the World Trade Organisation (Marrakech, 1994), the customs convention on containers (Geneva, 1972), and the Convention on the simplification and Harmonization of Customs Procedures (Kyoto, 1973);

AWARE of the inter-dependence between the transport sector and all the other sectors of the economy;

RECOGNIZING that the Gaborone-Walvis Bay Rail Corridor is important towards developing an integrated rail infrastructure and transit system which is economical, safe and environmentally sustainable in order to boost the agricultural, mineral, tourism and energy resources existing in the region;

RECOGNIZING the strategic importance of the African Continental Free Trade Area (AfCFTA), established by the AfCTFA Declaration in Kigali in March 2018, to boosting intra-Africa trade, and enhancing the economic growth of the continent;

FURTHER AWARE that neither government nor private enterprises can singularly assume all risks of investment, maintenance and operation of transport and communications facilities and equipment thus noting that close coordination between the Government and the Private Sector is key to the development of trade and transit facilitation;

ACKNOWLEDGING the importance of developing along the Gaborone-Walvis Bay Rail Corridor an integrated infrastructure and transit system which is economical, safe and environmentally sustainable;

CONVINCED that a regional approach is the best way to implement a project of such a magnitude as the Gaborone-Walvis Bay Rail Corridor by putting in place an institutional framework to oversee the project implementation and management process.

DO HEREBY AGREE AS FOLLOWS:

CHAPTER I: GENERAL PROVISIONS

Article 1: Definitions

For the purpose of this Treaty, the following terms and expressions shall have the meanings hereby assigned to them:

Authority: means the Gaborone-Walvis Bay Rail Corridor Management Authority;

Corridor: means the Gaborone-Walvis Bay Rail Corridor located in:

a) the Republic of Botswana;

b) the Republic of Namibia; and

c) the Republic of South Africa.

Hazardous Material: means any substance or material that could adversely affect the safety of the public, handlers or carriers during transportation. These include explosives, compressed gases, flammable liquids and solids, oxidizers and organic peroxides, toxic materials, radioactive materials, corrosive materials and any other material that presents a hazard in transportation.

Depository: means the Executive Secretary of the Southern African Development Community in accordance with Article 19;

Development Corridor: means the spatial development initiative approach to mobilise investment resource for the development of transportation, infrastructure, facilities and services in coordination with other sectors of the economy in, the Corridor;

Enabling Legislation: means the domestic legislation passed by each Contracting Party to incorporate this Treaty;

Facilities: means infrastructure such as buildings or equipment put in place for the purpose of enabling the execution of a specific task in relation to transportation and the transit of vehicles, goods and persons;

Facilitation: means procedures or measures put in place to ease the transportation of transit vehicles, goods and persons through the corridor;

Goods: means all personal chattels and include wares, ores, livestock, aquatic animals and products, merchandise, crops, currencies and other articles offered for transportation;

Interstate Traffic or Transport: means the transport of goods or passengers between two or more Contracting Parties;

Joint Border Post: means a border post established at designated land borders at which all traffic utilising the border post stops only once in each direction of travel and both exit and entry procedures are jointly undertaken by border control officers of the adjoining Contracting Parties from within the common control zone;

Steering Committee: means the Committee set up by Heads of States and Governments of the Contracting Parties in accordance with Article 10;

Other stakeholders: means actors or representatives of private sector, civil society, nongovernmental organisations or any other recognisable bodies as may from time to time be identified.

Project: means the construction and management of the railway from Gaborone, in the Republic of Botswana, to Walvis Bay, in the Republic of Namibia;

Right of Way: means the entire carriage way as well as adjacent portions of land, reserved sidewalks, roadside corridors for utilities, and future expansions as may be required;

Supra-National Status: means the transcending powers granted to the Gaborone-Walvis Bay Rail Corridor Management Authority. It also means the status granted to the railway which transcends the jurisdiction of the national laws, regulations or policies of the Contracting Parties;

Traffic in Transit: means the traffic passing across the territory of contracting party with or without transhipment warehousing, break bulk, cleaning, repairing, replacing assembly, disassembly, reassembly of machinery and goods, or change of mode and means of transport;

Transit: means the passage across the territories of Contracting Parties when such passage is only a portion of a complete journey, terminating beyond the frontier of the Parties across whose territory the transit takes place;

Other Terms and Expressions:

Words in the singular include the plural unless the context otherwise requires;

Unless otherwise indicated, references to "Chapters", "Articles", and "Paragraphs" refer to chapters of, articles to, and paragraphs of this Treaty.

Article 2: Establishment, Construction and Management of the Corridor

The Contracting Parties hereby:

a) establish the Corridor;

b) establish the Authority which shall have Supra-National Status, in accordance with the provisions of Article 9; and

c) undertake to construct and manage a railway more particularly described in the International Project Agreement, with complementary trade and transport facilitation measures, linking Gaborone (Botswana) to Walvis-Bay (Namibia), with such extensions and expansions as the Contracting Parties shall from time to time agree to.

Article 3: The Objectives and Scope of the Corridor

1. The objectives of the Corridor shall be to:

    a) facilitate safe and efficient movement of persons and goods, regional and international trade and transport by improving on the railway infrastructure and simplifying and harmonising the requirements and controls that govern the movement of goods and persons with a view to reducing transportation costs and transit times;

    b) stimulate economic and social development in the territories of the Contracting Parties and partnership between the public and private sectors;

    c) transform the Corridor into a Development Corridor which, in addition to offering safe, fast and competitive transport and transit services that secure regional trade, will also stimulate investment, encourage sustainable development, poverty reduction and guarantee security on the Corridor; and

    d) implement strategies for accelerating economic and social growth along the Corridor while ensuring environmental sustainability.

2. The alignment of the Corridor is as follows:

    a) Botswana: [insert origin] - [insert destination];

    b) Namibia: [insert origin] - [insert destination]; and

    c) South Africa: [insert origin] - [insert destination].

