FEASIBILITY STUDY FOR THE INTERCONNECTION OF RAILWAY NETWORKS IN THE ECONOMIC COMMUNITY OF WEST AFRICAN STATES (ECOWAS)

EXECUTIVE SUMMARY

CIMA INTERNATIONAL / UMA

FINAL REPORT

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1. INTRODUCTION

1.1 Project Background

The interconnection of railway networks in West Africa is related to both the Economic Community of West African States (ECOWAS) and the *Union Économique et Monétaire Ouest Africaine* (UEMOA).

The ECOWAS is a regional organization established in 1975, whose goal is to promote cooperation and integration between member states to improve the standard of living of these nations by putting in place an economic union. The member states are: Niger, Mali, Benin, Togo, Burkina Faso, Ivory Coast, Senegal, Guinea, Nigeria, Ghana, Gambia, Liberia, Sierra Leone, Cape Verde and Guinea Bissau.

The UEMOA was created on January 10, 1994 by seven (7) countries which use the same currency, the CFA Franc (Benin, Burkina Faso, Ivory Coast, Mali, Niger, Senegal and Togo). Guinea Bissau became the 8th member state in 1997. The goal of the UEMOA is to strengthen the competitiveness of the economic and financial activities of its member states within the scope of an open and competitive market, and a rationalized and harmonious legal environment. One of the main objectives is to implement the coordination of the national policies by setting up common actions in terms of human resources, land-use planning, agriculture, energy, industry, mines, transport infrastructures and telecommunications.

The ECOWAS has a population of 246 million, spread throughout a 6.14 km^2 territory, while the UEMOA has a population of 80 million, spread throughout a 3.15 km^2 territory. Both organizations have common objectives in terms of transport, particularly when it comes to integrating and modernizing the railway networks.

1.2 Description of the Study

1.2.1 Project History

Far from being a network, the national railways of West Africa are unidirectional entryways designed to ensure exchanges with industrialized countries. With two exceptions, these lines are not connected to each other and do not service some of the landlocked areas. The track dates back to colonial times and have long been neglected in terms of maintenance, and no longer possess the features necessary to operate railway services to meet the needs. The inefficiency of the railways and a lack of interconnections are the main obstacles to increasing interstate exchanges. This situation contributes to keeping the sub-region foreign trade dependent on industrialized countries.

Experiences elsewhere around the world have shown that regional cooperation cannot provide meaningful results if the infrastructures supporting the production and the markets are not integrated in an adequate manner, or if they exhibit structural deficiencies. The rehabilitation and the interconnection of the existing railways are therefore seen as a final

means of reinforcing regional integration, promoting economic union, improve access to landlocked countries and facilitate the transportation of persons and merchandise. The socio-economic impact of these measures can reduce poverty among the disadvantaged people and ease gender issues.

The idea of linking the railways in West Africa has been around for some time. Many generations have pondered such a feat but, various historical events have made the completion of such an endeavor difficult. Other than the ore carrying railways, only Burkina Faso has built a new segment, which is no longer in service.

Over the last few decades, many studies were conducted to assess the importance of linking the existing railways. The Union of African Railways (UAR) dedicated many years to studying this issue. An initial master plan, adopted at the Accra General Assembly in 1976, proposed the interconnection of the national networks. Many projects which emerged from this master plan were later incorporated into the United Nations Transport and Communications Decade for Africa (UNTCDA) programme.

In 1992, at the request of ECOWAS, the Economic Commission for Africa (ECA) prepared a Railway Interconnection Plan. It was endorsed by all railway executives concerned and subsequently approved by the ECOWAS Council of Ministers in 1994. The decision to follow through with the Railway Interconnection Plan came from a resolution adopted at the Conference of African Ministers of Transport & Communications held in Cairo in November 1997. The terms of reference for conducting a complementary study was put together and, in October 2006, with the financial support of the African Development Bank (ADB), the ECOWAS Commission mandated the CIMA-UMA partnership to carry out the study.

1.2.2 Objectives

The main objectives of the study are to prioritize the railway interconnections identified in the ECOWAS Master Plan and to indicate how these can be implemented using private-sector funding. The end goal of the study is to establish a classification of the Master Plan projects, based on a multicriteria assessment which takes into account the technical/economic, institutional, environmental, strategic and social aspects as well as gender issues and the fight against poverty. The assessment will also take into account the sectorial orientations of the ECOWAS and the UEMOA, as well as the priorities of the main development partners who support the transport sector.

Setting up a classification entails defining an order in which to implement the integration programme, by which one of the projects will be ranked first among all the others. To do this, each project must be isolated and its characteristics defined in order to be compared. Each project includes a new link to be built and existing tracks to be rehabilitated, the whole making up a new railway network. The territories crossed mark the limits for each network in terms of passenger, merchandise and heavy goods transport. Therefore, the analyses focus on the interconnections listed hereafter.

Interconnection A1: Ilaro (Nigeria) – Pobè (Benin)
Interconnection A2: Sègboroué (Benin) – Aneho (Togo)
Interconnection A3: Lomé (Togo) – Tema (Ghana)
Interconnection A4: Prestea (Ghana) – Abidjan (Ivory Coast)
Interconnection A5: Dimbokro (Ivory Coast) – Sanniquellie (Liberia)
Interconnection B1: Bamako (Mali) – Ouangolodougou (Ivory Coast)
Interconnection B2: Niamey (Niger) – Kaya (Burkina Faso)
Interconnection B3: Niamey (Niger) - Kaura Namoda (Nigeria)
Interconnection C1: Niamey (Niger) - Parakou (Benin)
Interconnection C2: Ansongo (Mali) - Kaya (Burkina Faso)
Interconnection C3: Maradi (Niger) - Kano (Nigeria)
Interconnection C4: Man (Ivory Coast) - San Pedro (Ivory Coast)
Interconnection C5: Niamey (Niger) – Blitta (Togo)
Interconnection C5 (1): Ouagadougou (Burkina Faso) – Blitta (Togo)
Interconnection C6: Bougouni (Mali) – Kankan (Guinea)
Interconnection C7: Man (Ivory Coast) - Kankan (Guinea)
Interconnection C8: Niamey (Niger) – Ouagadougou (Burkina Faso)
Interconnection C9: Tambacounda (Senegal) – Dabola (Guinea)

1.2.3 Project Organization

The study began in November 2006. It was lead under the auspices of the ECOWAS, through the *Direction des Transports et Télécommunictaions*. A unit was set up (Study Implementation Unit) at the Transport Division to manage and monitor the study. A Steering Committee, made up of a representative from the UAR and five railway experts from five networks of ECOWAS member states, was mandated to validate and approve the results.

The CIMA-UMA team is a partnership of leading Canadian firms in their respective fields of endeavor. CIMA International is a branch of CIMA+, a multidisciplinary engineering and management company. With considerable overseas experience in Africa as well as in America, CIMA International represents the partnership when dealing with the ECOWAS and other stakeholders. Moreover, CIMA International is in charge of organizing and executing field activities as well as environmental, social and institutional studies. The UMA is a consulting engineering firm specialized in transport economy and engineering, particularly railway. At the present time, UMA is the nominated supplier of large railway companies in Canada, namely Canadian National and Canadian Pacific. In charge of the technical, economic and financial components; UMA is at the very heart of the ongoing study.

The team is co-chaired by a Senior Vice-President of both companies, and is headed by a railway engineer with extensive experience in managing multidisciplinary studies abroad. The main Section Leaders are specialists in their respective fields.

Given the geographical scope of the study, the data collection and validation required for the analyses pose an important challenge. This task required setting up local organizations able

to collate the information received from various sources in each of the ten (10) countries and to transfer them electronically when appropriate. For this, CIMA-UMA has secured partnerships with companies located in Dakar, Bamako, Conakry, Abidjan, Ouagadougou, Accra, Lomé, Cotonou, Niamey and Abuja.

1.2.4 Scope of the Project

The study includes four main components:

- First, an analysis of the technical, economic, and financial analysis aspects of the 17 links indicated in the terms of reference, in order to bring out which of these has the better performance in terms of cost-benefit and internal rate of return, given the economic and social constraints.
- Second, an assessment of the environmental and social impacts of laying out the new interconnections, in order to quantify the advantages and inconveniences in the affected regions as well as the mitigation measures. This aspect must be treated in a very wide scope due to its importance and its sensitivity. Another important element in this component is job creation, particularly as it relates to economic benefits for low income and vulnerable groups.
- Third, an analysis of the institutional background, in order to define the most efficient structures for integrating the new links to the existing lines. We will pay special attention to ownership and responsibility, particularly in terms of infrastructures and equipment.
- Lastly, a general review of the basic means of the existing railways, to establish rehabilitation programme for the infrastructures and equipment in support of the new services.

2. METHODOLOGY

2.1 General Description of the Methodology

From a methodological point of view, the completion of this study includes three (3) main steps. The first is devoted to setting up the global framework for conducting the study and preparing all the data and information required to:

- Develop the route for the new interconnections
- Provide the technical characteristics of the new links
- Evaluate the economic and financial state of the new links
- Proceed to an environmental and social assessment of the new links
- Analyze the institutional aspects

This step was achieved through the following:

1. Startup Activities (mission towards the ECOWAS)

   The main experts of CIMA-UMA held a start-up mission from December 3rd to December 8th 2006, at the ECOWAS headquarters in Abuja (Nigeria). During this meeting, the Consultant was able to meet with those in charge of monitoring the project at the ECOWAS (Transport Division and the SIU (a group in charge of monitoring the study)). This mission made it possible to collect technical data at the ECOWAS and to set up the project office in Abuja.

2. Seminar held from January 23, 2007 to January 24, 2007 in Lomé (Togo)

   In accordance with the action plan, a seminar to launch the study was held in January 2007, to inform all key stakeholders and explain the proposed methodology for completing the study. The seminar focused on the railway segments identified in the February 2000 master plan, in the 10 member states of the ECOWAS that is, Benin, Burkina Faso, Ivory Coast, Ghana, Guinea, Mali, Niger, Nigeria, Senegal and Togo.

   Participants to the seminar were:

   - ECOWAS personnel in charge of the project.
   - National Directors of Land Transport of the countries affected by the study.
   - General Directors of Railways of the countries affected by the study.
   - Representatives of the Union of African Railways (UAR).
   - Representatives and main experts of the CIMA-UMA partnership.
   - Representatives of partner engineering firms in each of the countries affected by the study.

This seminar was a chance to provide information on the goal, scope and methodological approach of the study. It made it possible to obtain the approval of the decision-makers who backed the process throughout the execution of the mandate.

3. Document retrieval and preparation of the tools to help the experts of the CIMA-UMA partnership with data collection.

4. Data collection from the railway companies, administrations in charge of the following fields: transport, public works, environment, economy and various organizations involved in managing the transportation sector.

From the proposal stage of this study, the CIMA-UMA partnership understood the need to have a mechanism through which there could be efficient data and information collection. Based on previous experience and proven practices in the field, the following activities were proposed and executed:

- Start-up mission at the ECOWAS in Abuja.
- A seminar to launch the study in Lomé (Togo).
- An initial investigative mission by the main experts of the CIMA-UMA partnership, in collaboration with the Study Coordinator at the ECOWAS.
- An investigative mission on the rehabilitation component.
- A support mission and an opportunity to set up the Research Units (RU).
- Acquisition of topographical maps to establish the routes.
- Organization of national seminars in the ten countries affected by the study.
- Collaboration with the Study Coordinator at the ECOWAS.
- Participation in a validation meeting of the Inception Report, organized by the Steering Committee of the study.
- Participation in a validation meeting for the routes, organized by the Steering Committee of the study.
- Design and launch of a web site.
- Design and implementation of a database.
- Working conferences with those in charge of the transport and railway sectors in Benin, Burkina Faso, Niger, Mali, Senegal, and withAFRICARAIL.

This approach strengthens CIMA-UMA's commitment, which relies on the adoption and implementation of a participative approach at every step of the mandate. This choice is crucial to making the information about the project available to the key stakeholders of the railway industry and to those who will benefit from the infrastructures. This approach made it possible for all the stakeholders to participate and to approve the project objectives and make them part of the project's success.

5. Develop the routes with the help of the topographical maps and various sources of information on the geography of the area.
6. Validation of the results by the SST (Inception Report and routes).

The second step involved the following:

1. The inventory of the corridors based on the routes developed and validated: infrastructures, environment and social aspects.
2. National information seminars and gathering feedback on suggestions, concerns and expectations of the transport sector stakeholders.

In accordance with the action plan on public consultations, information seminars were held in the 10 countries affected by the study namely: Benin, Burkina Faso, Ivory Coast, Ghana, Guinea, Mali, Niger, Nigeria, Senegal and Togo. These events were organized by CIMA-UMA,

in collaboration with the ECOWAS and the ministries in charge of railway issues in the ECOWAS.

In each case, the routes for the interconnections and the project items related to the country affected by the project was presented. The representatives invited to the seminars included:

- National administrators:
  - The various government departments involved in the railway question (Ministry of Transport, Ministry of Finance, Ministry of the Environment, ministry in charge of African Integration, etc.).
  - Railway administrators: Heritage society, private or public operation structures.
- Representatives from regional organizations: ADB, ECOWAS, WAEMU, the Liptako-Gourma authority.
- Civil partnership: unions, NGO and associations.
- Representatives of the CIMA-UMA partnership: international consultants and members of the local Research Unit teams.

The seminars welcomed 40 to 70 participants, depending on the countries. In general, the debates centered on the following points:

- General information on the interconnection project and the current study.
- Characteristic of the interconnection master plan.
- Technical aspects of the interconnection.
- A few institutional aspects deemed important.
- Investigations with the populations affected, based on a sampling made up of a number of proposed railway links (focus group).
- Processing and compilation of the data collected and setting up a database.
- Validation of the results by the SST (study progress report).

During the third step, the following activities were completed:

1. Regular support missions of the CIMA-UMA experts to collect supporting data.
2. Analysis of the data and description of the segments by the CIMA-UMA experts.
3. Modeling and multicriteria analysis by the CIMA-UMA experts.
4. Comparative assessment of the segments by the CIMA-UMA experts.
5. Drafting of the study reports by the CIMA-UMA experts.

This third and last step will be completed through the following activities:

6. Validation of the results by the SST from February 26 to 27, 2008.
7. Study validation seminar from February 28 to 29, 2008.

In accordance with the scope of the study and the organization put in place for its completion, the titles of the various reports of the study are presented as follows:

Volume 1 : Technico-economic Analysis

Volume 2A : Environmental Assessment

Volume 2B : Socio-economic Analysis

Volume 3 : Institutional Component Analysis

Volume 4 : Multicriteria Analysis

Volume 5 : Interconnection Maps (plan and vertical alignment in A1 format)

Volume 6 : Database

This report was drafted as a summary which includes the main results of the entire study; following is an overview:

Volume 1 : Technico-economic Analysis

As soon as the basic information was available, the first task was to develop the routes for the interconnections. This task made it possible to identify the corridor or reception area for each interconnection on a 500 m width (250 m on either side of the route) and to have a plan and vertical alignment on the topographical map on a scale of 1:200 000.

Based on these routes, which were validated by the Steering Committee for the study, the technico-economic analysis of the 17 new links was completed; each link was considered within the backdrop of the zone of influence it creates.

The zone of influence is defined as being mini railway networks created following the completion of each of the 17 proposed interconnections. Each mini network being made up of new lines to be built, existing lines to be rehabilitated as needed, the whole constitutes the zone of influence of the new link. Therefore, for each zone of influence, 18 in all, the following issues were addressed:

- Planning assumptions and parameters
- Capital cost estimates
- Market overview
- Freight operating plan
- Assessment of the passenger services
- Technical studies
- Economic and financial analysis

Moreover, the following appendices are provided with each of the 18 zone of influence reports, namely:

- Appendix A: Interconnection Maps
- Appendix B: Zone of Influence Maps
- Appendix C: Railway Operations
- Appendix D: Engineering
- Appendix E: Capital Cost Estimates
- Appendix F: Economics and Finance
- Appendix G: Mineralization & Industrialization

The results of Volume 1 are summarized in Section 3.1 of this report.

Volume 2A and 2B : Environmental and Social Assessment

In accordance with the proposed action plan for the completion of this study, an environmental and social impact assessment (ESIA) is planned to take into account the potential environmental and social impacts of the project.