Article 4: Guiding Principles

a) Principle of Transparency

The Contracting Parties agree to cooperate in a transparent manner concerning issues relating to the funding, development, management and operation of the Corridor.

b) Principle of Equity

The Contracting Parties agree to manage and operate the Corridor in an equitable manner in the areas of funding, development, operation and management in order to achieve their objective.

c) Principle of Solidarity

The Contracting Parties agree that the principle of solidarity shall guide the implementation of this Treaty.

d) Principle of Mutual Assistance

The Contracting Parties shall give assistance to one another as may be required in matters of customs, immigration, security, health and any other such areas of interest with respect to the use of the Corridor. This assistance includes, but is not limited to, control at each entry and exit point of their respective territories.

e) Principle of Subsidiarity

The Contracting Parties agree to apply the principle of subsidiarity by granting the necessary powers to any authority or other body established under this Treaty to act for and on their behalf.

CHAPTER II: OBLIGATIONS OF THE CONTRACTING PARTIES

Article 5: Areas of Collaboration

The Contracting Parties agree to collaborate in matters relating to the following:

1. Infrastructure Development
   - a) Updating of existing studies on the different segments of the Corridor to include:
     - i. Economic and financial feasibility studies,
     - ii Detailed technical, engineering and environmental impact studies, and
     - iii. Construction works and supervision.
   - b) Ensuring the sensitization of social epidemics including HIV/AIDS, along the corridor and its area of influence,
2. Transport and Trade Facilitation

   Development and harmonisation of trade and transport facilitation measures along the Corridor, in the following areas:
   - a) port facilities;
   - b) routes and facilities;
   - c) customs control, operation, immigration, police and other agencies;
   - d) documentation and procedures;
   - e) multi-modal transport of goods;
   - f) handling of hazardous material;
   - g) measures of facilitation for transit agencies, traders and employees; and
   - h) construction of the Corridor.
3. To regard the project as a single unit, that may be divided into appropriate lots for purposes of contracting for works, supervision and management.
4. Review the scope and provisions of this Treaty to encourage the development of integrated transportation infrastructure, services and facilities on the Corridor.
5. Make available to the Authority parcels of land on each side to create for the Right of Way for the railway as well as to provide for future expansion and developments.

6. Jointly address matters relating to resettlement, compensation and protection of the Right of Way.
7. Search for the funds needed for the implementation of the Project, including from:
   a) contributions from the Contracting Parties;
   b) contributions from other governments;
   c) Loans from financial institutions, grants, bequests, subventions, donations from national and international donor partners and International institutions or bodies;
   d) Donations from civil society, professional organizations and private companies; and
   e) Donations from beneficiaries of the Corridor, in particular from private companies active along the Corridor.
8. The Contracting Parties agree to, for the time being, entrust the Executive Secretary of the Southern African Development Community with the power to open accounts, receive, accept and deposit at a designated bank on behalf of the Contracting Parties, loans, donations, contributions and grants both in cash and kind, that may from time to time be made for the purpose of the Project.

Article 6: Project Documentation

International Project Agreement

1. The Contracting Parties shall, after signing this Treaty, enter into an International Project Agreement with the Authority. The International Project Agreement shall be executed on behalf of the Contracting Parties by the Steering Committee.
2. A copy of the International Project Agreement shall be lodged with the Depository.

Agreed Regime and Stability

3. The Contracting Parties and the Authority recognise and agree that their rights and obligations relating to the Corridor shall be exclusively governed by the following set of principles, rules and instruments:
   a) this Treaty;
   b) the International Project Agreement;
   c) the Enabling Legislation;
   d) the Procedure Rules;
   e) all other instruments forming part of and or implementing the Agreed Regime, and
   f) all such general principles of international law, international treaties and domestic legislation as may be applicable to the Project, to the extent not inconsistent with any of the instruments contemplated in paragraphs (a), (b), (c), (d) or (e) above.

4. The Contracting Parties further recognise and agree with one another that the harmonised and stable application of this Treaty, the International Project Agreement, the Enabling Legislation and all other elements of the Agreed Regime by all the Contracting Parties throughout the duration of the International Project Agreement and across all three jurisdictions is essential to protect the rights and interests of each of the Contracting Parties in maintaining the Corridor in order to facilitate the transportation of persons, goods and services.

5. Each Contracting Party hereby agrees and undertakes that it shall:

   a) comply with the provisions of the Agreed Regime;

   b) abstain from the use of direct executive action or any action whatsoever, which may discontinue performance of, revoke, amend, suspend, terminate or disable the legal effectiveness of this Treaty; and

   c) abstain from adopting any legislation or do anything which is incompatible with the text and application of this Treaty or of any other instruments forming or contemplated under the Agreed Regime.

Article 7: Action in the Event of Breach of this Treaty

In the event of breach of any of the provisions of the Agreed Regime:

1. The affected Party shall promptly notify the Authority of the breach;
2. The Authority shall serve a notice of the breach on the Party in breach with a request to cease and cure the breach;
3. The Party in breach shall immediately cease and remedy any such breach upon receipt of notice of the breach;
4. Refusal or failure to cease or adequately remedy the breach shall entitle the affected Party to seek remedy under Article 19 of this Treaty.
5. The provisions of the International Project Agreement shall apply to determine any compensatory measures to be taken in respect of the party entitled to a remedy under this Treaty.

CHAPTER III: LEGAL AND INSTITUTIONAL FRAMEWORK

Article 8: Institutional Arrangements

1. Steering Committee

   The Steering Committee established by the Heads of State is composed of the Ministers in charge or railways or in charge of transport from each of the Contracting Parties and the Deputy Executive Secretary of the Southern African Development Community, Regional Integration.

2. The Committee shall, as soon as practicable after the signing of this Treaty, draw up the Procedure Rules which shall apply to its conduct and to any other organ that may be set up by it.

3. For the smooth development and management of the Corridor, the Committee shall set up the following organs:
   a. the Project Delivery Team; and
   b. any other organ or body as may be required.
4. The Steering Committee may by instrument amend the Procedure Rules.

Article 9: Status and Powers of the Authority

1. The Contracting Parties solemnly agree to grant the Authority with legal personality, financial autonomy and the supra-national status provided in Article 2 above.
2. The Authority shall have the responsibility to construct, manage and operate the Corridor and to do such other things as are expedient for the carrying out of its mandate.

Article 10: Competent Authority and Strategic Partnerships

1. For the purpose of implementing this Treaty, the competent authorities of the Contracting Parties shall be their respective Ministries, Departments and Agencies (MDAs) responsible for railways or transport and any other MDAs as may from time to time be required as well as the Deputy Executive Secretary of the Southern African Development Community, Regional Integration.
2. The Contracting Parties shall develop strategic partnerships with the private sector and other institutions for the purpose of ensuring effective and efficient implementation of this Treaty.
3. The Contracting Parties shall make all necessary information regarding the movement of persons, goods and services along the Corridor publicly available through an accessible medium, and inform each other and the other stakeholders.

CHAPTER IV: TRANSIT ROUTES, FACILITIES AND MOVEMENT OF PERSONS AND GOODS

Article 11 - Transit Routes and Facilities

1. *Technical Standards*

The Contracting parties shall develop, harmonise and implement technical standards for infrastructure, facilities, equipment and vehicles along the corridor as per section 7.5 of the Protocol on Transport, Communications and Meteorology in the Southern African Development Community Region (Maseru, 1996). These shall be in accordance with African Union of Railways.

2. *Facilities*

The Authority shall:

a) in partnership with the private sector, construct, facilitate, maintain and operate stopover facilities, at designated places, which shall include storage, buildings, loading and unloading and other ancillary facilities, accommodation for conductors and other train crew, at places that may be agreed by the Contracting Parties;

b) equip the Corridor with communication and data transfer systems as needed in order to monitor inter-state and transit traffic within and through the territories of the Contracting Parties.

3. *Safety and Security Measures*

   a) The Contracting Parties agree to cooperate in the prevention of cross border crimes

   b) The Authority shall:

      i. put in place measures for the safety and security of interstate and transit traffic within or passing through their territories.

      ii. ensure that safety and security measures put in place are designed and implemented without impediments to free movement, transit and interstate transport.

Article 12: Movement of Persons

The Contracting Parties agree to:

a) harmonise their immigration procedures in accordance with the SADC Protocol on the Facilitation of Movement of Persons (Gaborone, 2005);

b) undertake joint immigration controls at their respective borders in accordance with the SADC Protocol on the Facilitation of Movement of Persons (Gaborone, 2005).

Article 13: Frontier Facilities and Services

The Contracting Parties undertake to:

1. *Facilities for the Clearance of Goods*

   Provide adequate facilities to enable the expeditious clearance of interstate and transit traffic at their respective designated border crossing points.

2. *Border Post Facilities*

   a) establish Joint Border Posts at designated border points, to facilitate joint operations and examination of rolling stock and goods to avoid repeated customs control;

   b) provide adequate resources for the expeditious handling of border formalities, such as immigration, customs and health controls;

   c) permit third parties to offer warehousing services for storage of goods in customs bonded warehouses; and

   d) harmonise border working hours for all national border agencies to 24 hours a day to facilitate the movement of goods and persons.

Article 14: Customs Control and Operations

The Contracting Parties agree to:

1. *Joint Customs Posts*

Undertake joint customs controls at their respective borders in accordance with the Southern African Development Community (Maseru, 1996).

2. *Customs Inspection within respective territories*

Expedite, within their respective territories, customs inspection, periods of compulsory stays in parking areas, including periods of inspection of goods and documents, in accordance with the World Customs Organization's principles, relevant Community's acts, conventions, protocols, decisions and resolutions and international best practices.

3. *Harmonisation and Simplification of Procedures*

Simplify, lessen and harmonise documentation and procedures as follows:

a) limit the number of documents and extent of procedures and formalities required for interstate traffic and for traffic in transit; and

b) encourage the harmonisation of customs systems through the interconnectivity of customs administrations along the Corridor.

CHAPTER V: FINAL PROVISIONS

Article 15: Ratification of this Treaty

This Treaty shall be subject to ratification in accordance with the constitutional provisions of the respective Contracting Parties.

Article 16: Amendments.

1. Subject to the provisions of Article 6(3), any Contracting Party may propose to the Depository an amendment to this Treaty, which shall be considered by the Contracting Parties.
2. Any amendments shall be adopted by a unanimous decision of the Contracting Parties.
3. Any amendment to this Treaty which is adopted by the Contracting Parties shall enter into force upon receipt by the Depository of the instruments of ratification, acceptance or approval by the respective Contracting Parties, or such later date as may be specified in the amendment.
4. The Depository shall notify all the Contracting Parties of the entry into force of an amendment.

Article 17: Termination and Withdrawal

1. A Contracting Party may withdraw from this Treaty by giving one year prior notice to the other Contracting Parties.
2. The withdrawal from this Treaty by a Contracting Party in accordance with paragraph (1) of this Article shall be subject to the prior consent of all the other Contracting Parties.
3. The withdrawal of a Contracting Party shall not affect existing obligations arising from this Treaty.

4. The notice of withdrawal shall be lodged with the Depository who in turn shall inform the other Contracting Parties.

5. This Treaty can only be terminated by a unanimous agreement of all the Contracting Parties.

Article 18: Dispute Resolution

1. Any dispute arising from the interpretation or the application of the provisions of this Treaty shall be amicably settled through diplomatic channels or negotiation among the Contracting Parties.

2. Failing this, a Contracting Party may refer the matter to the Tribunal of the Southern African Development Community.

Article 19: Depository

1. The signed Treaty and the instruments of ratification shall be deposited with the Executive Secretary of the Southern African Development Community who is the Depository of this Treaty. Duly certified copies will be transmitted by the Executive Secretary to the Contracting Parties.