This component of the study was executed while taking into account the guidelines for the environmental and social assessment of the countries affected by the project and those of the ADB.

The ESIA was conducted in three steps:

The first step was devoted to the preparation which included: collecting basic data, preparing the tools (Protocol) for data collection and organization the field teams.

The second step involved the inventory operations for the interconnection corridors as defined and validated within the scope of the study. This part was done by the local engineering firms in each of the ten countries affected by the study, under the supervisions of the main CIMA-UMA experts. The inventory was conducted using the tools developed during the study; it made it possible to collect a large amount of data and information on the physical, biological, human and socio-economic components of the environments.

The third step also covered the processing and analysis of the data whose results were presented in two volumes:

- Volume 2A: Environmental Assessment
- Volume 2B: Socio-economic Analysis

These two volumes cover the ESIA whose analysis is structured as follows:

Volume 2A

- Legal and Institutional Framework
- Description of the Receiving Environment

- Technical Description of the Project
- Methods for Analyzing the Environmental Issues
- Defining the Receiving Environment Components
- Analysis of the Anticipated Environmental Issues
- Discriminant Issues

The results of Volume 2A are summarized in Section 3.2 of this report.

Volume 2B

- Methodological Approach
- Socio-economic Characteristics of the Targeted Areas
- Economic Activities
- Access to Basic Service
- Gender Issue
- Fight Against Poverty
- Population Shift
- Potential Socio-economic Impacts of the Project

The results of Volume 2B are summarized in Section 3.2 of this report.

Volume 3 : Institutional Component Analysis

This volume is devoted to examining the issues related to the institutional aspects (regulation, organization, legal elements, capacity building). Based on the data and information collected within the framework of this study, the analysis of the institutional aspect was structured as follows:

- Inventory of the structures being considered and the ability of the countries to adapt.
- Diagnosis of the current situation
- Recommendations

In this part of the study, an inventory of the institutions and organizations of the ten countries to be interconnected was done, and a description for each country of the institutional framework and how the railway companies are operated. For each of the countries, description of the abilities acquired on which we must rely and the abilities to be strengthened, and this, on an institutional level (of the system), for the entities (railway companies) and the human resources. Lastly, a conclusion of the analysis by defining the skills required within the scope of the revitalization of the railway industry and the proposed actions and steps to take to set up strong institutions that could contribute to developing the interconnected network and the economic growth of the area.

A summary of the elements used to analyze the previous points is presented in Section 3.3 of this report.

Volume 4 **:** Multicriteria Analysis

This volume deals with multicriteria analysis, the approach selected to rank the 17 new links in accordance with the specific objective of the study. The AHP model, developed by Thomas Saaty of the Wharton School of Business of Pennsylvania, was used. Volume 4 gives a detailed description of the AHP model and the ranking results of the 17 interconnections based on technical, economic, strategic, environmental, socio-economic, and institutional criteria. The characteristics of these criteria were determined within the framework of the technico-economic analysis (Volume 1), the environmental assessment (Volume 2B), the socio-economic analysis (Volume 2B), and the analysis of the institutional aspects (Volume 3), the plan and vertical alignment of the corridors (Volume 5). In Volume 4, the following points were discussed:

- Methodological Approach
- Modeling
- Exploratory
- Assessment

Moreover, the following appendices are provided with the multicriteria analysis report:

- Appendix A: Fact sheets of the assessment criteria
- Appendix B: Classification of the interconnection projects based on the assessment criteria
- Appendix C: Characteristics of the interconnection projects

The summary of the results of Volume 4 is presented in Section 3.4 of this report.

Volume 5 : Interconnection Maps (plan and vertical alignment of the 17 interconnections on topographical maps on a scale of 1:200 000).

Volume 6 : Database

In accordance with the established action plan to conduct the feasibility study for the interconnection of railway networks in the member states of the ECOWAS, a database was created by the CIMA-UMA partnership to hold all the data collected in the field par the RU. Volume 6 provides a description of this database, particularly the methodology and task execution process for which a presentation table is provided in an appendix to this report.

The following chapters present the summary of the main results of the study.

3. SUMMARY OF THE RESULTS OF THE STUDY

3.1 Volume 1: Technico-economic Analysis

3.1.1 General Structure of the Technico-economic Analysis

The methodology developed to conduct a technico-economic analysis is tied to the goal of the study which is to set forth an order for the completion of the various railway interconnection projects identified in the ECOWAS Master Plan. For this analysis, each new link indicated in the ECOWAS Master Plan is considered as a distinct project, which is not linked to the other interconnections but rather the existing lines to which it is tied. Thus, each newly formed network has distinct features which make it possible to operate the passenger and freight transportation services (containerized and others) which meet the needs of the areas serviced. Where relevant, the lines are designed to welcome the block trains necessary for heavy traffic (transportation from the mines). Therefore, the interconnections generate as many networks which must be described, quantified and assessed in order to be compared.

The technico-economic component involves:

- market studies to determine the needs in terms of services and traffic forecasts in the zones of influence
- the operating studies to define the service offer and the operating procedures;
- engineering studies to define the boundaries of the new railway right-of-ways and design the infrastructures, systems and equipment required;
- studies on the estimate to assess the capital, operating and maintenance costs;
- financial studies to asses the revenues, establish the cash flow statements, determine the profitability of the investments and assess the related risks;
- economic studies to assess the public purpose of the projects.

The results of these studies are summarized in the following paragraphs, per project. Each summary, of particular interest to the states who are members of the ECOWAS, is written to be read as a standalone document and therefore has a text with a repetitive nature. However, some fundamental assumptions and methodological approaches, which are common to all projects, need some general clarifications that apply to all projects.

The opportunities in the market for rail transport in West Africa are very difficult to quantify with precision and confidence. With a few exceptions, the existing railways have completely abandoned their role as far as freight transport and passenger services. The most important network in the region (Nigeria Railway Corporation) is, practically, inoperative. The Guinea railway, managed by the ONCFG, has been abandoned almost its entire length. The railways of Togo and Benin-Niger have reduced the level of their services, focusing exclusively on heavy transport. The Ivory Coast and Burkina Faso railways, long considered as a competitive mode of transportation in the Abidjan-Ouagadougou corridor, is slowly coming back from the torments of a civil war. The railways of Senegal and Mali, leased to a private

concession holder, limits its services to profitable market niches in the Dakar-Bamako corridor.

The classic needs analyses for railway transportation consists of making, from the current situation, forecasts in terms of traffic using econometric models, adjusted based on the observations of past events. This approach, as safe as it is, cannot be used in the present situation as the railway clientele is practically null based on the lack of an adequate offer. Moreover, it is clear that the volume of exchanges between ECOWAS member states cannot, at the present time, justify the proposed interconnection. A much better suited approach would consist of taking the potentials of the zone under study and assessing how the construction of the new tracks in addition to the rehabilitation of existing tracks can contribute to promote these resources, particularly mineral deposits. This voluntary approach supposes the development of the mine related projects in conjunction with the railway projects as well as improvements to the ports as required for the proper operation of the transport line.

The first step in analyzing voluntary scenarios consists of making an inventory of the resources of the region (iron, manganese, phosphate, limestone deposits) and set the potential extractions which lead to the mass traffic towards the seaports. Take an inventory of the sites is easy. To set the handling forecasts is much more difficult given the lack of accessibility to reliable data in the public domain. We are then forced to define the order of magnitude based on the available information and the opinions of the experts consulted. Of course, the investments required to promote the resources are excluded from the cost estimates of the railway projects, including the means of connecting the networks. Also, the costs related to the improvements to the ports are not included in the railway capital assets, except for the railway facilities already in place.

As for general freight transportation (containerized and other), the statistical base was established from the available data on foreign trade for each country and the volumes of traffic on the roads and at the ports. Given the delays incurred when implementing the Research Units on the field, no origin-destination study was conducted to determine distribution. The request for freight transportation was projected for 2015 and 2030 using econometric growth models of the traffics. We then went on to assign traffic using a modal distribution model based on the general costs of transportation. We are relying heavily on developing the dry ports and container facilities to promote rail transport towards load transfer within the country for import as well as export. We are also relying on the implementation of policies and reforms that aim to create a fair climate to ensure that the new railways obtain the share of the market which is vested to them.

The predictive analysis for passenger traffic encounters the same dilemma. On the one hand, the utter lack of passenger services on the existing railway lines provides no recent statistical base from which to extrapolate. On the other hand, the lack of reliable data on the origin and destination of the current hauls, either by mass transit or personal vehicles cars, renders the traffic forecast for 2015 and 2030 subjective. Under these conditions, we have no other

choice but to use the data from secondary sources of information on the modal distribution in the corridors under study in order to estimate the need based on population growth. At any rate, a good dose of judgment is required to understand the propensity of the travelling public for the train rather than the other modes of transportation in West African countries. There are numerous key elements such as speed, comfort, convenience and security but, in the end, price is the deciding factor. The forecasts were made based on a traffic volume and fee schedule which maximizes revenues. Inevitably, this leads to operating losses, such as in the case of all the other railway networks of passenger rail around the world. As is the case elsewhere, these losses are the responsibility of the states as a subsidy for a public service.

In terms of their technical aspects, the new interconnections meet the norms of the International Railway Community (IRC) and the requirements of the UAR. The International Railway Community is an international association which represents, worldwide, some 190 members on all five continents. The IRC's mission is to strengthen the coherence of the sub-sector in order to standardize the construction and operating conditions, particularly in terms of interoperability. As such, it publishes requirements sheets that proved to be very useful when designing the ECOWAS interconnection project infrastructures.

The standardization of the track gauge in West Africa is a desirable goal which we must chose whenever possible. No one can refute the worthiness of an international template (1,4355 mm) for all new construction undertaken in normal operating conditions. However, the challenge with developing the ECOWAS integrated network is a separate issue altogether. The existing tracks which are currently under study all use a track gauge of 1,000 mm or 1,067 mm. Building new interconnections with a standard gauge (1,435 mm) would require a careful review of the situation. Such cases require that we provide a reasoning based on an analysis and common sense.

There are numerous options, when we think that each interconnection of the ECOWAS Master Plan must be considered individually, in the framework of the current study, to be prioritized. The first option consists of building all the new interconnections using from the onset a standard gauge. Operating the trains cannot be limited to simple back and forth shuttles on the new interconnections. Consequently, this option would then create a large number of transient runs at the meeting points with the existing tracks, the latter being of a narrow gauge. However, there are many ways to make the transition.

The long established solution consists of transshipping the merchandise separately or in standardized containers, with the well-know inconveniences: loss of time, additional costs, risk of damaging the merchandise – all reasons that diminish the effectiveness and competitiveness of rail transportation.

Another solution consists of using shape-retaining train sets, passenger and merchandise, with a change of rail trucks at the junction. The Consultants of CIMA-UMA possess practical knowledge of this type of operation which was, for many years, used by the CN Canada's

national railway, at Port aux Basques in the province of Newfoundland. This solution requires the immobilization of the trains and switching locomotives.

A final solution consists of using vehicles equipped with axles with variable gauge designed to allow the wheels to be loosened, moved perpendicularly and locked while still on, when the train is moving at reduced speed on a transition device. Just as with the previous solution, this operation requires switching locomotives. This solution which has been in use for a long while on the Spanish network RENFE is interesting because it provides an effective way to connect different networks. This solution has been examined closely and deserves that we take a closer look in this paper.

The Spanish manufacturer Talgo is a pioneer in manufacturing wagons with variable axles. The Talgo RD trains (Rodadura Desplazable), equipped with an ingenuous automatic gauge system, make it possible to travel without stopping the conventional tracks (1,668 mm) at the high speed tracks (1,435 mm). The Talgo RD rail trucks have been in service since 1968 on a variety of passenger and freight trains across the country and can travel to speeds up to 200 km/h. Moreover, the Talgo RD trains provide a few links between France and Spain, which cross the border into the Pyrenees

Operating these trains requires that all the wagons be equipped with expandable axles and that the trains be equipped with conversion devices at the transfer points. The transition from one gauge to another is done in numerous phases when the cars and wagons, pushed by a locomotive, cross a ditch where the wheels mounted on the axles are first lifted from the tracks at the entry then pushed across towards the tracks at the exit. The CIMA-UMA experts witnessed this operation in Irun and Cerbere in Spain where the Talgo RD trains go from a wide track (1,668 mm) to a normal gauge (1,435 mm). Currently, Talgo is running tests in Haparanda (Sweden) and Moscow (Russia) to go from wide tracks (1,530 mm) to international tracks (1,435 mm).

Incidentally, we know that the CAF (Compania Auxiliar de Ferrocarriles) put together a similar system (BRAVA) which makes it possible to adapt the gauge while the train is operating. To do this the cars and wagons must be equipped with BRAVA rail trucks that are also able to run at high speeds. This technology was developed by the Swiss manufacturer Vevey, now a subsidiary of Bombardier Transport. The BRAVA system was tested on the Cordoba-Seville line but to date has not been commercially operated. Other manufacturers have developed rail trucks with variable gauge, namely DB Cargo-Knorr-Bremse, DBAG-Rafil Type V and SW-2000 used for the transition between Polish (1,435 mm) and Ukrainian (1,520 mm) railways. There is no data on the performance of these systems.

Regardless, Talgo's experience over the last decades is sufficiently convincing to conclude that the Spanish system is ready and offers a practical and effective means of allowing train operation on various gauge tracks. From an infrastructure standpoint it is quite affordable however this solution requires an overall replacement of the rolling stock. Such an approach is admittedly interesting to solve a limited problem, in order to allow a number of regional or

international trains to cross the obstacle that is the incompatible gauge. In this instance, the Consultants heavily debated whether it was wise to add a major constraint to the ECOWAS network that applies to all the new lines and which limits the choice in equipment to an exclusive technology (the Talgo RD rail trucks are patented). Currently, there is no problem. All the affected railways in the scope of this study can be linked inexpensively by using interconnections with the same gauge. The decision is therefore a matter of choice as it implies additional costs, particularly in terms of motive power.

Other than the costs related to infrastructure, the implementation of the anticipated services (passenger, freight and ore carrier) on the entirety of the network would require the acquisition of some 35,000 vehicles with variable gauge, in addition to more locomotives of varying sizes. That said, would it be wise to prepare an integration plan for the existing networks which relies entirely on the use of specialized equipment which, currently, is only available through one supplier? The question, which is more strategic than technical, deserves a closer look by the ECOWAS and the affected railways.

The search for a pragmatic solution to the thorny issue of incompatible gauges leads the Consultants to prefer the narrow gauge (1,000 mm and 1,067 mm depending on the case at hand) for the new links of the sub-sahelian corridor and all its related cross-sections. To make the future transition to an international template easier, the Consultants favor a cross-section of standard size for the sub-ballast and the subgrade, as well as the appropriate clearances for the bridges, viaducts, culverts and level crossings. Thus, the foundations of the track and engineering structures are designed to ease the future transformation of the infrastructures to the international gauge with an axle load of 30 tones.

The Consultants also believe that it is better to limit the repairs to the existing lines to an upgrade that is compatible with the operation requirements for the services anticipated on these lines. These measures will significantly reduce the amount of money required for such things as infrastructures, systems, equipment and rolling stock. They also make it possible to complete the works required on the existing tracks without any major inconveniences which could put a stop to the existing services.

In summary, the Consultants agree that the recommended concept for the track is optimal for the new interconnections and for the lateral and longitudinal lines of projects A5 - Dimbokro-Saniquellie, B1 - Bamako-Ouagadougou, B2 - Niamey-Kaya, B3 - Niamey-Kaura Namoda, C1 - Niamey-Parakou, C2 - Ansongo-Kaya, C3 - Maradi-Kano, C4 - Man-San Pedro, C5 - Niamey-Blitta, C5 (1) - Ouagadougou-Blitta, C6 - Bougouni-Kankan, C7 - Man-Kankan, C8 - Niamey-Ouagadougouand C9 - Tamabacounda-Dabola. The studies show that such a track – properly built and maintained on a regular basis in conformity with the standards of use – has all the performance characteristics to meet the needs of these networks for many years to come. It makes it possible to implement each project with networking in mind, without any break bulk. Moreover, it makes it possible to undertake the most promising projects in a viable economic and financial framework. The recommendations found in this report are therefore based on this outfitting concept. At the request of the ECOWAS and the

Steering Committee responsible for validating the results of the study, this report provides an estimate of the costs related to an immediate standardization of all the tracks included in the previously mentioned projects. Moreover, the report provides an indication of the economies of scale which could be generated by acquiring rolling stock of a standard gauge rather than a metric gauge.

Because we anticipate a gradual increase in passenger and freight traffic, the projects take into consideration a major improvement of the traffic control mechanisms on these single track lines. There were changes made to the passing track configuration (spacing, length) as well as to the prescribed systems currently used for the block system. In a first phase, we do not anticipate the deployment of an automated signalization such as the automatic block with colour-light signals or the centralized traffic control (CTC) for the previously mentioned projects. The implementation of these systems is quite costly (approximately $700,000/km) and their maintenance requires much responsibility. The traffic forecasted in the medium term does not justify such expenses.

At the request of the ECOWAS and the Steering Committee, an estimate of the required investments to have these systems on each of the line is provided in the project sheets provided further in this report. Therefore, it is important to explain this aspect. In railway signalization the basic element is the block section, which is a section of tray whose entry is regulated by signal indicators, typically illuminated. In an automatic block with colour-light signals system, the signals are activated by the presence of a train in the block section or by the position the switches. This system makes it possible to prevent collisions but it does not provide a means to authorize the movements of the trains, a serious limitation in the case of a single track line railway. When required by the operating conditions, we can overcome this problem by using a CTC system, using this system a dispatcher assigned to a control panel can activate the mechanical switching on part of the track and thus direct the trains. The dispatcher can also keep an eye on the devices installed on the rails to detect the overheating of the wheel bearings, the equipment's resistance, wheel breaking and the load distribution. Further in this report we will see that the Consultants recommend that such a system be installed on the new links of the coastal corridor where frequent and fast passenger trains share the single track with much heavier and slower freight trains.

The telecommunications aspect is crucial for operating the ECOWAS railway networks. With the increasing volume of traffic, the systems being used on the existing lines are not adequate to ensure traffic safety and to follow the travel flow. The lack of means and reliability of the transmission mechanisms available today is a major problem. This issue is discussed at length in the technical appendices of the report. Three new systems were studied to improve the situation, namely fibre optics and satellite or microwave communication systems.

The fibre optics system is a leading-edge technology which is used more and more to send all types of information on long distances at the speed of light. It offers a throughput that is quite superior to the one offered by coaxial cables and can handle a large bandwidth network

where telephony and computer data can travel. Buried in raceways within the right-of-way, the cables are protected from atmospheric interference, theft and vandalism. Because of its large capacity and high performance, this system is a first choice for a railway, first for its own use and for the numerous possible commercial outlets it offers. Despite all these characteristics, the Consultants did not opt for this choice for the current study because of the cost (approximately $70,000/km) of the initial facilities (casings for burial, repeater stations, repeaters) and the slim perspectives for a secondary market in the serviced corridors. At the request of the ECOWAS and the Steering Committee, an estimate of the investments required is provided in the following interconnection project sheets.

In 1998, a mobile satellite telephony project designed to provide coverage to the entire planet was launched by Motorola. To date, this leading-edge technology has not generated the success anticipated. What remains of this endeavor is a constellation of artificial satellites (approximately 60) that populate the sky in low orbit around the Earth. These satellites are different in that they have three large antennas covered with a reflective material called iridium, which is designed to protect the satellites. Recently, the Australian Rail Track Corporation announced that it planned to use this technology to cover its national network of 10,000 kilometers of rail track located in a rugged terrain. The usefulness of this system for the ECOWAS relies in the fact that it does not require an initial investment, except for the terminals in the control centers and aboard the locomotives. On the other hand, the user fees are high. The problem is that its implementation for railway purposes has not been completely proven, both from a reliability and performance point of view.

All things considered, the microwave communication system remains the most reliable and best able to meet the needs of the ECOWAS railways. It is a signal carrying system (nowadays mostly digital) between two stationary points. As its support it uses radio waves with carrier frequencies of 1 to 40 GHz (micro wave field), heavily concentrated using beam antennas. However these waves are sensitive to masking (landform, vegetation, buildings), to precipitations, refractive conditions of the atmosphere and to reflection events. Thus, the relay towers must be placed at high elevations, away from the railway right-of-way. The range of signals being of 50 kilometers, relay stations are required. Moreover, there is a need for a source of energy (typically solar) in these areas. Just as with the fiber optics, the excess capacity can be commercialized. The initial costs (approximately $15,000/km) is included in the estimate for the basic needs for each project, which includes the infrastructures, signalization and communication.

As previously mentioned, the projects covering the coastal corridor bring about a challenge all their own. The main goal of these projects is to link the capitals of the coast. The distances are relatively short and the road network is well developed. The inter-port traffic is booming and competition (truck, coastal shipping) is now well established as all railway services disappeared a long time ago. Moreover, the existing railway lines are in such poor shape they are beyond any reasonable rehabilitation and, in many areas, the geometry of the routes is not well suited to outfitting a modern railway. Obviously, what was said

previously does not apply to projects A1 - Ilaro-Pobè, A2 - Sègboroué-Aneho, A3 - Lomé-Tema, and A4 - Prestea-Abidjan.

The economic activity and the perspectives in terms of demographic in the Logos-Abidjan corridor are among the highest in West Africa. The challenge for railway is to enter this market and get a hold of a big enough share of the transportation activities which is important for its survival and its growth. This requires ample means. As the anticipated services on the various segments are focused on the frequency and speed of the trains, it is necessary to build normal tracks (1,435 mm) along the straightened right-of-ways. Thankfully access to the normal tracks from the narrow tracks is easily achieved by placing a third track. It will also be necessary to introduce the centralized traffic control with display in the compartment to make it possible to have a proper operation on this single track network.

During the validation meeting maximum speeds on this outstanding track were discussed (120 km/h for passenger trains and 100 km /h for two level freight trains). The real issue is the operational and regulatory limits because strictly from a technical standpoint, the track, rolling stock, equipment and systems proposed enable the highest limits. Beyond the limits suggested, we must consider eliminating level crossings and the implementation of more rigorous maintenance programmes. These issues increase the capital and operating costs.

The interconnection projects are an opportunity to establish standards for the acquisition of new rolling stock in order to make all components uniform and all parts interchangeable. At the present time, we can identify numerous types of couplers and braking systems on the cars and wagons of the ECOWAS railways. Generally speaking, the rolling stocks of the French-speaking and English-speaking countries are not compatible, which poses a major obstacle to the interoperability of the networks. The issue affects various parts of the world; in Europe, where there are many types of couplers, some locomotives are equipped with two or even three different types of couplers. The problem is complex; in spite of numerous experiments, in Europe, they have not yet been able to make the automated coupler a standard.

The rolling stock currently in use on the West African railways is either equipped with a unified IUR coupler or a semi-automatic coupler. Without a doubt the completely automatic coupler is best for the ECOWAS integrated network as it eliminates all forms of human intervention. The issue that remains is to determine which technology is best suited to the anticipated operating plan on the various lines of the integrated network. The Janney coupler is widespread in America, Japan, and China and in some African countries. The Wilson coupler, which can be found mostly in Russia, is used on a few rail motor cars and trailer cars in Senegal. The Schwarzenberg coupler, which can be found on the HST, is more and more popular on all the continents. By and large, there are numerous types of automatic couplers with different properties and functionalities. The entirely automatic couplers deal with all the connections (mechanical, pneumatic, hydraulic and electrical). They can be found mostly in the mass transit systems, such as underground railroads and commuter trains

(TightLok, Wedgelock, Dellner, BSI). The choice of a system over another requires analyses which go beyond the scope of the current study.

On modern railways, the trains whose speed exceeds 50 km/h must be equipped in an uninterrupted manner of automatic brakes, so that we can tighten or release the brakes of all the cars from a single place. A brake installation is automatic if each interruption of the brake pipe causes braking. The Consultants recommend that the new cars be equipped with indirect air brakes. This system, which meets the international standards, makes it possible to modify the pressure in the drive-by-wire using an automatic brake valve installed aboard the locomotive. The braking force is produced in a pneumatic cylinder using a hydraulic piston linked to the brake shoes via a brake rigging. A spring keeps the hydraulic piston of the brake cylinder in a released state so that the brake shoes can rest against the wheels. During the braking, the compressed air gets to the brake cylinder; the hydraulic piston overcomes the pressure from the spring and presses the brake shoes against the wheels through the brake rigging. There are numerous systems of this type: choosing one requires further analyses, consultations and discussions.

As for locomotive and rolling stock maintenance in the workshops and warehouses anticipated on each network created by the various interconnections, the reader is invited to read the general indications provided in the technical appendices. The preparation of action plans (inspection, standard maintenance, intermediate review, general review) as well as the placement and development of the required institutions to these means go beyond the scope of this study.

3.1.2 Summary of the Results per Zone of Influence

3.1.2.1 Interconnection A1: Ilaro (Benin)-Pobè (Nigeria)

This new line, part of the ECOWAS Master Plan, is part and parcel of the coastal corridor. With its 23 km in length, it connects the railways of Nigeria and Benin, making up a railway network of 1,968 km (1,400 km in Nigeria and 568 km in Benin). In Nigeria, Ilaro is located at the top of a junction with the main section leading to Lagos. In Benin, Pobè is the final terminal of the main track leading to Porto Novo and Cotonou. This project will make it possible to link Lagos to Cotonou by rail, on a 198 km stretch and to operate regional and international services. In addition to the new interconnection, the project requires the reconstruction of existing tracks as well as the acquisition of new rolling stock.

For the Ilaro-Pobè interconnection, the Consultants recommend a track with a standard track clearance (1,435 mm between tracks, 30 tones load limit, maximum speed of 120 km/h for passenger trains and 100 km/h for freight trains). Given the obsolescence of the existing infrastructures, the Consultants recommend replacing the meter gauge (1,000 mm) between Cotonou and Pobè with a standard track clearance. On the Ilaro junction, it is also recommended to replace the narrow meter gauge (1,067 mm) with a standard track. Moreover, a new double meter gauge (1,067 mm and 1,435 mm) is required on the main

section leading to Lagos in order to preserve the integrity of the existing line. This new track will have 3 rails on concrete monobloc sleepers.

The capital cost of the systems and infrastructures to outfit the 23 kilometers of interconnection is estimated at $218 M and $178 M for the reconstruction of the 175 kilometers of existing tracks. The cost of the equipment (locomotives, cars, wagons) is estimated at $71 M. Therefore, the project calls for a total of $468 M (2007 dollars) spread out over 5 years.

The capital cost of the infrastructures for outfitting the 23 km of interconnection is estimated at $43 M and $178 M for rebuilding the 175 km of existing tracks. The cost for equipment (locomotives, cars, wagons) is estimated at $71 M. The cost for a centralized monitored signalization on the entire length of the path (198 km) is estimated at $144 M, which includes a microwave communication system. Therefore, the project calls for assets totaling $436 M (2007 dollars) spread out over 5 years. The additional cost for the fibre optics rather than the microwave communication system is $11 M. This investment could prove to be cost effective given the hopes for commercializing the network all along this corridor.

The forecast for passenger traffic during the first operational year is estimated at 620,000 passengers. Moreover, traffic of 1 million tones of merchandise is expected during the same year. Mainly, it consists of a containerized freight which is currently the truckers' prerogative as well as large part of the cement coming from the Massè plant near Pobè. Institutional and regulatory reforms are required to create a fair climate and guarantee the portion of the market which is vested to the railway transport.

The passenger services will bring about an annual loss of $5.3 M, which we suppose is the state's responsibility (below the line). However, the freight services will generate an operating income of $7 M a year. Discounted with a rate of 7% on a 30-year period, the cash flow statements generate a negative present value of $315 M. These results are strictly related to the railway elements therefore, they do not take into consideration the port improvements required to ensure the proper operation of the transport line.

Despite the rather optimistic expected traffic, project A1 - Ilaro-Pobèis not profitable based on the volumes of traffic and forecasted revenues. However, backed by a cost-benefit ratio of 4.3, it could be of socio-economic interest for the affected countries. In the current backdrop, the Consultants estimated the internal risk of this project to be high, particularly from a commercial standpoint.

3.1.2.2 Interconnection A2: Sègboroué (Benin) – Aného (Ghana)

This new interconnection, shown on ECOWAS Master Plan is part and parcel of the coastal corridor. With a 49 kilometer stretch, it links the railways of Benin and Togo, creating a 955 km railway network (610 km in Benin and 345 in Togo). In Benin, Sègboroué is located some 50 km west of Cotonou, at the end of the railway track which runs along the coast. In Togo, Aného is in the eastern tip of the country, only a few kilometers from the border. The project

makes it possible to link both capitals on a 168 km stretch and to use the regional and international services. In addition to the new interconnection, the project requires the reconstruction of the existing tracks. Moreover, it requires the acquisition of new rolling stock.

The Consultants recommend a standard track clearance (1,435 mm between the rails, 30 tones load limit, maximum speeds of 120 km/h and 100 km/h) for the Sègboroué-Aného interconnection track. Given the obsolescence of the existing infrastructures, the Consultants recommend replacing the meter gauge (1,000 mm) on the Sègboroué-Cotonou segment (50 km). As a result, the Cotonou-Lomé line is completely transformed to the standard template on monobloc concrete sleepers. Moreover, the Consultants recommend adding a third rail between the city of Lomé and the ports of Lomé (5 km) to make travel possible for meter gauge trains coming from Blitta. The Consultants also recommend adding a third rail between the Pahou junction and the Port of Cotonou (25 km) to make travel possible for meter gauge trains coming from Parakou.

The interconnection's route runs along the RN1 which makes it easier to build. However, it does have the disadvantage of crossing a swampy area, a wide lagoon and two great rivers (Mono and Haho). The construction of the track formation in the narrow strip between Grand Popo and Aného is particularly troublesome. In addition to the technical constraints, the presence of Lake Aheme and numerous swampy areas is indicative of numerous environmental impacts. The capital costs of the infrastructures for developing the 49 km of interconnection is estimated at $72 M and $100 M for rebuilding the 119 km of existing tracks. The cost for equipment (locomotives, cars, wagons) is estimated at $78 M. The cost for a centralized monitored signalization on the entire length of the path (168 km) is estimated at $143 M, which includes a microwave communication system. Therefore, the project calls for assets totaling $393 M (2007 dollars) spread out over 5 years. The additional cost for the fibre optics rather than the microwave communication system is $9 M. This investment could prove to be cost effective given the hopes for commercializing the network all along this corridor

The forecast for passenger traffic during the first operational year is estimated at 620,000 passengers. Moreover, a traffic of 800,000 tones of merchandise is expected during the same year. Mainly, it consists of a containerized freight which is currently the truckers' prerogative. Institutional and regulatory reforms are required to create a fair climate and guarantee the portion of the market which is vested to the railway transport.

The passenger services will bring about an annual loss of $2.2 M, which we suppose is the state's responsibility (below the line). However, the freight services will generate an operating income of $5 M a year. Discounted with a rate of 7% on a 30-year period, the cash flow statements generate a negative present value of $275 M. These results are strictly related to the railway elements therefore, they do not take into consideration the port improvements required to ensure the proper operation of the transport line.

Despite the rather optimistic expected traffic, project A2 - Sègboroué-Aného is not profitable based on the volumes of traffic and forecasted revenues. Moreover, the public interest in the investment is in question based on the economic record (cost-benefit ratio of 1.3). However, the project couls be justified in the wider perspective of the integration and regional cooperation which aims to increase the population's mobility and commercial exchanges between the two countries. In the current backdrop, the Consultants estimated the internal risk inherent to this project to be high, particularly from a commercial standpoint.

3.1.2.3 Interconnection A3: Lomé (Togo) – Tema (Ghana)

This new line, shown on the ECOWAS Master Plan, is part and parcel of the coastal corridor. With its 147 km, it links the Togo and Ghana railways, creating an 863 km railway network (345 km in Togo and 518 km in Ghana). In Togo, Lomé is located in the wetsren tip of the country, only a kilometer or so away from the border. In Ghana, Tema is at the end of a track which runs along the coast, some 24 kilometers east of Accra. The project makes it possible to use the regional and national services between the two capitals (178 km). In addition to the new interconnection, the project requires the reconstruction of the existing tracks. Moreover, it requires the acquisition of new rolling stock.