2. The Depository shall have the following powers:
    a. keep custody of the original text of this Treaty;
    b. prepare certified copies of the original text and transmit them to Contracting Parties;
    c. receive any signatures to this Treaty and receive and keep custody of any instruments, notification or communications relating to it;
    d. examine whether the signature or any instrument, notification or communication relating to this Treaty is due and in proper form;
    e. inform the Contracting Parties when the number of signatures or of instruments of ratification or acceptance required for the entry into force of this Treaty has been received or deposited.
    f. inform the Contracting Parties of the withdrawal of a Party.
    g. register this Treaty with the Secretariat of the United Nations; and
    h. perform other functions specified in the provisions of the Vienna Convention on the Law of Treaties.

Article 20: Entry into Force

This Treaty shall enter into force and be binding from the day the last Contracting Party deposits its instruments of ratification.

Article 21: Transitional Arrangements

All such functions and powers conferred on the Authority by this Treaty, and the Procedures Rules which were previously being exercised by the Steering Committee, shall automatically vest in the Authority from the date it is empowered to exercise said functions and powers in accordance with the provisions of this Treaty.

Done at [Location, in Country], on the XX day of XXX, XXX in the English language.

IN WITNESS WHEREOF the undersigned, duly authorised by their respective Governments, have duly signed this treaty.

FOR THE GOVERNMENT OF THE REPUBLIC OF BOTSWANA

Signature:

Name:

Title:

FOR THE GOVERNMENT OF THE REPUBLIC OF NAMIBIA

Signature:

Name:

Title:

FOR THE GOVERNMENT OF THE REPUBLIC OF SOUTH AFRICA

Signature:

Name:

Title:

Appendix H. Draft Multinational Treaty / Cooperation Agreement for Accelerated Pilot: Dar es Salaam-Kigali / Kampala-Bujumbura

TREATY

ON THE ESTABLISHMENT OF THE ISAKA-KIGALI KAMPALA-BUJUMBURA RAIL CORRIDOR

BETWEEN

THE GOVERNMENTS OF

THE REPUBLIC OF UGANDA, THE REPUBLIC OF RWANDA, THE UNITED REPUBLIC OF TANZANIA AND THE REPUBLIC OF BURUNDI

The Government of the Republic of Uganda;

The Government of the Republic of Rwanda;

The Government of the United Republic of Tanzania; and

The Government of the Republic of Burundi.

Hereinafter referred to as "the Contracting Parties"

PREAMBLE

ANIMATED by the desire to maintain, further develop and strengthen friendly relations and cooperation among themselves;

BEING OF THE VIEW that no country, whether landlocked or not should be isolated from the rest of the world;

DESIROUS TO ENSURE the smooth and rapid movement of goods and persons originating from or destined to a Contracting Party in transit through the territories of other Contracting Parties as well as the smooth and rapid movement of goods and persons between their respective territories;

RECALLING the Treaty establishing the African Economic Community (Abuja 1991) and the Treaty for the Establishment of the East African Community (Arusha, 1999) to which all Contracting Parties have subscribed;

TAKING INTO ACCOUNT the principles formulated and the rules agreed upon in the Agreement establishing the World Trade Organisation (Marrakech, 1994), the customs convention on containers (Geneva, 1972), and the Convention on the Simplification and Harmonisation of Customs Procedures (Kyoto, 1973);

AWARE of the inter-dependence between the transport sector and all the other sectors of the economy;

RECOGNISING that the Isaka-Kigali Kampala-Bujumbura Rail Corridor is important towards developing an integrated rail infrastructure and transit system which is economical, safe and environmentally sustainable in order to boost the agricultural, mineral, tourism and energy resources existing in the region;

RECOGNISNG the strategic importance of the African Continental Free Trade Area (AfCFTA), established by the AfCTFA Declaration in Kigali in March 2018, to boosting intra-Africa trade, and enhancing the economic growth of the continent;

FURTHER AWARE that neither Government nor private enterprises can singularly assume all risks of investment, maintenance and operation of transport and communications facilities and equipment, thus noting that close coordination between the Government and the Private Sector is key to the development of trade and transit facilitation;

ACKNOWLEDGING the importance of developing along Isaka-Kigali Kampala-Bujumbura Rail Corridor an integrated infrastructure and transit system which is economical, safe and environmentally sustainable;

CONVINCED that a regional approach is the best way to implement a project of such a magnitude as the Isaka-Kigali Kampala-Bujumbura Rail Corridor by putting in place an institutional framework to oversee the project implementation and management process.

DO HEREBY AGREE AS FOLLOWS:

CHAPTER I: GENERAL PROVISIONS

Article 1: Definitions

For the purpose of this Treaty, the following terms and expressions shall have the meanings hereby assigned to them:

Authority: means the Isaka-Kigali Kampala-Bujumbura Rail Corridor Management Authority;

Corridor: means the Isaka-Kigali Kampala-Bujumbura Rail Corridor located in:

a) The Republic of Uganda;
b) The Republic of Rwanda;
c) The United Republic of Tanzania; and
d) The Republic of Burundi.

Hereinafter referred to as "the Contracting Parties"

Hazardous Material: means any substance or material that could adversely affect the safety of the public, handlers or carriers during transportation. These include explosives, compressed gases, flammable liquids and solids, oxidizers and organic peroxides, toxic materials, radioactive materials, corrosive materials and any other material that presents a hazard in transportation.

Depository: means the Secretary General of the East African Community in accordance with Article 19;

Development Corridor: means the spatial development initiative approach to mobilise investment resources for the development of transportation, infrastructure, facilities and services in coordination with other sectors of the economy in the Corridor;

Enabling Legislation: means the domestic legislation passed by each Contracting Party to incorporate this Treaty;

Facilities: means infrastructure such as buildings or equipment put in place for the purpose of enabling the execution of a specific task in relation to transportation and the transit of vehicles, goods and persons;

Facilitation: means procedures or measures put in place to ease the transportation of transit vehicles, goods and persons through the corridor;

Goods: means all personal chattels and include wares, ores, livestock, aquatic animals and products, merchandise, crops, currencies and other articles offered for transportation;

Interstate Traffic or Transport: means the transport of goods or passengers between two or more Contracting Parties;

Joint Border Post: means a border post established at designated land borders at which all traffic utilising the border post stops only once in each direction of travel, and both exit and entry procedures are jointly undertaken by border control officers of the adjoining Contracting Parties from within the common control zone;

Steering Committee: means the Committee set up by Heads of States and Governments of the Contracting Parties in accordance with Article 10;

Other stakeholders: means actors or representatives of private sector, civil society, nongovernmental organisations or any other recognisable bodies as may from time to time be identified.