The Consultants recommend a standard track clearance (1,435 mm gauge between the rails, 30 tones load limit, maximum speeds of 120 km/h for passenger trains and 100 km/h for freight trains) for the Lomé-Tema interconnection track. Given the obsolescence of the existing infrastructures, the Consultants recommend replacing the meter gauge (1,067 mm) with a standard track gauge on the Accra-Téma segment (31 km). As a result, the Lomé-Tema line is completely transformed to the standard template on monobloc concrete sleepers. Moreover, the Consultants recommend adding a third rail between Accra and Tema to make travel possible for meter gauge trains (1,067 mm) coming from Tarkwa and the rest of the national network.

The capital cost of the infrastructures to outfit the 147 kilometers of interconnection is estimated at $312 M and $39 M for the reconstruction of the 31 kilometers of existing tracks. It is worth mentioning that the geography and topography of the coast are particularly rugged for building a railway in Ghana. Moreover, the presence of numerous watercourses and the crossing of the Volta will require numerous engineering structures, which has an impact on the costs. The cost for equipment (locomotives, cars, wagons) is estimated at $107 M. The cost for a centralized monitored signalization on the entire length of the path (178 km) is estimated at $134 M, which includes a microwave communication system. Therefore, the project calls for assets totaling $592.0 M (2007 dollars) spread out over 5 years. The additional cost for the fibre optics rather than the microwave communication system is $10 M. This investment could prove to be cost effective given the hopes for commercializing the network all along this corridor.

The forecast for passenger traffic during the first operational year is estimated at 620,000 passengers. Moreover, a traffic of 935,000 tones of merchandise is expected during the same year. Mainly, it consists of a containerized freight which is currently the truckers'

prerogative. Institutional and regulatory reforms are required to create a fair climate and guarantee the portion of the market which is vested to the railway transport.

The passenger services will bring about an annual loss of $6.0 M, which we suppose is the state's responsibility (below the line). However, the freight services will generate an operating income of $5 M a year. Discounted with a rate of 7% on a 30-year period, the cash flow statements generate a negative present value of $420 M. These results are strictly related to the railway elements therefore, they do not take into consideration the port improvements required to ensure the proper operation of the transport line.

Despite the rather optimistic expected traffic, project A3 - Lomé-Togois not profitable based on the volumes of traffic and forecasted revenues. However, backed by a cost-benefit ratio of 3.1, it could be of socio-economic interest for the affected countries. In the current backdrop, the Consultants estimated the internal risk of this project to be high, particularly from a commercial standpoint.

3.1.2.4 Interconnection A4: Prestea (Ghana) – Abidjan (Ivory Coast)

This new line, shown on the ECOWAS Master Plan, is part and parcel of the coastal corridor. With its 222 km, it links the railways of Ghana and the Ivory Coast, creating a railway network where the zone of influence covers 1,842 km in three countries (442 km in Ghana, 800 km in the Ivory Coast and 600 in Burkina Faso). In Ghana, the city of Prestea is located on the eastern tip of the country, some 70 kilometers from the border. In the Ivory Coast, Abobo lies in the suburbs of Abidjan. The project makes it possible to link the two capitals (Accra and Abidjan) by rail on a 519 km stretch and to use the regional and national services. In addition to the new interconnection, the project requires the reconstruction of the existing tracks. Moreover, it requires the acquisition of new rolling stock.

For the Prestea-Abobo interconnection, the Consultants recommend a standard track gauge (1,435 mm gauge between the rails, 30 tones load limit, maximum speeds of 120 km/h for passenger trains and 100 km/h for freight trains). Given the obsolescence of the existing infrastructures, it is recommended to replace the narrow meter gauge (1,067 mm) with a standard track on the Accra-Prestea segment (282 km). This makes it possible to preserve the integrity of the current services between Takoradi and Accra. To reach Abidjan, it is also recommended to replace one of the two tracks starting in Abobo (15 km) with a new double gauge track (1,000 mm and 1,435 mm) with 3 rails. As a result, the Accra-Abidjan line is completely transformed to the standard gauge on monobloc concrete sleepers, while still allowing the use smaller material on the segments with double gauge.

Although it is possible to complete with investments, this project is riddled with obstacles. We must expect difficult conditions for the earthworks in Ghana (lack of access roads, mountainous terrain) as well as in the Ivory Coast (swampy lands, dense vegetation). Moreover, the route of the current line, between Accra and Prestea, is sinuous and rough rock. We find numerous curbs and steep slopes for use by modern trains, all of which requires very costly adjustments.

The capital cost of the infrastructures for outfitting the 222 km of interconnection is estimated at $425 M and $391 M for rebuilding the 363 km of existing tracks. The cost for equipment (locomotives, cars, wagons) is estimated at $139 M. The cost for a centralized monitored signalization on the entire length of the path (585 km) is estimated at $419 M, which includes a microwave communication system. Therefore, the project calls for assets totaling $1,374 M (2007 dollars) spread out over 5 years. The additional cost for the fibre optics rather than the microwave communication system is $11 M. This investment could prove to be cost effective given the hopes for commercializing the network all along this corridor.

The forecast for passenger traffic during the first operational year is estimated at 770,000 passengers. Moreover, a freight traffic of 1.8 M tones is expected during the same year. Mainly, it consists of a containerized freight which is currently the truckers' prerogative. Institutional and regulatory reforms are required to create a fair climate and guarantee the portion of the market which is vested to the railway transport.

The passenger services will bring about an annual loss of $8.7 M, which we suppose is the state's responsibility (below the line). However, the freight services will generate an operating income of $30 M a year. Discounted with a rate of 7% on a 30-year period, the cash flow statements generate a negative present value of $862 M. These results are strictly related to the railway elements therefore, they do not take into consideration the port improvements required to ensure the proper operation of the transport line.

Despite the rather optimistic expected traffic, project A4 is not profitable based on the volumes of traffic and forecasted revenues. Moreover, the public interest in the investment is in question based on the economic record (cost-benefit ratio of 1.6). However, the project could be justified in the wider perspective of the integration and regional cooperation which aims to increase the population's mobility and commercial exchanges between the two countries. In the current backdrop, the Consultants estimated the internal risk inherent to this project to be high, particularly from a commercial standpoint.

3.1.2.5 Interconnection A5: Dimbokro (Ivory Coast) – Sanniquellie (Libéria)

This new line, shown on the ECOWAS Master Plan, is part and parcel of the coastal corridor, towards Liberia and Guinea. With its 535 km, it links the railways the Ivory Coast and Liberia, creating a railway network where the zone of influence covers 1,783 km in three countries (1,137 km in Ivory Coast, 46 in Liberia and 600 in Burkina Faso). In the Ivory Coast, Dimbokro is located 183 km north of Abidjan, on the line that crosses the country towards Burkina Faso. In Liberia, Sanniquellie is located on the northern tip of the ore carrying line of LAMCO, in the foothills of Mont Nimba, some 46 kilometers from the Ivorian border. The construction of the new track will make it possible to service the region of Man and to link the political capital of the Ivory Coast (Yamoussoukro) to the economic capital (Abidjan). It also provides a way to forward items towards the port of Abidjan for iron ore carrying trains from the rich deposits of Man (Mont Klahoyo, Mont Gao, Mont Touba, Mont

Tia and Mont Nian). As well as the Nimba region located at the outermost of the Ivory Coast, Liberia and Guinea.

This project mainly holds a national interest for the Ivory Coast. As it does not anticipate the reconstruction of the LAMCO railway that leads to the port of Buchanan, it contributes very little to the ECOWAS objectives in terms of regional integration and cooperation. The operation scenario use for the current analysis based on the implementation of international services between Abidjan and Saniquellie (718 km). The operating plan anticipates the carriage of passenger, merchandise and ore trains. Its implementation calls upon a shared use of the track with the SITARAIL trains, between Dimbokro and Abidjan.

For this new line, the Consultants recommend a standard meter gauge (1,000 mm gauge, 25 tones load limit, maximum speeds of 80 km/h for passenger trains and 60 km/h for freight trains). It goes without saying given the standard meter gauge to which the existing tracks are linked. However, it is recommended to outfit the subgrade and other infrastructures of the right-of-way (bridges, viaducts, culverts) to the norms of the standard template (appropriate design loads and track clearances) in order to facilitate the proposed transition.

In addition to the new line, the project anticipates improvements to the Dimbokro-Abidjan segment to increase the capacity of the line and its operational characteristics. The capital cost of the systems and infrastructures to outfit the 535 kilometers of interconnection is estimated at $984 M and $41 M to improve the 183 km of existing tracks. These estimates include the costs related to improving the signalization and communication systems. The cost of buying the equipment (locomotives, cars, wagons) is estimated at $137 M for passenger and freight services and at $375 M for iron ore carrying services, for a sub-total of $1,537 M (2007 dollars) spread out over 5 years.

The Consultants understand that the ECOWAS and the affected railways could, if they wish, opt for a standard track gauge rather than a narrow gauge on the entire length of the path. The cost for building the 535 km of interconnection is then estimated at $1,180 M while the cost for rebuilding the 183 km of existing tracks could be $220 M for a total of $1,400 M. The cost for standard rolling stock is $435 M. If it is deemed appropriate, the addition of a centralized traffic monitoring system would require an additional $503 M. The added cost for fibre optics rather than a microwave communication system stands at $39 M.

The forecast for passenger traffic during the first operational year is estimated at 133,000 passengers. Moreover, a traffic of 300,000 tones of merchandise is expected during the same year. Mainly, it consists of a containerized freight which is currently the truckers' prerogative. Institutional and regulatory reforms are required to create a fair climate and guarantee the portion of the market which is vested to the railway transport. As for heavy transport, we anticipate the travel of some 3 M tones of mineral ore a year from the Man deposits.

The financial analyses, based on the recommended concept, show that the passenger services will bring about an annual loss of $2.0 M, which we suppose is the Ivory Coast

government's responsibility (below the line). However, the freight services will generate an operating income increasing from $9 M to $22 M a year on a 30-year period. Discounted with a rate of 7% on a 30-year period, the cash flow statements generate a negative present value of $862 M. These results are strictly related to the railway elements therefore, they do not take into consideration the port improvements required to ensure the proper operation of the transport line.

Despite the rather optimistic expected traffic, project A5 - Dimbokro-Sanniquellie is not profitable based on the volumes of traffic and forecasted revenues. Moreover, the public interest in the investment is in question based on the cost-benefit ratio of 2.2 and the meager contribution to the ECOWAS objectives in terms of regional integration and cooperation. In the current backdrop, the Consultants estimated the internal risk inherent to this project to be high, particularly from a commercial standpoint.

3.1.2.6 Interconnection B1: Bamako (Mali) – Ouangolodougou (Ivory Coast)

This new line, shown on the ECOWAS Master Plan, is a key element in the trans-sahelian corridor. With its 569 km (474 km in Mali and 95 km in the Ivory Coast) it links Bamako to Ouangolodougou via Bougouni and Sikasso. Ouangolodougou is an intermodal centre on the Ivory Coast railway, located near the Burkina Faso border. Towards the north, this railway runs all the way to Ouagadougou and Kaya. Towards the south, it ends in Abidjan. Incidentally, Bamako is already has a rail link to Dakar. Correspondingly, the new link brings joins the capitals of Senegal, Mali, the Ivory Coast and Burkina Faso via a railway network where the zone of influence has a total reach of 2,934 km reach.

As for the interconnection route, the new railway will run along the RN7 from end to end. The terrain is generally easy except south of Sikasso where hills must be bypassed. The crossing of the Niger River in Bamako, from Baoulé to Bougouni and from Bagoé to Koumantou require major engineering structures.

For this new line, the Consultants recommend a standard meter gauge (1,000 mm gauge, 25 tones load limit, maximum speeds of 80 km/h for passenger trains and 60 km/h for freight trains). It goes without saying given the standard meter gauge to which the existing tracks are linked. However, it is recommended to outfit the subgrade and other infrastructures of the right-of-way (bridges, viaducts, culverts) to the norms of the standard template (appropriate design loads and track clearances) in order to facilitate the proposed transition.

From an operational point of view, the current study supposes an integrated operating plan on the entire network from the very implementation of the interconnection. It would then be necessary to rework the current services, currently executed by the concession holders TRANSRAIL and SITARAIL. The operating plan anticipates passenger services (250,000 passenger traffic), freight services (2 M tones) and ore carrying services (1 M tones). The new railway will be the obvious choice for mass transit. However, institutional and regulatory reforms are required to create a fair climate which guarantees the rail transportation sector its share of containerized freight.

In addition to the new interconnection, the project anticipates improvements to the Dakar-Bamako segment to increase the capacity of the line and its operational characteristics. The capital cost of the systems and infrastructures to outfit the 569 kilometers of interconnection is estimated at $1,133 M while improvements to the 1,828 km of existing tracks is estimated at $292. The cost of buying the equipment (locomotives, cars, wagons) is estimated at $404 M for passenger and freight services and $91 M for ore carrying services. Therefore, the project calls for a total of $1,920 M (2007 dollars) spread out over 5 years

The Consultants understand that the ECOWAS and the affected railways could, if they wish, opt for a standard track gauge rather than a narrow gauge on the entire length of the path. The cost for building the 569 km of interconnection is then estimated at $1,360 M while the cost for rebuilding the 1,828 km of existing tracks could be $2,194 M for a total of $3,552 M. The cost for standard rolling stock is $420 M. If it is deemed appropriate, the addition of a centralized traffic monitoring system would require an additional $1,678 M. The added cost for fibre optics rather than a microwave communication system stands at $131 M.

The financial analyses, based on the recommended concept, reveal that the passenger services will generate a loss of $7.7 M, which we suppose is the state's responsibility (below the line). However, the freight services will generate an operating income growing from $68 to $96 M per year, during the first 30 years of operation. Incidentally, the ore carrying services generate a net cash flow of $24 M per year during the same period. Discounted with a rate of 7%, the cash flow statements generate a negative present value of $675 M. These results are strictly related to the railway elements therefore, they do not take into consideration the port improvements required to ensure the proper operation of the transport line.

The B1 - Bamako-Ouangolodougou project is economically viable, with an internal rate of return of 2.2%. However, the public purpose of the investment remains questionable as the benefit-cost ratio sits at 1.7. The Consultants deem the risks inherent to the project moderate, should there be an improvement in the socio-political climate in the Ivory Coast.

3.1.2.7 Interconnection B2: Niamey (Niger) – Kaya (Burkina Faso)

This new line, shown on the ECOWAS Master Plan, is a track which will enable opening-up for Niger, which is part of the trans-sahelian corridor. With its 398 km (210 km in Burkina Faso and 188 km in Niger) it links Kaya to Niamey via Dori. Kaya is at the top of the Burkina Faso railway, which in turn is linked to the railway of the Ivory Coast. Correspondingly, the new link joins the capitals of Niger, Burkina Faso and the Ivory Coast via a railway network of 1,646 km (188 km in Niger, 810 in Burkina Faso, 648 km in the Ivory Coast). The operating plan anticipates the carriage of the passenger, merchandise and ore trains on the entire length of the haul. Its implementation requires reworking the current services performed by the concession holder SITARAIL.

As for the route for this interconnection, the new railway if first located within the right-of-way already in place between Kaya and Dori (153 km). It then runs along the RN6 towards

Tera and Gotheye and along the west shore of the Niger River, without crossing the river, up to the new terminal.

From an operational point of view, the current study supposes an integrated operating plan on the Abidjan-Ouagadougou-Niamey corridor. The proximity to the mining resources of Tambao makes it possible to service this region using block trains. For the purposes of the current study, the operating plan anticipates passenger services (250,000 passenger traffic) and freight services (1.2 M tones). The new railway will be the obvious choice for mass transit. However, institutional and regulatory reforms are required to create a fair climate which guarantees the rail transportation sector its share of containerized freight.

For this new line, the Consultants recommend a standard meter gauge (1,000 mm gauge, 25 tones load limit, maximum speeds of 80 km/h for passenger trains and 60 km/h for freight trains). It goes without saying given the standard meter gauge to which the existing tracks are linked. However, it is recommended to outfit the subgrade and other infrastructures of the right-of-way (bridges, viaducts, culverts) to the norms of the standard template (appropriate design loads and track clearances) in order to facilitate the proposed transition.

The capital cost of the systems and infrastructures to outfit the 398 kilometers of interconnection is estimated at $729 M and $181 M for the reconstruction of the 1,248 kilometers of existing tracks. The cost of buying the equipment (locomotives, cars, wagons) is estimated at $329 M for passenger and freight services and $394 M for iron ore carrying services. Therefore, the project calls for a total of $1,633 M (2007 dollars) spread out over 5 years.

The Consultants understand that the ECOWAS and the affected railways could, if they wish, opt for a standard track gauge rather than a narrow gauge on the entire length of the path. The cost for building the 398 km of interconnection is then estimated at $875 M while the cost for rebuilding the 1,248 km of existing tracks could be $1,498 M for a total of $2,373 M. The cost for standard rolling stock is $615 M. If it is deemed appropriate, the addition of a centralized traffic monitoring system would require an additional $1,152 M. The added cost for fibre optics rather than a microwave communication system stands at $90 M.

The financial analyses, based on the recommended concept, reveal that the passenger services will generate an annual loss of $5.3 M, which we suppose is the state's responsibility (below the line). However, the freight services will generate an operating income growing from $64 to $91 M per year, during the first 30 years of operation. Incidentally, the ore carrying services generate a net cash flow of $112 M per year during the same period. Discounted with a rate of 7%, the cash flow statements generate a positive present value of $76 M, which leads to an internal rate of return of 7.6%, which is slightly above the break-even point used in the current study. These results are strictly related to the railway elements therefore, they do not take into consideration the port improvements required to ensure the proper operation of the transport line.

The B2 - Niamey-Kaya project is economically and socio-economically viable. The benefit-cost ratio sits at 2.8. The Consultants deem the risks inherent to the project moderate, should there be an improvement in the socio-political climate in the Ivory Coast.

3.1.2.8 Interconnection B3: Niamey (Niger) – Kaura Namoda (Nigeria)

This new line, shown on the ECOWAS Master Plan, is a track which will enable opening-up for Niger, which is part of the trans-sahelian corridor. With its 500 km (257 km in Niger and 243 km in Nigeria) it links Niamey to Kaura Namoda via Dosso and Sokoto. Kaura Namoda is a spurtrack of Nigeria's railway which leads to Zaria on the main core. Correspondingly, the new link gives access to the Port of Lagos or the Port of Harcourt by diverging Kaduna on the NRC network. The course is substantially the same in both cases that is, 1,665 km (257 km in Niger and 1,408 km in Nigeria). The Tin Island facilities at the Port of Lagos are however better equipped to welcome the additional containers.

As for the route for this interconnection, the new railway must first cross the Niger River from a new terminal located on the west shore of the river. It then runs along the RN1 towards Dosso and then heads towards Sokoto via Be Be, Lema, Bagizza and Katami. From Sokoto, the line runs along Route A128 up to Talata Mafara and heads in Kaura Namoda via Maradun. From an operational point of view, the current study supposes an integrated operating plan between Niamey and Lagos. The current services performed by the NRC, very few are reworked accordingly.

For this new line, the Consultants recommend a narrow meter gauge (1,067 mm gauge, 25 tones load limit, maximum speeds of 80 km/h for passenger trains and 60 km/h for freight trains). However, it is recommended to outfit the subgrade and other infrastructures of the right-of-way (bridges, viaducts, culverts) to the norms of the standard template (appropriate design loads and track clearances) in order to facilitate the proposed transition. This solution, which preserves the integrity of the traffic from end to end, is perfectly logical within the framework of the current study which takes into account the various ECOWAS interconnection projects as independent or even mutually exclusive projects. However, it is questionable within the perspective of developing the trans-sahelian corridor up to Dakar, as it moves the incompatible gauge problems towards the west. With networking in mind, it would undoubtedly be preferable to build a new meter gauge up to Kaura and to acquire new cars and new wagons equipped with axles with variable gauge to operate the new services. While still thinking about networking, this strategy would have the advantage of facilitating the possible connection of the Benin and Togo railways to the integrated network. However, it would penalize the C3 option of the current study by increasing the costs of the rolling stock and decreasing the performance parameters, which the Consultants deem unfair. However, these elements are taking into consideration in the multicriteria analysis.

The operating plan is based on a forecasted 130,000 passenger and 1.9 M tones of general merchandise traffic during the first operational year. We then anticipate the carriage of 1 M tones of mineral ore per year. Of course, this implies the concurrent implementation of mining and railway related projects. The new railway will be the obvious choice for mass

transit. However, institutional and regulatory reforms are required to create a fair climate which guarantees the rail transportation sector its share of containerized freight.

In addition to the new track, the project anticipates punctual improvements to the main track between Kano and Zaria to increase the capacity of the line and its operational characteristics. The capital cost of the systems and infrastructures to outfit the 500 kilometers of interconnection is estimated at $875 M and $75 M for the rehabilitation of the existing tracks. The cost of buying the equipment (locomotives, cars, wagons) is estimated at $467 M for passenger and freight services and at $110 M for iron ore carrying services for a sub-total of $577 M. Therefore, the project calls for a total of $1,527 M (2007 dollars) spread out over 5 years.

The Consultants understand that the ECOWAS and the affected railways could, if they wish, opt for a standard track gauge rather than a narrow gauge on the entire length of the path. The cost for building the 500 km of interconnection is then estimated at $1,050 M while the cost for rebuilding the 1,069 km of existing tracks could be $1,283 M for a total of $2,333 M. The cost for standard rolling stock is $490 M. If it is deemed appropriate, the addition of a centralized traffic monitoring system would require an additional $1,098 M. The added cost for fibre optics rather than a microwave communication system stands at $86 M.

The financial analyses, based on the recommended concept, reveal that the passenger services will generate an annual loss of $4.7 M, which we suppose is the state's responsibility. However, the freight services will generate an operating income growing from $92 to $162 M per year, during the first 30 years of operation. Incidentally, the ore carrying services generate a net cash flow of $33 M per year during the same period. Discounted with a rate of 7%, the cash flow statements generate a positive present value of $192 M which leads to an internal rate of return of 8.5%, which is slightly above the break-even point used in the current study. These results are strictly related to the railway elements therefore, they do not take into consideration the port improvements required to ensure the proper operation of the transport line.

The B3 - Niamey-Kaura Namoda project is economically and socio-economically viable. The benefit-cost ratio sits at 4.2. In the current climate, the Consultants deem the internal and external risks of the project high.

3.1.2.9 Interconnection C1: Niamey (Niger) –Parakou (Benin)

This new line, shown on the ECOWAS Master Plan, is a track which will enable opening-up for Niger. With its 625 km (329 in Benin and 296 in Niger) it links Niamey to Parakou, providing direct access to the Port of Cotonou. Parakoou is at the top of the Benin railway line leading to Cotonou. The new link connects the two capitals through a 1,059 km railway network (763 km in Benin and 296 km in Niger).

The recommended route for the interconnection has roots to previous studies conducted by the *Organisation Commune Bénin-Niger* (OCBN). The new track runs through Ndali,

Bembéréké, Gogounou, Kandi and Malanville, along RN 2 in Benin and then Gaya and Dosso in Niger, along N7 and N1. In Niamey, the new railway must cross the Niger River to get to the completed terminal on the west shore of the river.

To outfit this new line, the Consultants recommend a standard meter gauge (1,000 mm gauge, 25 tones load limit, maximum speeds of 80 km/h for passenger trains and 60 km/h for freight trains). It goes without saying given the standard meter gauge to which the existing tracks are linked. However, it is recommended to outfit the subgrade and other infrastructures of the right-of-way (bridges, viaducts, culverts) to the norms of the standard template (appropriate design loads and track clearances) in order to facilitate the proposed transition.

The operating scenario on the Cotonou-Niamey line anticipates the carriage of passenger, merchandise and mineral ore on the entire course. Its implementation will require that the current services performed by the OCBN be reworked. We anticipate a traffic of 663,000 passengers and a freight traffic of 1,135,000 tones during the first operational year. The operating plan also makes it possible to service mining areas such as Say, Loumbou-Loumbou and Madékali (5 M tones) using block trains. Of course, this implies the concurrent implementation of mining and railway related projects. The new railway will be the obvious choice for mass transit. However, institutional and regulatory reforms are required to create a fair climate which guarantees the rail transportation sector its share of containerized freight.

In addition to the new line, the project anticipates improvements to the Parakou-Pahou-Cotonou segment to increase the capacity of the line and its operational characteristics. The capital cost of the systems and infrastructures to outfit the 625 kilometers of interconnection is estimated at $1,129 M and $68 M for the rehabilitation of the 434 kilometers of existing tracks. The cost of buying the equipment (locomotives, cars, wagons) is estimated at $748 M for passenger and freight services and at $364 M for iron ore carrying services, for a sub-total of $1,112 M. Therefore, the project calls for a total of $2,309 M (2007 dollars) spread out over 5 years.

The Consultants understand that the ECOWAS and the affected railways could, if they wish, opt for a standard track gauge rather than a narrow gauge on the entire length of the path. The cost for building the 625 km of interconnection is then estimated at $1,355 M while the cost for rebuilding the 434 km of existing tracks could be $521 M for a total of $1,875 M. The cost for standard rolling stock is $945 M. If it is deemed appropriate, the addition of a centralized traffic monitoring system would require an additional $741 M. The added cost for fibre optics rather than a microwave communication system stands at $58 M.

The financial analyses, based on the recommended concept, reveal that the passenger services will generate an annual loss of $9.1 M, which we suppose is the state's responsibility. However, the freight services will generate an operating income growing from $24 to $93 M per year, during the first 30 years of operation. Incidentally, the ore carrying

services generate a net cash flow of $82 M per year during the same period. Discounted with a rate of 7%, the cash flow statements generate a negative present value of $590 M. These results are strictly related to the railway elements therefore, they do not take into consideration the port improvements required to ensure the proper operation of the transport line.

The C1 - Niamey-Parakou project is economically viable, with an internal rate of return of 3%. However, the public purpose of the investment remains questionable as the benefit-cost ratio sits at 1.2. The Consultants deem the risks inherent to the project moderate.

3.1.2.10 Interconnection C2: Ansongo (Mali) - Kaya (Burkina Faso)

This new line, shown on the ECOWAS Master Plan, gives the northeast portion of Mali a direct railway access to the Port of Abidjan. Besides the structuring effect of such an opening, the linking of the current network makes it possible to promote the natural resources found in the regions of Gao and Tambao. With its 364 kilometers (92 km in Mali and 272 km in Burkina Faso) the new link connects Ansongo to Ouagadougou and Abidjan. The resulting railway stretches over 1,612 kilometers (364 km in Mali, 600 km in Burkina Faso and 648 km in the Ivory Coast). The operating plan anticipates the carriage of the passenger, merchandise and ore trains on the entire length of the haul. Its implementation inevitably requires the integration of the current services performed by the concession holder SITARAIL.

From Kaya, the route heads towards Dori within the right-of-way which has already been leveled on almost its entire length. The line then runs along the RN3 through the Sahel Reserve, through Galgu, Loyraa Zana and Salmossi and then bends towards Markoye and Tambao. Then, the crossing of dunes in desert areas poses a construction challenge which must be carefully examined. By running along Route L62 via Tessit, it is possible to cross the Niger River in Lelehoy to then reach Ansongo.

For this new line, the Consultants recommend a standard meter gauge (1,000 mm gauge, 25 tones load limit, maximum speeds of 80 km/h for passenger trains and 60 km/h for freight trains). It goes without saying given the standard meter gauge to which the existing tracks are linked. However, it is recommended to outfit the subgrade and other infrastructures of the right-of-way (bridges, viaducts, culverts) to the norms of the standard template (appropriate design loads and track clearances) in order to facilitate the proposed transition.

A traffic of 250,000 passengers and 40,000 tones of merchandise is anticipated from the very first operational year. The mining related traffic is estimated at 5 M tones. Of course, this implies the concurrent implementation of mining and railway related projects. The new railway will be the obvious choice for mass transit. However, institutional and regulatory reforms are required to create a fair climate which guarantees the rail transportation sector its share of containerized freight.

In addition to the interconnection, the project anticipates improvements to the existing track between Kaya and Abidjan to increase the capacity of the line and its operational characteristics. The capital cost of the systems and infrastructures to outfit the 364 kilometers of interconnection is estimated at $638 M and $181 M for the rehabilitation of the 1,248 kilometers of existing tracks. The cost of buying the equipment (locomotives, cars, wagons) is estimated at $71 M for passenger and freight services and at $500 M for iron ore carrying services. Therefore, the project calls for a total of $1,390 M (2007 dollars) spread out over 5 years.

The Consultants understand that the ECOWAS and the affected railways could, if they wish, opt for a standard track gauge rather than a narrow gauge on the entire length of the path. The cost for building the 364 km of interconnection is then estimated at $766 M while the cost for rebuilding the 1,248 km of existing tracks could be $1,498 M for a total of $2,264 M. The cost for standard rolling stock is $485 M. If it is deemed appropriate, the addition of a centralized traffic monitoring system would require an additional $1,128 M. The added cost for fibre optics rather than a microwave communication system stands at $89 M.

The financial analyses, based on the recommended concept, reveal that the passenger services will generate an annual loss of $5.7 M, which we suppose is the state's responsibility. However, the freight services will generate a surplus ranging from $2 M to $3 M a year, during the first 30 years of operation. However, the ore carrying services will generate a net cash flow of $144 M per year during the same period. Discounted with a rate of 7%, the cash flow statements generate a negative present value of $178 M. These results are strictly related to the railway elements therefore, they do not take into consideration the port improvements required to ensure the proper operation of the transport line.

The C2 - Ansongo-Kaya project is economically viable, with an internal rate of return of 5.4%. The public purpose of the investment sits at 2.7. In the current climate, the Consultants deem the inherent risk of this project moderate.

3.1.2.11 Interconnection C3: Maradi (Niger) – Kano (Nigeria)

This new line, shown on the ECOWAS Master Plan, gives the central-south portion of Niger a direct railway access to a seaport. Kano is an intermediate point on the main core of the Nigeria railway, leading either to the Port of Lagos or the Port of Harcourt from Kaduna. The course is more or less the same in both cases that is, 1,373 km (45 km in Niger and 1,328 km in Nigeria). The Tin Island facilities at the Port of Lagos are however better equipped to welcome the additional traffic. The operating plan anticipates the carriage of passenger trains and general merchandise freight on this course. The few currents services performed by the NRC will be reworked accordingly.

From Kano, the route runs through Katsina, along RN9. For this new line, the Consultants recommend a narrow meter gauge (1,067 mm gauge, 25 tones load limit, maximum speeds of 80 km/h for passenger trains and 60 km/h for freight trains). However, it is recommended to outfit the subgrade and other infrastructures of the right-of-way (bridges, viaducts,

culverts) to the norms of the standard template (appropriate design loads and track clearances) in order to facilitate the proposed transition.

A traffic of 130,000 passengers and 1.3 M tones of merchandise is anticipated from the very first operational year. However, institutional and regulatory reforms are required to create a fair climate which guarantees the rail transportation sector its share of containerized freight.

In addition to the interconnection, the project anticipates punctual improvements of the main track between Kana and Zaria to increase the capacity of the line and its operational characteristics. The capital cost of the systems and infrastructures to outfit the 241 kilometers of interconnection is estimated at $509 M and $75 M for improvements to the existing tracks. The cost of buying the equipment (locomotives, cars, wagons) is estimated at $178 M. Therefore, the project calls for a total of $760 M (2007 dollars) spread out over 5 years.

The Consultants understand that the ECOWAS and the affected railways could, if they wish, opt for a standard track gauge rather than a narrow gauge on the entire length of the path. The cost for building the 241 km of interconnection is then estimated at $611 M while the cost for rebuilding the 1,981 km of existing tracks could be $2,377 M for a total of $2,988 M. The cost for standard rolling stock is $151 M. If it is deemed appropriate, the addition of a centralized traffic monitoring system would require an additional $1,555 M. The added cost for fibre optics rather than a microwave communication system stands at $122 M.

The financial analyses, based on the recommended concept, reveal that the passenger services will generate an annual loss of $3.9 M, which we suppose is the state's responsibility. However, the freight services will generate an operating income growing from $30 to $52 M per year, during the first 30 years of operation. Discounted with a rate of 7%, the cash flow statements generate a negative present value of $238 M. These results are strictly related to the railway elements therefore, they do not take into consideration the port improvements required to ensure the proper operation of the transport line.

The C3 - Maradi-Kano project is economically viable, with an internal rate of return of 2.8%. Moreover, the public purpose for this investment sits at 5.8. In the current climate, the Consultants deem the internal and external risks of the project high.