Project: means the construction and management of the railway from Isaka in the United Republic of Tanzania to Kigali in the Republic of Rwanda and from Kampala in the Republic of Uganda to Bujumbura in the Republic of Burundi via Kigali.

Right of Way: means the entire carriage way as well as adjacent portions of land, reserved sidewalks, roadside corridors for utilities, and future expansions as may be required;

Supra-National Status: means the transcending powers granted to the Isaka-Kigali Kampala-Bujumbura Rail Corridor Management Authority. It also means the status granted to the railway which transcends the jurisdiction of the national laws, regulations or policies of the Contracting Parties;

Traffic in Transit: means the traffic passing across the territory of contracting party with or without transhipment warehousing, break bulk, cleaning, repairing, replacing assembly, disassembly, reassembly of machinery and goods, or change of mode and means of transport;

Transit: means the passage across the territories of Contracting Parties when such passage is only a portion of a complete journey, terminating beyond the frontier of the Parties across whose territory the transit takes place;

Other Terms and Expressions:

Words in the singular include the plural unless the context otherwise requires;

Unless otherwise indicated, references to "Chapters", "Articles", and "Paragraphs" refer to chapters of, articles to, and paragraphs of this Treaty.

Article 2: Establishment, Construction and Management of the Corridor

The Contracting Parties hereby:

a) establish the Corridor;

b) establish the Authority which shall have Supra-National Status, in accordance with the provisions of Article 9; and

c) undertake to construct and manage a railway more particularly described in the International Project Agreement, with complementary trade and transport facilitation measures, linking Isaka to Kigali and Kampala to Bujumbura via Kigali, with such extensions and expansions as the Contracting Parties shall from time to time agree to.

Article 3: The Objectives and Scope of the Corridor

1. The objectives of the Corridor shall be to:

    a) facilitate safe and efficient movement of persons and goods, regional and international trade and transport by improving on the railway infrastructure and simplifying and harmonising the requirements and controls that govern the movement of goods and persons with a view to reducing transportation costs and transit times;

    b) stimulate economic and social development in the territories of the Contracting Parties and partnership between the public and private sectors;

    c) transform the Corridor into a Development Corridor which, in addition to offering safe, fast and competitive transport and transit services that secure regional trade, will also stimulate investment, encourage sustainable development, poverty reduction and guarantee security on the Corridor; and

    d) implement strategies for accelerating economic and social growth along the Corridor while ensuring environmental sustainability.

2. The alignment of the Corridor is as follows:

    a) The Republic of Uganda: [insert origin] - [insert destination];
    b) The Republic of Rwanda: [insert origin] - [insert destination];
    c) The United Republic of Tanzania: [insert origin] - [insert destination]; and
    d) The Republic of Burundi: [insert origin] - [insert destination].

Article 4: Guiding Principles

a) Principle of transparency

The Contracting Parties agree to cooperate in a transparent manner concerning issues relating to the funding, development, management and operation of the Corridor.

b) Principle of Equity

The Contracting Parties agree to manage and operate the Corridor in an equitable manner in the areas of funding, development, operation and management in order to achieve their objective.

c) Principle of Solidarity

The Contracting Parties agree that the principle of solidarity shall guide the implementation of this Treaty.

d) Principle of Mutual Assistance

The Contracting Parties shall give assistance to one another as may be required in matters of customs, immigration, security, health and any other such areas of interest with respect to the use of the Corridor. This assistance includes, but is not limited to, control at each entry and exit point of their respective territories.

e) Principle of Subsidiarity

The Contracting Parties agree to apply the principle of subsidiarity by granting the necessary powers to any authority or other body established under this Treaty to act for and on their behalf.

CHAPTER II: OBLIGATIONS OF THE CONTRACTING PARTIES

Article 5: Areas of Collaboration

The Contracting Parties agree to collaborate in matters relating to the following:

1. Infrastructure Development
    a) Updating of existing studies on the different segments of the Corridor to include:
        i. Economic and financial feasibility studies,
        ii Detailed technical, engineering and environmental impact studies, and
        iii. Construction works and supervision.
    b) Ensuring the sensitisation of social epidemics including HIV/AIDS, along the corridor and its area of influence,
2. Transport and Trade Facilitation

    Development and harmonisation of trade and transport facilitation measures along the Corridor, in the following areas:
    a) port facilities;
    b) routes and facilities;
    c) customs control, operation, immigration, police and other agencies;
    d) documentation and procedures;
    e) multi-modal transport of goods;
    f) handling of hazardous material;
    g) measures of facilitation for transit agencies, traders and employees; and
    h) construction of the Corridor.
3. To regard the project as a single unit, that may be divided into appropriate lots for purposes of contracting for works, supervision and management.
4. Review the scope and provisions of this Treaty to encourage the development of integrated transportation infrastructure, services and facilities on the Corridor.

5. Make available to the Authority parcels of land on each side to create for the Right of Way for the railway as well as to provide for future expansion and developments.

6. Jointly address matters relating to resettlement, compensation and protection of the Right of Way.

7. Search for the funds needed for the implementation of the Project, including from:

   a) contributions from the Contracting Parties;

   b) contributions from other Governments;

   c) Loans from financial institutions, grants, bequests, subventions, donations from national and international donor partners and International institutions or bodies;

   d) Donations from civil society, professional organisations and private companies; and

   e) Donations from beneficiaries of the Corridor, in particular from private companies active along the Corridor.

8. The Contracting Parties agree to, for the time being, entrust the Secretary General of the East African Community with the power to open accounts, receive, accept and deposit at a designated bank on behalf of the Contracting Parties, loans, donations, contributions and grants both in cash and kind, that may from time to time be made for the purpose of the Project.

Article 6: Project Documentation

International Project Agreement

1. The Contracting Parties shall, after signing this Treaty, enter into an International Project Agreement with the Authority. The International Project Agreement shall be executed on behalf of the Contracting Parties by the Steering Committee.

2. A copy of the International Project Agreement shall be lodged with the Depository.

Agreed Regime and Stability

3. The Contracting Parties and the Authority recognise and agree that their rights and obligations relating to the Corridor, shall be exclusively governed by the following set of principles, rules and instruments:

   a) this Treaty;

   b) the International Project Agreement;

   c) the Enabling Legislation;

   d) the Procedure Rules;

   e) all other instruments forming part of and or implementing the Agreed Regime, and

   f) all such general principles of international law, international treaties and domestic legislation as may be applicable to the Project, to the extent not inconsistent with any of the instruments contemplated in paragraphs (a), (b), (c), (d) or (e) above.

4. The Contracting Parties further recognise and agree with one another that the harmonised and stable application of this Treaty, the International Project Agreement, the Enabling Legislation and all other elements of the Agreed Regime by all the Contracting Parties throughout the duration of the International Project Agreement and across all three jurisdictions is essential to protect the rights and interests of each of the Contracting Parties in maintaining the Corridor in order to facilitate the transportation of persons, goods and services.

5. Each Contracting Party hereby agrees and undertakes that it shall:

    a) comply with the provisions of the Agreed Regime;

    b) abstain from the use of direct executive action or any action whatsoever, which may discontinue performance of, revoke, amend, suspend, terminate or disable the legal effectiveness of this Treaty; and

    c) abstain from adopting any legislation or do anything which is incompatible with the text and application of this Treaty or of any other instruments forming or contemplated under the Agreed Regime.

Article 7: Action in the Event of Breach of this Treaty

In the event of breach of any of the provisions of the Agreed Regime:

1. The affected Party shall promptly notify the Authority of the breach;

2. The Authority shall serve a notice of the breach on the Party in breach with a request to cease and cure the breach;

3. The Party in breach shall immediately cease and remedy any such breach upon receipt of notice of the breach;

4. Refusal or failure to cease or adequately remedy the breach shall entitle the affected Party to seek remedy under Article 19 of this Treaty.

5. The provisions of the International Project Agreement shall apply to determine any compensatory measures to be taken in respect of the party entitled to a remedy under this Treaty.

CHAPTER III: LEGAL AND INSTITUTIONAL FRAMEWORK

Article 8: Institutional Arrangements

1. Steering Committee

    The Steering Committee established by the Heads of State is composed of the Ministers in charge or railways or in charge of transport from each of the Contracting Parties and the Deputy Secretary General of the East African Community, Planning and Infrastructure.

2. The Committee shall, as soon as practicable after the signing of this Treaty, draw up the Procedure Rules which shall apply to its conduct and to any other organ that may be set up by it.

3. For the smooth development and management of the Corridor, the Committee shall set up the following organs:

    a. the Project Delivery Team; and

    b. any other organ or body as may be required.

4. The Steering Committee may by instrument amend the Procedure Rules.

Article 9: Status and Powers of the Authority

1. The Contracting Parties solemnly agree to grant the Authority with legal personality, financial autonomy and the supra-national status provided in Article 2 above.

2. The Authority shall have the responsibility to construct, manage and operate the Corridor and to do such other things as are expedient for the carrying out of its mandate.

Article 10: Competent Authority and Strategic partnerships

1. For the purpose of implementing this Treaty, the competent authorities of the Contracting Parties shall be their respective Ministries, Departments and Agencies (MDAs) responsible for railways or transport and any other MDAs as may from time to time be required as well as the Deputy Secretary General of the East African Community, Planning and Infrastructure.

2. The Contracting Parties shall develop strategic partnerships with the private sector and other institutions for the purpose of ensuring effective and efficient implementation of this Treaty.

3. The Contracting Parties shall make all necessary information regarding the movement of persons, goods and services along the Corridor publicly available through an accessible medium, and inform each other and the other stakeholders.

CHAPTER IV: TRANSIT ROUTES, FACILITIES AND MOVEMENT OF PERSONS AND GOODS

Article 11 - Transit Routes and Facilities

1. *Technical Standards*

The Contracting parties shall develop, harmonise and implement technical standards for infrastructure, facilities, equipment and vehicles along the corridor. These shall be in accordance with the African Union of Railways.

2. *Facilities*

The Authority shall:

a) in partnership with the private sector, construct, facilitate, maintain and operate stopover facilities, at designated places, which shall include storage, buildings, loading and unloading and other ancillary facilities, accommodation for conductors and other train crew, at places that may be agreed by the Contracting Parties;

b) equip the Corridor with communication and data transfer systems as needed in order to monitor inter-state and transit traffic within and through the territories of the Contracting Parties.

3. *Safety and Security Measures*

   a) The Contracting Parties agree to cooperate in the prevention of cross-border crimes

   b) The Authority shall:

      i. put in place measures for the safety and security of interstate and transit traffic within or passing through their territories.

      ii. ensure that safety and security measures put in place are designed and implemented without impediments to free movement, transit and interstate transport.

Article 12: Movement of Persons

The Contracting Parties agree to:

a) harmonise their immigration procedures in accordance with the Protocol on the Establishment of the East African Community Common Market (Arusha, 2009);

b) undertake joint immigration controls at their respective borders in accordance with the Protocol on the Establishment of the East African Community Common Market (Arusha, 2009).

Article 13: Frontier Facilities and Services

The Contracting Parties undertake to:

1. *Facilities for the Clearance of Goods*

   Provide adequate facilities to enable the expeditious clearance of interstate and transit traffic at their respective designated border crossing points.