3.1.2.12 Interconnection C4: Man (Ivory Coast) – San Pedro (Ivory Coast)

This new line, shown on the ECOWAS Master Plan, extends from the Port of San Pedro to the city of Man in southern Ivory Coast, is an element of the future integrated network. However, it does not connect to an existing railway and its implementation does not contribute to the ECOWAS objectives in terms of regional integration and cooperation. Moreover, the population density and request for freight transportation are not enough to sustain a railway operation. However, the potential for industrial development in the Man region seem, at first, quite promising to examine the feasibility of a mining railway which could be used to transport people and merchandise. However, there is an indispensable

condition that the fundamental hypothesis of the concurrent implementation of mining and railway related projects.

Man is located at the foothills of a range of mountains with a high potential for mineral ore deposits (mounts Klahoyo, Gao, Touba, Tia and Nian). The relatively short distance (399 km) between these two development poles and the sea is certainly an asset. The difference in elevation is considerable but acceptable for the return when block trains are empty. From the Port of San Pedro, the route for the new line first runs through Soubré and then Déléya, Duékoué and Bangolo and end at the foot of Mont Tonkoui, on the outskirts of Man. The deposit of Mont Klahoyo is located some 30 km north of Man.

The operating plan is based on forecast of 115,000 passengers and 490,000 tones of general merchandise during the first operational year. . We then anticipate the carriage of some 3 M tones of mineral ore per year. The new railway will be the obvious choice for mass transit. However, institutional and regulatory reforms are required to create a fair climate which guarantees the rail transportation sector its share of containerized freight.

Individually, the mining vocation of this line would lead to opt from the outset for a standard template. However, with networking in mind, it would be preferable to choose a meter gauge (1,000 mm gauge, 25 tones load limit, maximum speeds of 80 km/h for passenger trains and 60 km/h for freight trains). To facilitate the possible conversion, it is recommended to outfit the subgrade and other infrastructures of the right-of-way (bridges, viaducts, culverts) to the norms of the standard template (appropriate design loads and track clearances) in order to facilitate the proposed transition.

The capital cost of the systems and infrastructures to outfit the line is estimated at $718 M and $75. The cost of buying the equipment (locomotives, cars, wagons) is estimated at $115 M for passenger and freight services and at $162 for ore carrying services. Therefore, the project calls for a total of $995 M (2007 dollars) spread out over 5 years.

The Consultants understand that the ECOWAS and the affected railways could, if they wish, opt for a standard track gauge rather than a narrow gauge on the entire length of the path. The cost for building the 399 km of interconnection is then estimated at $862 M. The cost for standard rolling stock is $235 M. If it is deemed appropriate, the addition of a centralized traffic monitoring system would require an additional $279 M. The added cost for fibre optics rather than a microwave communication system stands at $22 M.

The financial analyses, based on the recommended concept, reveal that the passenger services will generate an annual loss of $1 M, which we suppose is the Ivorian government's responsibility. However, the freight services (containerized and others) will generate an operating income growing from $5 to $18 M per year, during the first 30 years of operation. Incidentally, the ore carrying services generate a net cash flow of $24 M per year during the same period. Discounted with a rate of 7%, the cash flow statements generate a negative present value of $497 M. These results are strictly related to the railway elements therefore,

they do not take into consideration the port improvements required to ensure the proper operation of the transport line.

Despite the rather optimistic expected traffic, project C4 - Man-San Pedro is not profitable based on the volumes of traffic and forecasted revenues. Moreover, the public interest in the investment is in question based on the poor economic record (cost-benefit ratio of 1.7). In the current backdrop, the Consultants estimated the internal risks inherent to this project to be high, particularly from a commercial standpoint.

3.1.2.13 Interconnection C5: Niamey (Niger) – Blitta (Togo)

This interconnection, shown on the ECOWAS Master Plan, is a track which will enable opening-up for Niger. With its 839 km (416 km in Togo, 306 km in Burkina Faso and 117 km in Niger) it links Niamey to Blitta, giving direct access to the Port of Lomé. Blitta is at the top of the Togo railway line leading to Lomé. The new link connects both capitals through a 1,119 km railway network (696 km in Togo, 306 in Burkina Faso and 117 in Niger) using the existing track of 280 kilometers.

To determine an appropriate route for outfitting a new track through the mountains range of Togo turned out to be long and difficult, as evidenced by the numerous studies conducted over the years to reach the iron deposits of the Bassar-Bandjeli belt. These studies recommended abandoning the existing track between Anié and Blitta (83 km) in favor of a new route in the Mono valley. In accordance with the Master Plan, the Consultants believe it is preferable to keep and rehabilitate this segment. To maximize the profits and minimize the costs, the Consultants also recommend outfitting a new line linking the most important population clusters in Togo, while still avoiding the major constraints brought on by the numerous massifs and reserves in the northern part of the country.

From Blitta, the new line runs along RN1 up to Sokodé, where it bends towards Tchamba to avoid Mont Koranga. Bypassing the deep crevasse of Alédjo, the route runs along the Beninese border to reach Kara and then swerves towards the west to avoid the Kabyé and Défalé mountains. From Guérin-Kouka, the route runs along Route 17 up to Sansanné-Mango while skirting around the Kéran national park. A spurtrack towards the south is anticipated in Guérin-Kouka to service the Bassar region. From Sansanné, the route runs along Route 41 along the wildlife refuge of Oti to cross the Burkinabe border near Tambina. In Burkina Faso, the line runs along Route 18 between the Pama reserve and the Koulpelogo reservoir.

To get to Ouagadougou and Niamey, the Master Plan recommends a connection with the cross-country route south of Pama. However, the Consultants question the practicability of a cross-country route in the Ouagadougou-Tenkodogo-Pama-Tansarga-Say-Niamey. Rather, it is recommended to extend the line up to Fada Ngouma and to move the cross-country route in the Ouagadougou-Fada Ngouma-Kantchari-Niamey corridor as explained in the section pertaining to C8 - Niamey-Ouagadougou.

Incidentally, the Consultants took note of the route suggested in the AFRICARAIL project which, from Lama Kara, runs to Dapango and Tenkodogo towards Sansanné and Ouagadougou. On the one hand, the course along RN1 in Togo faces the mountains in the Défalé region and crosses the Kéran national park from end to end; this goes against the design criteria. On the other hand, the course along routes N16, N17 and N5 in Burkina Faso do not allow for the creation of the Lomé-Niamey link recommended in the Master Plan, therefore it cannot be considered for the purposes of the current study.

To outfit this new line, the Consultants recommend a standard meter gauge (1,000 mm gauge, 25 tones load limit, maximum speeds of 80 km/h for passenger trains and 60 km/h for freight trains). It goes without saying given the standard meter gauge to which the existing tracks are linked. However, it is recommended to outfit the subgrade and other infrastructures of the right-of-way (bridges, viaducts, culverts) to the norms of the standard template (appropriate design loads and track clearances) in order to facilitate the proposed transition.

The operating scenario on the Lomé-Niamey line anticipates the carriage of passenger, merchandise and mineral ore on the entire course. Its implementation will require that the current services performed by the concession holder TOGORAIL be reworked. The operating plan is based on a 250,000 passenger traffic and a freight traffic of 2 M tones of general merchandise during the first operational year. We then anticipate the carriage of some 5 M tones of mineral ore per year from the Say, Kandadji, Kodjari, wagon-Mongteéo and Bassar-Bandjeli deposits. Of course, this implies the concurrent implementation of mining and railway related projects. The new railway will be the obvious choice for mass transit. However, institutional and regulatory reforms are required to create a fair climate which guarantees the rail transportation sector its share of containerized freight.

In addition to the new track, the project anticipates improvements to the existing line between Blitta and the Port of Lomé. The capital cost of the systems and infrastructures to outfit the 839 kilometers of interconnection is estimated at $1,705 M and $50 M for improvements to the 280 kilometers of existing tracks. The cost of buying the equipment (locomotives, cars, wagons) is estimated at $389 M for passenger and freight services and at $276 M for ore carrying services. Therefore, the project calls for a total of $2,420 M (2007 dollars) spread out over 5 years.

The Consultants understand that the ECOWAS and the affected railways could, if they wish, opt for a standard track gauge rather than a narrow gauge on the entire length of the path. The cost for building the 839 km of interconnection is then estimated at $2,046 M while the cost for rebuilding the 280 km of existing tracks could be $336 M for a total of $2,382 M. The cost for standard rolling stock is $565 M. If it is deemed appropriate, the addition of a centralized traffic monitoring system would require an additional $783 M. The added cost for fibre optics rather than a microwave communication system stands at $62 M.

The financial analyses, based on the recommended concept, reveal that the passenger services will generate an annual loss of $3.8 M, which we suppose is the states' responsibility. However, the freight services (containerized and others) will generate a surplus ranging from $36 M to $64 M per year, during the first 30 years of operation. Incidentally, the ore carrying services generate a net cash flow of $42 M per year during the same period. Discounted with a rate of 7%, the cash flow statements generate a negative present value of $1,149 M. These results are strictly related to the railway elements therefore, they do not take into consideration the port improvements required to ensure the proper operation of the transport line.

All in all, the project C5 - Niamey-Blitta is not profitable based on the volumes of traffic and forecasted revenues. Moreover, the public interest in the investment is in question based on the low cost-benefit ratio (1.1). In the current backdrop, the Consultants estimated the internal risks inherent to this project to be moderate.

3.1.2.14 Interconnection C5 (1): Ouagadougou (Burkina Faso) - Blitta (Togo)

This interconnection, shown on the ECOWAS Master Plan, gives Burkina Faso a second seaport access. With its 783 km (416 km in Togo and 367 km in Burkina Faso) the new line connects Ouagadougou to Blitta, giving access to the Port of Lomé. Blitta is at the top of the Togo railway line leading to Lomé. The new link connects two capitals via a 1,063 km railway network (696 km in Togo and 367 km in Burkina Faso) using the existing track which covers 280 kilometers. Moreover, it has the advantage of creating a railway loop throughout the Ivory Coast, Burkina Faso and Togo starting at the ports of Lomé and Abidjan. This loop covers 2,375 km. It includes, in addition to the Togo railway operated by the concession holder TOGORAIL, the railways of the Ivory Coast and Burkina Faso operated by the concession holder SITARAIL.

As for the route, the C5 (1) - Ouagadougou-Blitta interconnection uses the same corridor as the C5 interconnection, between Blitta and Fada Ngouma and then swerves towards Ouagadougou via Koupéa and Zorgo along RN4. IN Burkina Faso, access to the two seaports increases the competitiveness of the transportation sector by putting the operators (consignor of goods and carriers) in a competitive situation. In this backdrop, it is very difficult to establish the respective parts of the market belonging to the freight carriage. For the purposes of the current study, the operating plan used on the Ouagadougou-Lomé line relies on the most optimistic forecasts; 250,000 passengers and 1.4 M tones of general merchandise during the first operational year. We then anticipate the carriage of some 4 M tones of mineral ore per year from the Wagon-Mongteéo and Bassar-Bandjeli deposits. Of course, this implies the concurrent implementation of mining and railway related projects. The new railway will be the obvious choice for mass transit. However, institutional and regulatory reforms are required to create a fair climate which guarantees the rail transportation sector its share of containerized freight.

To outfit this interconnection, the Consultants recommend a standard meter gauge (1,000 mm gauge, 25 tones load limit, maximum speeds of 80 km/h for passenger trains and 60

km/h for freight trains). The project anticipates improvements to the Blitta-Lomé-Port of Lomé segment, to increase the capacity of the line and its operational characteristics.

The capital cost of the systems and infrastructures to outfit the 783 kilometers of interconnection is estimated at $1,594 M and $50 M for the reconstruction of the 280 kilometers of existing tracks. The cost of buying the equipment (locomotives, cars, wagons) is estimated at $420 M for passenger and freight services, and at $190 M for ore carrying services. Therefore, the project calls for a total of $42,254 M (2007 dollars) spread out over 5 years.

The Consultants understand that the ECOWAS and the affected railways could, if they wish, opt for a standard track gauge rather than a narrow gauge on the entire length of the path. The cost for building the 783 km of interconnection is then estimated at $1,913 M while the cost for rebuilding the 280 km of existing tracks could be $336 M for a total of $2,249 M. The cost for standard rolling stock is $518 M. If it is deemed appropriate, the addition of a centralized traffic monitoring system would require an additional $744 M. The added cost for fibre optics rather than a microwave communication system stands at $58 M.

The financial analyses, based on the recommended concept, reveal that the passenger services will generate an annual loss of $3.8 M, which we suppose is the states' responsibility. However, the freight services (containerized and others) will generate a surplus ranging from $57 to $95 M per year, during the first 30 years of operation. Incidentally, the ore carrying services generate a net cash flow of $20 M per year during the same period. Discounted with a rate of 7%, the cash flow statements generate a negative present value of $936. These results are strictly related to the railway elements therefore, they do not take into consideration the port improvements required to ensure the proper operation of the transport line.

All in all, the project C5 (1) - Ouagadougou-Blitta is not profitable based on the volumes of traffic and forecasted revenues. Moreover, the public interest in the investment is in question based on the low cost-benefit ratio (1.3). In the current backdrop, the Consultants deem the internal risks inherent to this project to be moderate.

3.1.2.15 Interconnection C6: Bougouni (Mali) – Kankan (Guinea)

This interconnection, shown on the ECOWAS Master Plan, gives western Mali a second seaport access. It also makes it possible to open up the remote areas of northern Guinea which were isolated because the *Office National du Chemin de fer de Guinée* (ONCFG) railway was abandoned. With its 261 km (111 km in Mali and 150 in Guinea) it connects Bougouni to Kankan, giving direct access to the Port of Conakry. Kankan is at the top of the railway right-of-way leading to the capital, Conakry. Bougouni is located some 170 km southwest of Bamako. The new track, together with the existing completely rebuilt line with its 662 km, creates an international network of 923 kilometers (111 km in Mali and 812 in Guinea).

From Bougouni, the route runs along Route N8 crossing Faragouaran, Yanfolila and Mandiana to reach Kankan. To outfit the new line, the Consultants recommend meter gauge (1,000 mm gauge, 25 tones load limit, maximum speeds of 80 km/h for passenger trains and 60 km/h for freight trains). This recommendation is made in the context of networking, given that Bougouni and Mandiana are nodes in the future ECOWAS integrated network, which itself is of meter gauge in this area.

In addition to strengthening cooperation and exchanges between the two countries, the project makes it possible to improve the population's mobility and freight transportation. However, because the Bougouni-Conakry line is located away from the corridors with potential and the development poles, it does not benefit from the mass transit generated by the mineral extraction industry (iron, manganese, limestone, phosphate deposits). Moreover, the competition from the Bamako-Dakar railway limits the market shares available in Mali for freight transportation. Despite this, the Consultants deem the passenger and merchandise traffics to 130,000 passengers and 1.5 M tones respectively, during the first operational year. However, institutional and regulatory reforms are required to create a fair climate which guarantees the rail transportation sector its share of containerized freight.

In addition to strengthen cooperation and exchanges between the two countries, the project makes it possible to improve the population's mobility and freight transportation. However, because the Bougouni-Conakry line is located away from the corridors with potential and the development poles, it does not benefit from the mass transit generated by the mineral extraction industry (iron, manganese, limestone, phosphate deposits). Moreover, the competition from the Bamako-Dakar railway limits the market shares available in Mali for freight transportation. Despite this, the Consultants deem the passenger and merchandise traffics to 130,000 passengers and 1.5 M tones respectively, during the first operational year.

The capital cost of the systems and infrastructures to outfit the 261 kilometers of interconnection is estimated at $514 M and $544 M for the reconstruction of the 662 kilometers of existing tracks. The cost of buying the equipment (locomotives, cars, wagons) is estimated at $121 M for passenger and freight services. Therefore, the project calls for a total of $1,179 M (2007 dollars) spread out over 5 years.

The Consultants understand that the ECOWAS and the affected railways could, if they wish, opt for a standard track gauge rather than a narrow gauge on the entire length of the path. The cost for building the 261 km of interconnection is then estimated at $617 M while the cost for rebuilding the 662 km of existing tracks could be $794 M for a total of $1,411 M. The cost for standard rolling stock is $102 M. If it is deemed appropriate, the addition of a centralized traffic monitoring system would require an additional $646 M. The added cost for fibre optics rather than a microwave communication system stands at $51 M.