2. *Border Post Facilities*

   a) establish Joint Border Posts at designated border points, to facilitate joint operations and examination of rolling stock and goods to avoid repeated customs control;

   b) provide adequate resources for the expeditious handling of border formalities, such as immigration, customs and health controls;

   c) permit third parties to offer warehousing services for storage of goods in customs bonded warehouses; and

   d) harmonise border working hours for all national border agencies to 24 hours a day to facilitate the movement of goods and persons.

Article 14: Customs Control and Operations

The Contracting Parties agree to:

1. *Joint Customs Posts*

Undertake joint customs controls at their respective borders in accordance with the Protocol on the Establishment of the East African Community Customs Union (Arusha, 2004).

2. *Customs Inspection within respective territories*

   Expedite, within their respective territories, customs inspection, periods of compulsory stays in parking areas, including periods of inspection of goods and documents, in accordance with the World Customs Organization's principles, relevant Community's acts, conventions, protocols, decisions and resolutions and international best practices.

3. *Harmonisation and Simplification of Procedures*

   Simplify, lessen and harmonise documentation and procedures as follows:

   a) limit the number of documents and extent of procedures and formalities required for interstate traffic and for traffic in transit; and

   b) encourage the harmonisation of customs systems through the interconnectivity of customs administrations along the Corridor.

CHAPTER V: FINAL PROVISIONS

Article 15: Ratification of this Treaty

This Treaty shall be subject to ratification in accordance with the constitutional provisions of the respective Contracting Parties.

Article 16: Amendments.

1. Subject to the provisions of Article 6(3), any Contracting Party may propose to the Depository an amendment to this Treaty, which shall be considered by the Contracting Parties.
2. Any amendments shall be adopted by a unanimous decision of the Contracting Parties.
3. Any amendment to this Treaty which is adopted by the Contracting Parties shall enter into force upon receipt by the Depository of the instruments of ratification, acceptance or approval by the respective Contracting Parties, or such later date as may be specified in the amendment.
4. The Depository shall notify all the Contracting Parties of the entry into force of an amendment.

Article 17: Termination and Withdrawal

1. A Contracting Party may withdraw from this Treaty by giving one year prior notice to the other Contracting Parties.
2. The withdrawal from this Treaty by a Contracting Party in accordance with paragraph (1) of this Article shall be subject to the prior consent of all the other Contracting Parties.
3. The withdrawal of a Contracting Party shall not affect existing obligations arising from this Treaty.

4. The notice of withdrawal shall be lodged with the Depository who in turn shall inform the other Contracting Parties.

5. This Treaty can only be terminated by a unanimous agreement of all the Contracting Parties.

Article 18: Dispute Resolution

1. Any dispute arising from the interpretation or the application of the provisions of this Treaty shall be amicably settled through diplomatic channels or negotiation among the Contracting Parties.

2. Failing this, a Contracting Party may refer the matter to the East African Court of Justice.

Article 19: Depository

1. The signed Treaty and the instruments of ratification shall be deposited with the Secretary General of the East African Community who is the Depository of this Treaty. Duly certified copies will be transmitted by the Secretary General to the Contracting Parties.

2. The Depository shall have the following powers:

   a. keep custody of the original text of this Treaty;

   b. prepare certified copies of the original text and transmit them to Contracting Parties;

   c. receive any signatures to this Treaty and receive and keep custody of any instruments, notification or communications relating to it;

   d. examine whether the signature or any instrument, notification or communication relating to this Treaty is due and in proper form;

   e. inform the Contracting Parties when number of signatures or of instruments of ratification or acceptance required for the entry into force of this Treaty has been received or deposited.

   f. inform the Contracting Parties of the withdrawal of a Party.

   g. register this Treaty with the Secretariat of the United Nations; and

   h. perform other functions specified in the provisions of the Vienna Convention on the Law of Treaties.

Article 20: Entry into Force

This Treaty shall enter into force and be binding from the day the last Contracting Party deposits its instruments of ratification.

Article 212: Transitional Arrangements

All such functions and powers conferred on the Authority by this Treaty, and the Procedures Rules which were previously being exercised by the Steering Committee, shall automatically vest in the Authority from the date it is empowered to exercise said functions and powers in accordance with the provisions of this Treaty.

Done at Location, in Country], on the XX day of XXX, XXX in the English and French languages, both texts being equally authentic.

IN WITNESS WHEREOF the undersigned, duly authorised by their respective Governments, have duly signed this treaty.

FOR THE GOVERNMENT OF THE REPUBLIC OF UGANDA

Signature:

Name:

Title:

FOR THE GOVERNMENT OF THE REPUBLIC OF RWANDA

Signature:

Name:

Title:

FOR THE GOVERNMENT OF THE UNITED REPUBLIC OF TANZANIA

Signature:

Name:

Title:

FOR THE GOVERNMENT OF THE REPUBLIC OF BURUNDI

Signature:

Name:

Title:

Appendix I. Narration of AIHSRN Promotion Video

The Africa Integrated High Speed Railway Network, an Agenda 2063 Flagship Project.

In 2013, the African Union heads of state and governments pledged the development of a Continental Agenda to the Year 2063.

Africa has come a long way: from the 1980 'Lagos Plan of Action', to the 'New Partnership for Africa's Development', to Agenda 2063 and 'The Africa We Want', all lead to the common vision of a single 'Africa Continental Free Trade Market' – connecting the continent with the Africa Integrated High Speed Railway Network could not come at a better time.

Developing African infrastructure will play a vital role in Agenda 2063 by stimulating physical consolidation as well as social and economic development in African countries.

Agenda 2063 encompasses 12 flagship projects, including the African Integrated High-Speed Railway Network.

Using the latest in railway technology, the Network is expected to be a key driver of economic development on the continent, connecting landlocked countries and regions to ports, African capitals, special economic zones and industrial hubs.

The continental railway network project will complement the sister-trans Africa highway network project of PIDA and other development aspiration frameworks, enabling Africa to realize its transformation as enshrined in Agenda 2063.

Most railways in Africa today exist within national borders. To complicate matters, these railways were built of differing gauges so that the trains could not transfer from one line to another.