The financial analyses, based on the recommended concept, reveal that the passenger services will generate an annual loss of $2.6 M, which we suppose is the states'

responsibility. However, the freight services (containerized or others) will generate an operating income growing from $39 to $67 M per year, during the first 30 years of operation. Discounted with a rate of 7%, the cash flow statements generate a negative present value of $487 M. These results are strictly related to the railway elements therefore, they do not take into consideration the port improvements required to ensure the proper operation of the transport line.

Based on the chosen forecasts, project C6 - Bougouni-Kankan has an internal rate of return of 1.3% and a benefit-cost ratio of 2.1. In the current climate, the Consultants deem the risks inherent to this project, particularly from a commercial point of view, high.

3.1.2.16 Interconnection C7: Man (Ivory Coast) - Kankan (Guinea)

This interconnection, shown on the ECOWAS Master Plan, gives the hinterland of northern Ivory Coast and northern Guinea a link road leading to a seaport. With its 576 km (385 km in the Ivory Coast and 191 km in Guinea) it connects Man to Kankan, giving direct access to the Port of Conakry. Kankan is at the top of Guinea's national railway, leading to the capital, Conakry. Man is located some 580 km northwest of Abidjan. The new track, together with the existing completely rebuilt line with its 662 km, creates an international network of 1,238 kilometers (385 km in the Ivory Coast and 853 km in Guinea).

In addition to strengthening cooperation and exchanges between the two countries, the project makes it possible to improve the population's mobility and freight transportation. Furthermore it offers an option for the evacuation of iron ore, from the deposits of Man and Nimba located at the outermost of the Ivory Coast, Liberia and Guinea, to the Port of Conakry. The operating scenario is based on forecasts of 250,000 passengers and 1.4 M tones of general merchandises during the first operational year. We then anticipate the carriage of some 5 M tones of mineral ore per year from the deposits serviced. Of course, this implies the concurrent implementation of mining and railway related projects. The fact that it is remote from the sea and the need to outfit a new port in deep waters could be an major obstacle in the completion of this project.

The Consultants are aware that the studies conducted by the conglomerate Euro-Nimba and Rio Tinto to outfit the Trans-Guinean railway in the Lola-Forécariah-Kankan-Conakry corridor. This project is estimated at $5 M, recommends the construction of a new sea port in Matakan, some 100 km southeast of the capital. In preparing the ECOWAS Master Plan for the integration of various interconnection projects, the possibility to connect Man to Lola via Danané was studied with the idea of bypassing the reserved forest of Nimba. This route was not selected.

To outfit the Man-Odienné-Mandiana-Kankan-Conakry line, the Consultants recommend a standard meter gauge (1,000 mm gauge, 25 tones load limit, maximum speeds of 80 km/h for passenger trains and 60 km/h for freight trains). It is also recommended to outfit the subgrade and other infrastructures of the right-of-way (bridges, viaducts, culverts) to the norms of the standard template (appropriate design loads and track clearances) in order to

facilitate the proposed transition. This recommendation is made in the context of networking, given that Man and Mandiana are located on future latitudinal of the ECOWAS integrated network, which itself is of meter gauge.

The capital cost of the systems and infrastructures to outfit the Man-Kankan interconnection is estimated at $1,146 M and $544 M for the reconstruction of the 662 kilometers of Kankan-Conakry segment. The cost of buying the equipment (locomotives, cars, wagons) is estimated at $160 M of passenger and freight services and at $455 M for ore carrying services. Therefore, the project calls for a total of $2,305 M (2007 dollars) spread out over 5 years.

The Consultants understand that the ECOWAS and the affected railways could, if they wish, opt for a standard track gauge rather than a narrow gauge on the entire length of the path. The cost for building the 576 km of interconnection is then estimated at $1,375 M while the cost for rebuilding the 662 km of existing tracks could be $795 M for a total of $2,170 M. The cost for standard rolling stock is $522 M. If it is deemed appropriate, the addition of a centralized traffic monitoring system would require an additional $867 M. The added cost for fibre optics rather than a microwave communication system stands at $68 M.

The financial analyses, based on the recommended concept, reveal that the passenger services will generate an annual loss of $5.2 M, which we suppose is the states' responsibility. However, the freight services will generate an operating income growing from $35 M to $73 M per year, during the first 30 years of operation and at $124 M a year for ore carrying services. Discounted with a rate of 7%, the cash flow statements generate a negative present value of $582 M. These results are strictly related to the railway elements therefore, they do not take into consideration the port improvements required to ensure the proper operation of the transport line.

Based on the chosen forecasts, project C7 - Man-Kankan has an internal rate of return of 3.8% and a benefit-cost ratio of 1.7. In the current climate, the Consultants deem the risks inherent to this project, particularly from a commercial point of view, high.

3.1.2.17 Interconnection C8: Niamey (Niger) – Ouagadougou (Burkina Faso)

This interconnection, shown on the ECOWAS Master Plan, is a variation of B2. With hits 492 km (375 km in Burkina Faso and 117 km in Niger) it connects Ouagadougou to Niamey via Fada Ngouma. Correspondingly, the new link connects the capitals of Niger, Burkina Faso and the Ivory Coast through a 1,635 km railway network (117 km in Niger, 870 km in Burkina Faso and 646 km in the Ivory Coast).

As for the route for this interconnection, the Consultants recommend a new railway right-of-way along RN 4 and RN 6, crossing Zorgo, Koupéla, Fada Ngouma, Kantchari and Taradi before reaching the new terminal in Niamey, located in the Gaweye suburb, on the west shore of the Niger River. This route is different from the one proposed in the Master Plan which had a greater bend towards the south along RN 5 and RN 17, running through

Tenkodogo and bypassing the Koulpelogo reservoir to come back to Diapaga along RN 19 and extending directly towards the Say deposits in Niger before heading back up to the Niamey terminal. This long and sinuous route crosses the reserves of Pama and Arli and the Arli national park when it then runs along the Gognangou cliff.

For this new line, the Consultants recommend a standard meter gauge (1,000 mm gauge, 25 tones load limit, maximum speeds of 80 km/h for passenger trains and 60 km/h for freight trains). It goes without saying given the standard meter gauge to which the existing tracks are linked. However, it is recommended to outfit the subgrade and other infrastructures of the right-of-way (bridges, viaducts, culverts) to the norms of the standard template (appropriate design loads and track clearances) in order to facilitate the proposed transition.

For the purposes of the current study, the operating plan used on the Niamey-Ouagadougou-Abidjan line relies on forecasts of 250,000 passengers and 1.4 M tones of general merchandise during the first operational year. We then anticipate the carriage of some 1.2 M tones of mineral ore per year from the Say and Diapaga deposits. Of course, this implies the concurrent implementation of mining and railway related projects. The new railway will be the obvious choice for mass transit. However, institutional and regulatory reforms are required to create a fair climate which guarantees the rail transportation sector its share of containerized freight.

The capital cost of the systems and infrastructures to outfit the 492 kilometers of interconnection is estimated at $910 M and $173 M for the reconstruction of the 1,143 kilometers of existing tracks. The cost of buying the equipment (locomotives, cars, wagons) is estimated at $344 M for passenger and freight services and at $110 M for ore carrying services. Therefore, the project calls for a total of $1,537 M (2007 dollars) spread out over 5 years.

The Consultants understand that the ECOWAS and the affected railways could, if they wish, opt for a standard track gauge rather than a narrow gauge on the entire length of the path. The cost for building the 492 km of interconnection is then estimated at $1,092 M while the cost for rebuilding the 1,143 km of existing tracks could be $1,372 M for a total of $2,464 M. The cost for standard rolling stock is $386 M. If it is deemed appropriate, the addition of a centralized traffic monitoring system would require an additional $1,145 M. The added cost for fibre optics rather than a microwave communication system stands at $90 M.

The financial analyses, based on the recommended concept, reveal that the passenger services will generate an annual loss of $5.5 M, which we suppose is the states' responsibility. However, the freight services will generate an operating income growing from $73 to $129 M per year, during the first 30 years of operation and at $33 M per year for the ore carrying services. Discounted with a rate of 7%, the cash flow statements generate a negative present value of $108 M. These results are strictly related to the railway elements therefore, they do not take into consideration the port improvements required to ensure the proper operation of the transport line.

Based on the chosen forecasts, project C8 - Niamey-Ouagadougou has an internal rate of return of 6.1% and a benefit-cost ration of 2.5. In the current climate, the Consultants deem the risks inherent to this project moderate.

3.1.2.18 Interconnection C9: Tambacounda (Senegal) – Dabola (Guinea)

This interconnection, shown on the ECOWAS Master Plan, links the railways of Senegal and Guinea through a route which crosses the southwestern tip of Mali. With its 646 km (306 km in Senegal, 143 km in Mali and 197 km in Guinea) it connects Tambacounda to Dabola, creating a railway loop between the capitals of Senegal (Dakar) and Guinea (Conakry). Moreover, this link increases the rail's zone of influence throughout all three countries with an impressive 2,514 km grid (946 km in Senegal, 729 km in Mali and 839 km in Guinea).

Tambacounda is located along the Dakar-Bamako railway operated by concession holder VECTURIS for the governments of Senegal and Mali. Dabola is located on the Conakry-Kankan railway which was once operated by the *Office National du Chemin de Fer de la Guinée* (ONCFG).

In Senegal, the route along RN7 is heavily influenced by the need to reach the mining development of Falémé where the *Mines de fer du Sénégal Oriental* (MIFERSO) intends to promote the rich deposits of the Saraya region. This ambitious project, led by the Arcelor Mittal conglomerate, includes the outfitting of the railway, the development of the mining site and the construction of port facilities. A detour from the Bambouk region in Mali makes it possible to bypass the foothills of Fouta Djalon. Although this detour increases the distance and adds border controls, it provides for a better integration on the regional front while still serving the isolated region of Faraba. The Guinean border is crossed at Fandanda. From this point, the line runs along RN 15 towards Diatifère and Lansanaya to keep acceptable gradients up to Dinguiray, then Route N30 up to the spurtrack with the Guinea railway.

For this new line, the Consultants recommend a standard meter gauge (1,000 mm gauge, 25 tones load limit, maximum speeds of 80 km/h for passenger trains and 60 km/h for freight trains). It goes without saying given the standard meter gauge to which the existing tracks are linked. However, it is recommended to outfit the subgrade and other infrastructures of the right-of-way (bridges, viaducts, culverts) to the norms of the standard template (appropriate design loads and track clearances) in order to facilitate the proposed transition.

To increase the population's mobility in this new corridor, the operating scenario anticipates the operation of international trains between Conakry and Dakar. Moreover, it anticipates the carriage of freight trains (general and containerized) towards the ports of Dakar and Conakry. As for the bulk transportation of mine products, the plan relies on the assumption of the carriage of block trains towards a new port in deep waters, in the region of Barny-Sendou.

In addition to the new construction, the project anticipates punctual improvements to the Tambacounda-Dakar segment and the complete reconstruction of the Dabola-Conakry

segment. The capital cost of the systems and infrastructures to outfit the 646 kilometers of interconnection is estimated at $1,164 M and $436 M for the reconstruction of the 902 kilometers of existing tracks. The cost of buying the equipment (locomotives, cars, wagons) is estimated at $98 M for passenger and freight services and at $142 M for ore carrying services. Therefore, the project calls for a total of $1,840 M (2007 dollars) spread out over 5 years.

The Consultants understand that the ECOWAS and the affected railways could, if they wish, opt for a standard track gauge rather than a narrow gauge on the entire length of the path. The cost for building the 646 km of interconnection is then estimated at $1,397 M while the cost for rebuilding the 902 km of existing tracks could be $1,082 M for a total of $2,479 M. The cost for standard rolling stock is $204 M. If it is deemed appropriate, the addition of a centralized traffic monitoring system would require an additional $1,084 M. The added cost for fibre optics rather than a microwave communication system stands at $85 M.

The financial analyses, based on the recommended concept, reveal that the passenger services will generate an annual loss of $5.5 M, which we suppose is the states' responsibility. However, the freight services will generate an operating income growing from $3 to $6 M per year, during the first 30 years of operation and $31 M a year for ore carrying services. Discounted with a rate of 7%, the cash flow statements generate a negative present value of $1,232 M.

These results suppose the concurrent implementation of the mining and railway projects.

All in all, project C9 - Tambacounda-Dabola is not profitable based on the volumes of traffic and forecasted revenues. Moreover, the public interest in the investment is in question based on the low cost-benefit ratio (1.1). However, the project could be justified in the wider perspective of regional integration and cooperation which aims to increase the population's mobility and commercial exchanges between the two countries. In the current backdrop, the Consultants deem the internal risks inherent to this project to be high, particularly from a commercial standpoint.

3.2 Volumes 2A and 2B: Environmental and Social Assessment

3.2.1 Introduction

In accordance with the proposed action plan for the completion of this study, an environmental and social impact assessment (ESIA) is planned to take into account the potential environmental and social impacts of the project.

This component of the study was executed while taking into account the guidelines for the environmental and social assessment of the countries affected by the project and those of the ADB.

The ESIA was conducted in three steps:

The first step was devoted to the preparation which included: collecting basic data, preparing the tools (Protocol) for data collection and organization the field teams.

The second step involved the inventory operations for the interconnection corridors as defined and validated within the scope of the study. This part was done by the local engineering firms in each of the ten countries affected by the study, under the supervisions of the main CIMA-UMA experts. The inventory was conducted using the tools developed during the study; it made it possible to collect a large amount of data and information on the physical, biological, human and socio-economic components of the environments.

The third step also covered the processing and analysis of the data whose results were presented in two volumes:

- Volume 2A: Environmental Assessment
- Volume 2B: Socio-economic Analysis

The results of the ESIA are presented in two volumes as follows:

Volume 2A

- Legal and Institutional Framework
- Description of the Receiving Environment
- Technical Description of the Project
- Methods for Analyzing the Environmental Issues
- Defining the Receiving Environment Components
- Analysis of the Anticipated Environmental Issues
- Discriminant Issues

Volume 2B

- Methodological Approach
- Socio-economic Characteristics of the Targeted Areas
- Economic Activities
- Access to Basic Service
- Gender Issue
- Fight Against Poverty
- Population Shift
- Potential Socio-economic Impacts of the Project

This summary describes the main results of the ESIA and is structured as follows:

- Environmental Assessment
- Socio-economic Analysis
- Population Shift
- Classification of the socio-economic impacts
- Conclusion and recommendations from the socio-economic impact

3.2.2 Technical Description

3.2.2.1 General Objective

The current feasibility study for interconnections between railway networks in ECOWAS' member countries covers ECOWAS' ten member states: Benin, Burkina Faso, Cote d'Ivoire, Ghana, Guinea, Mali, Niger, Senegal and Togo. The project being studied covers 17 new rail lines, totaling more than 6000 km, divided among these ten countries.

The interconnections defined by ECOWAS, as part of its master plan for railway interconnections, will be designed later, in accordance with international rail transport specifications and standards. The construction and operation of these new lines will be divided into three phases.

- In the beginning, the main activities to carry out will be linked to acquiring land. Next is the preparatory work (recruiting personnel, setting up construction sites, building encampment structures (living environments)), etc.
- During the construction phase, the follow activities will be carried out: clearing brush from the land, expropriation, quarry operation, earthworks, installation of the rail infrastructure (tracks, crossings, telecommunications, passenger stations, freight and sorting stations, administrative and headquarters offices, etc.).
- Once the network has entered operation, activities for managing the network and fixed facilities will continue for the entire lifecycle of the infrastructure.

The purpose of this study is to establish priorities for the future implementation of the seventeen new rail interconnections indentified in the ECOWAS Master Plan. The ranking must be based upon an assessment that draws upon technical, economic, environmental, and social considerations, as well as gender issues and the struggle against poverty. The assessment must also take into account the departmental orientations of ECOWAS and WAEMU, and the priorities of major partners which support the field of transportation.

For a better understanding of the environmental issues related to the project, the routes of interconnections and the main technical specifications of the project are summarized in this chapter.

3.2.2.2 Interconnection Routes

Beginning with the stage in which routes were developed in the new segments, the following environmental guidelines have been taken into consideration:

- Guideline 1: Whenever possible, routes in new segments must run alongside existing roads, except where a change is required in order to protect a specific aspect of the environment.
- Guideline 2: Regional and departmental capitals should be served by the new segments whenever possible, in order to encourage the population to access infrastructure.
- Guideline 3: Whenever possible, the routes must be changed so that they run alongside towns and villages rather than cross them, in order to minimize the destruction of infrastructure and dwellings.