A lack of efficient railway connectivity has led to higher costs, as well as longer, unreliable and riskier transportation compared to the rest of the world. As a result, Africans pay higher prices for goods and their exports are less competitive.

The net impact of less connectivity is reduced intra-Africa trade, under-developed manufacturing, agriculture and mineral extraction and an overreliance on the world for imports and exports.

And Africa pays one of the highest transportation cost. One of the key decisions of the AU is the planned introduction of the African Union Passport – a game changer, which will pave the way for Africans to move freely.

But railways are experiencing a Renaissance in Africa. New networks are physically connecting countries, lowering costs and transit times, while improving travel services for passengers and the delivery of goods.

In 2018, Morocco built 323 kilometres of high-speed railway between Casablanca and Tangier. With speeds as high as 320 km per hour, the line is the first of the Trans-Maghreb High Speed Railway project to link Morocco, Algeria and Tunis.

Kenya's Mombasa-Nairobi Standard Gauge Railway has quickly become a central conduit for freight and passengers in East Africa.

Nigeria's Lagos-Kano line is quickly developing. Once complete, the line will become a key link to landlocked Chad and Niger, among others.

Landlocked Ethiopia has gained access to the sea with the construction of the Addis Ababa-Djibouti Railway. The Addis Ababa-Djibouti Railway is the first of several planned for the region High Speed Railway Network.

Tanzania and Rwanda's standard gauge railway project, one of the proposed regional pilots of the Integrated High Speed Railway Network, serves key hubs along the Central Corridor. Construction is well-underway between Dar es Salaam and Morogoro.

South African President recently announced his commitments to developing "a bullet train" by interconnecting its megacities, as part of the national development programme. It is an opportunity for Southern Africa to benefit from the continental railway development initiative.

Full development of the African Integrated High Speed Railway Network Master Plan will deliver a continental network of rail links.

The Network's four main objectives are aimed at economically and physically integrating the continent.

Firstly, the network will connect the 16 landlocked countries in Africa to major seaports and neighbouring countries.

Secondly, the network will establish interoperability of railways across different regions of the continent, providing seamless transport.

Thirdly, the network will establish east-west and north-south landbridges, offering shorter alternative to marine transport.

By connecting capitals and economic hubs, the Network will drive economic growth and boost intra-African free trade, helping to eradicate poverty by lowering prices on goods and transport costs.

The plan is on its way to meeting the first three objectives by 2033.

By 2043, all four objectives will be met and the network will be complete, connecting the remaining political and economic capitals.

The Master Plan railway links have been analysed and prioritised. The Dar es Salaam-Kigali link combined with the Kampala-Kigali-Bujumbura, as well as the Gaborone-Walvis Bay, have been identified as pilots for accelerated development.

In addition, 10 others have been identified as priority projects and will be subjected to feasibility assessment as soon as possible.

Railways are being developed throughout the continent. To realise the African Integrated High Speed Railway Network Master Plan, visionary leadership is needed.

It is critical to look beyond national and regional borders to realise the benefits of linking the lines and providing connectivity to landlocked countries and hinterland regions.

Only then will the benefits flow to all Africans. It will take leaders with a true passion and vision for all of Africa to make the continent great.

Africa's largely isolated regions must be transformed into an inter-connected continent with free movements of people, goods and services.

Africa's freight costs must no longer be the highest in the world, making us more competitive while reducing prices for consumers.

And, Africa's citizens must have access to easier and more affordable travel beyond their borders.

The African Integrated High Speed Railway Network is poised to deliver all of this.

It will bring economic growth through increased trade, increased production, competitive prices and greater affordability within Africa.

It will open up regions of the continent to new resources, producers, markets and ideas.

It will accelerate the movement of people across borders, driving innovation, entrepreneurship and cooperation across the continent.

The African Integrated High Speed Railway Network is central to the "Africa Agenda 2063" and will be key to building the new Africa – "the Africa we want", with regional integration, peace and prosperity for all for the next 50 years and beyond.

"It always seems impossible until it's done"

AFRICAN UNION DEVELOPMENT AGENCY - NEPAD

NEPAD TRANSFORMING AFRICA

Abdou
Rahman Mboob •
Abdoulaye Lo • Abubakari Baba Moussa •
Aconkpanle Placide Badji • Adama M. Deen •
Akram Soltan Mahmoud Kotb • Ashoke Maliki •
Dr Alham Mahmoud Ibrahim • Dr. Amani Abu-Zeid •
Amine Idriss Odoum • Azeb Desta • Beatrice Loko •
Bernard Dzawanda • Boineelo Shubane • Cheikh Bedda •
Chipiliro Saka • Chris Appiah • Cleopatra Shiceka •
Daniel Osiemo • David Kajange • Edward Gaitho • Elsadig
Abdalla • Amb. Elkanah Odembo • Emmanuel Kamden •
Dr. Ibrahim Assane Mayaki • Jean-Aime Nziengui • Jonty Sandler •
Joster Imbuchi • Kamugisha Kazaura • Kaoru Takahashi • Kudzanayi
Bangure • Kisa Nhkoma • Louis Napo Gnagbe • H.E.,
Moussa Faki Mahamat • Mike Salawou •
Mamady Souare • Mtchera Chirwa •
Mohamed Abdisalaam • Maurice
Niaty-Mouamba • Dr. Nkozana
Dlamini Zuma • Tichakunda
Simbini • Raissa Ada Allogo •
Miriam Rahedi • Pathe Gueye •
Rt. Hon. Raila Odinga • Richard
Vallihu • Snowden Mmadi •
Robert Lisinge • Samatar
Mohammed • Suleiman
Athumani • Symerre Grey
Johnson • Soteri Gatera •
Tilahun Sarka • Vincent
Moola • Younes
Touitha • Zimba
Jordan

Dr Madam Amani Abu-Zeid
Commissioner of Infrastructure and Energy
African Union Commission (AUC),
Addis Ababa, Ethiopia

Dr Ibrahim Assane Mayaki
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