- Guideline 4: Economic activity development zones (agriculture, mining, etc.) should be served by the routes whenever possible, without excessive detours by the new segments.
- Guideline 5: Changes to routes must be made whenever possible in order to avoid crossing ecosystems with a high ecological value (reserved forests, parks, nature preserves, etc.)
- Guideline 6: The routes must limit travel through farmland, and prioritize travel through land with low agricultural value.

By combining the technical and environmental considerations beginning with the route development stage, numerous negative environmental and social effects are avoided or minimized from the beginning.

The 17 interconnections are described in the summary of the technico-economic analysis (Section 3.1 and Appendix B of this report).

3.2.3 General Characteristics of the Track

3.2.3.1 Right-of-Way

The right-of-way to be used for the interconnection has a nominal width of 50 m. Nevertheless, given the uneven topography of the land in certain areas, soil conditions and plans for future tracks, a large number of width extensions may be needed in the cut-and-fill areas. Width extensions are also required for putting other types of infrastructure into place. The result of these width extensions is therefore to increase the right-of-way to more than 50 m in several locations. The sectors where the largest width extensions are needed are concentrated mainly in stream crossings, wherever depressions are found, and wherever soil conditions are sometimes poor.

3.2.3.2 Vertical Alignment

With respect to the specifications for routes which are relevant to the environmental analysis, one must bear in mind that in accordance with international standards, the longitudinal section of the route indicates that the ascending and descending inclines may not exceed 1%. To reach such slopes in rolling and mountainous sectors, cut-and-fill will be necessary. Furthermore, similar cut-and-fill will also be required to set up engineering structures and planned infrastructures.

The following table summarizes the main technical specifications of the project.

Tableau 1 Main Technical Characteristics of the Project

Elements at Issue	Characteristics
Location and Length of the Route	Lengths vary depending on the interconnection. In total, 6270 km will be analyzed, spread out among the 10 countries studied, on 17 different interconnections.

Elements at Issue	Characteristics
Width of Right of Way	The minimum right-of-way is 20 meters, although width extensions are required in rolling and mountainous sectors, as well as in some sectors where engineering structures, edifices, and additional tracks are planned. In some cases, it may be 50 meters in width.
Vertical Alignment	Maximum inclines of 1%.
Cut and Fill	Due to the uneven configuration of the land, the routes include numerous successive cut-and-fill areas on a majority of the 17 interconnections.
Track	A single track.
Intersections	Grade crossings are planned.
Waterway Crossings	Bridges are planned for crossing waterways. For crossing smaller waterways, culverts will be used.
Other Structures	Some structures will be set up in certain places: installing walkways in the more densely populated sectors, protective barriers, etc.

3.2.4 Main Steps to Production

3.2.4.1 Deforestation and Protection of Remaining Trees and Shrubs

Deforestation will be limited to the widths needed for earthworks and leveling. Timber with commercial value will be recovered, and wood debris will be either chipped or shredded on-site. No burning of wood debris (i.e. non-commercial twigs and branches) will be authorized.

In any event, no deforestation will be preformed outside the limits of the right-of-way and deforestation that will be shown in the final plans. It should be noted that only deforestation that is required for construction will be carried out.

3.2.4.2 Cut and Fill

Blasting will be necessary during construction. Small valleys and escarpments are also found in the low terraces, where a non-negligible amount of clearing is also planned. In several places along the route, problem areas are found: sensitive soil with low carrying capacities, occasionally subject to landslides. This will require special measures during construction.

3.2.4.3 Track Laying

The work involved in laying the tracks includes, but is not limited to:

- Preparing the infrastructure.
- Laying the granular material foundation.
- Laying the actual tracks.

3.2.5 Methods for Analyzing the Anticipated Environmental Impacts

In a feasibility study, the environmental assessment can only be done on the project's progress. The true analysis of the impacts will be carried out later, during the pre-project phase. For now, it is difficult to say with certainty what environmental impact is anticipated along the 17 interconnections. However, we can assess the feared environmental effects.

There are many procedures for assessing environmental effects, and each one has its own unique traits, as well as its strengths and weaknesses. Matrix methods have the benefit of flexibility, applicability to all aspects of a project, and their interdisciplinary nature. The main drawback of using this type of method comes from the subjective nature of qualitative assessments of environmental effects. This downside may be reduced by using a standard grid frequently used for evaluating the importance of environmental effects, based on criteria set beforehand.

The approach recommended here includes three steps.

3.2.5.1 STEP 1 – Identifying the Interrelations

Before identifying the interrelations, the project activities are defined and grouped according to their nature and their possible effect on the components of the receiving environment.

The first step is to identify the existing interactions between the project components and those of the receiving environment. In this homogenous framework as far as the effects generated and expected are concerned, the identification of the interactions is done based on pertinent information contained in the previous chapters. A matrix provides a summary of the relationships between the project activities and the environment components. These relationships are deemed significant or negligible. The goal of this first level analysis is to limit the detailed assessment of the environmental effects only to the significant interactions of the project onto the environment. Thus, the consequences of the project are better controlled and the important environmental challenges are clearly identified.

The interrelation matrix shows that there is a causal link between the project components and the receiving environment components, given the works to be completed. Based on a professional judgment and in order to limit the detailed environmental assessment only to the pertinent elements, the interrelations which are deemed negligible are described and justified in this section. The analysis of the interrelations deemed significant will follow.

Each interconnection is analyzed on its own merits. An evaluation grid can be found at the end of each sub-section. When there is no reciprocal relationship between a project component and the affected receiving environment component, there is no symbol for that cell. A white circle indicates that the link between a project component and a receiving environment component are deemed negligible. The reasons for this assessment may include the contractor’s commitments and obligations to avoid a major environmental impact. A

black circle indicates a significant relationship and that this relationship will be subjected to a more detailed assessment. The diamond indicates a positive foreseeable impact.

All negligible interrelations must be justified in a short text while the significant interrelations are assessed based on the method described hereafter.

Table 1 Interrelations Matrix

Matrice des interrelations

Interrelation significative ● Interrelation non significative o Interrelation positive ◊	Composantes du milieu récepteur		Milieu physique			Milieu biologique					Milieu humain				
			QUALITÉ DE L'EAU	QUALITÉ ET DYNAMIQUE DES SOL	QUALITÉ DE L'AIR	FLORE PARTICULIÈERE	FORÊT ET AIRES PROTÉGÉES	PLANTATIONS ARTIFICIELLES	ZONES ÉCOLOGIQUEMENT SENSIBLES	FAUNE ET RESSOURCES HALIEUTIQUES	OCCUPATION DU SOL	INFRASTRUCTURES	PATRIMOINE CULTUREL, HISTORIQUE ET ACTIVITÉS TRADITIONNELLES	QUALITÉ DE VIE	GENRE ET DÉVELOPPEMENT
Activités du projet	Phase Pré construction et construction	Travaux préparatoires													
		Organisation du chantier/main d'œuvre													
		Expropriations													
		Déblais-remblais													
		Utilisation de la machinerie													
	Phase Exploitation	Présence des ouvrages													
		Exploitation et entretien des ouvrages													

3.2.5.2 STEP 2 – Assessing Environmental Effects

The second step of the analysis consists in identifying the advantages and disadvantages of the project components from an environmental standpoint, based on the known significant interactions and to qualify, based on a standardized assessment method matrix, these advantages and disadvantages which we call significant environmental impacts. Each environmental impact is analyzed in detail, making the most of the information provided in the receiving environment description and the proposed project while taking into account, if possible, the populations' concerns.

When they are present, the environmental effects of a project are evaluated based on the criteria or standards in effect. In the absence of regulations, the importance of the apprehended environmental effects are evaluated based on three criteria, namely intensity, span and duration.

Intensity

The intensity conveys the level of disruption or disturbance which will be generated by the execution of the project components. This intensity is evaluated based on the information

available or on a theoretical basis when the information is not available. The level of intensity is defined as shown in the next table.

High	The project component destroys or renders unusable a component of the native environment, or endangers that component's sustainability. For the human environment, the intensity of the disturbance is high when it significantly compromises or limits the use of that component by a local community or population, or endangers its integrity.
Moderate	The activity significantly changes a component of the native environment, without endangering its sustainability or its long-term use. For the human environment, the intensity of the disturbance is medium when it affects or compromises the use of this component by a portion of the local population without endangering its integrity or use.
Low	The activity does little to change a component in the native environment, and does not endanger its sustainability or long-term use in any way. For the human environment, the intensity of the disturbance is low when it slightly or partially compromises the use of this component by a low proportion of the population.

Scope

The scope of the impact expresses the spatial reach of the effects generated by an intervention on the environment. This concept refers either to the distance or the area where the changes will be felt or the portion of the population who will be affected by the changes

Limited	A limited span refers to a controlled disruption which affects a small area, in this case less than 500 m on either side of the work sites or, in the case of the human environment, a small area used or perceptible by a small group of individuals.
Local	A local span refers to an impact which is perceptible on a distance between 0.5 and 10 km from the work sites. In the case of the human environment, it refers to an effect which is felt by a significant portion of the local population.
Regional	A regional span refers to an impact which would be perceptible over more than 10 km, or which can be felt by the entire population of the regional community.

3.2.5.3 Duration

The third criterion is the duration of the environmental effect; it helps in assessing the temporary span of the consequences of the execution of the project components. The duration of the effect may be temporary or permanent and will help establish a contrast in the assessment of the importance of the expected environmental effect.

Long	When the impact is felt in a continuous or discontinuous fashion for more than 5 years. The impact is often permanent or irreversible.
Medium	When the impact is felt in a continuous or discontinuous fashion for more than 1 year but less than 5 years. The impact is often reversible.
Short	When the impact is felt in a continuous or discontinuous fashion for a period lasting anywhere from a few days up to a few months. The impact is often reversible.

3.2.5.4 Importance

At this stage in the project, when reading these three criteria it is possible to qualify the importance of the apprehended environmental effects. The impact may be major, moderate, minor or negligible. The positive impacts are not qualified. As for the components of the physical environment, it would be more appropriate to talk about modifications rather than impact. The following assessment grid describes the approach.

Tableau 2 Impact Assessment Grid

Intensity	Scope	Duration	Importance
High	Regional	Long Moderate Short	Major Major Moderate
	Local	Long Moderate Short	Major Moderate Moderate
	Limited	Long Moderate Short	Moderate Moderate **Minor** to Negligible
Moderate	Regional	Long Moderate Short	Major Moderate Moderate
	Local	Long Moderate Short	Moderate Moderate **Minor** to Negligible
	Limited	Long Moderate	Moderate **Minor** to Negligible

Intensity	Scope	Duration	Importance
		Short	**Minor** to Negligible
Low	Regional	Long Moderate Short	Moderate Moderate **Minor** to Negligible
	Local	Long Moderate Short	Moderate **Minor** to Negligible **Minor** to Negligible
	Limited	Long Moderate Short	**Minor** to Negligible **Minor** to Negligible **Minor** to Negligible

3.2.5.5 STEP 3 – Mitigation Measures and Residual Impacts

The third and last step of the evaluation procedure, in summary form, is the mitigation measures which will make it possible to minimize the negative environmental effects or to optimize the positive environmental effects of the project. The mitigation measures are proposed during the impact assessment, once the project has been well defined.

3.2.6 Definition of Project Components and Receiving Environment

To assess interrelations between project components (activities vs. receiving environment), here are their respective definitions.

Technical Components of the Project

Pre-construction Construction Phase

A. Preparatory Work

This activity encompasses surveying, deforesting, pruning, and shredding wood debris from the rights-of-way. Cut-and-fill, as well as expropriations, will be treated separately. The same holds for noise and transporting materials treated in the component "Using the Machinery, Transportation and Circulation."

B. Site Organization/Labor

This project component encompasses the land development required for installing a construction site trailer as well as land for maintaining machinery and storing household refuse and by-products.

This component also includes temporarily connections to the electrical grid and the installation of chemical toilets and the use of generators. It also includes all activities related to the presence of laborers during constructions.

Finally, managing and maintaining the machinery is part of this component, as for fuel lines.

This component does not include the noise generated by all of its activities. That will be treated as part of the activity "Using the Machinery, Transportation and Circulation."

C. Expropriation

This component encompasses the expropriation of residences and buildings found in the area set aside for work, as well as the relocation or demolition of other infrastructure, such as telecommunications antennas, aqueduct networks, wells, etc.

D. Cut and Fill

This component encompasses the excavation of soil and the filling work. It does not include the noise generated by these activities, nor the transportation of materials, which are treated by the component "Using the Machinery, Transportation and Circulation."

E. Using the Machinery

This component includes the transportation of all materials (clean rock, rails, etc.) needed for carrying out the project, as well as transporting cut materials, waste products, etc. off-site. This component also includes transporting workers and maintaining roads. It additionally encompasses all noise generated by the machinery and equipment during all work. The management and maintenance of the machinery used, as well as fuel lines, and waste management are treated by the component "Organizing the Worksite" and are not included in the present definition.

Operation and Maintenance Phase

A. Presence of the Infrastructures

This component includes the presence of new tracks, as well as related infrastructure.

B. Operation and Maintenance

This component specifically encompasses management and maintenance activities for new rail tracks and connected buildings.

Defining Receiving Environment Components

For the purposes of the present environmental assessment, the components of the native environment have been defines in some cases, divided as follows:

Physical Environment Components

A. Water Quality

This component covers the physical and chemical characteristics of surface and ground water which is found in the territory being studied and is affected by the work.

B. Soil Quality and Dynamics

This component refers to the physical and chemical traits of the soil on-site, including their nature and stability.

C. Air Quality

This component refers to the atmospheric emissions of vehicles assigned to the project which impact the environment. Locally, through the emission of nitrous oxide, carbon monoxide, hydrocarbons, ozone, and airborne particles. Regionally, through the spread of gas into the atmosphere, and globally, by carbon dioxide that is responsible for GHG (greenhouse gases). During the operating phase, this component refers to the reduction of pollutant emissions (positive effects).

Noise is also a sub-criterion specific to air quality, but it will be treated in the quality of life component, as will risks to human health arising from atmospheric emissions.

Biological Environment Components

A. Particular Flora

This component is defined in terms of land-based, river-based, and aquatic plant communities. It encompasses plant species (trees, shrubs, and grasses) which are found in the sector being studied and are not part of protected areas and forests, which will be treated separately.

B. Forests and Protected Areas

These are essentially national parks, wildlife preserves and reserved forests.

C. Artificial Plantations

In the corridors visited, several areas have been reforested either for the production of fruit trees, combustible material (charcoal), or for the use of resources such as rubber, palm oil, etc.

D. Environmentally Sensitive Areas

This component refers to all sensitive habitats, such as wetlands, areas at risk of desertification, special habitats, etc., which do not fall under the category of forests and protected areas.

E. Fauna and Fishery Resources

This component encompasses all land mammals (including rodents, ungulates, predators, and bats), as well as all amphibian and reptile species whose area of distribution transects the territory being studied, whatever their stage of development (eggs, larvae, young,

adults, breeders) and their activities to ensure that populations are maintained. The avian wildlife is also taken into consideration under this category.

This component also includes habitats used by species for reproductive, feeding, rest, and migratory purposes. Rare and threatened species with a protected status are part of this component.

Human Environment Components

A. Land Use

This component refers to the uses, whether written in the development plan or not, and the classification of land for the territory being studied. It also affects the land and buildings that will be affected by the project, whether in whole (expropriation) or in part.

B. Infrastructures

The infrastructure involves bridges, wells, electrical grids and telecommunications networks, roads, etc. which ensure that services are provided to the population.

C. Cultural and Historical Heritage and Traditional Activities

This component of the human environment refers to structures and artifacts with archaeological, historical, and cultural interest, if found in the territory being studied (mosques, special buildings, burial sites, etc.).

This component of the human environment also encompasses traditional activities (hunting, trapping, and fishing) as well the sites where these activities are practiced. It also includes the sites where cultural ceremonies are held.

D. Quality of Life

For the purposes of the present environmental assessment, this component encompasses the following pressures, which are inherent to the quality and tranquility of the sites: noise, vibrations, fields of vision, traffic circulation (jams, detours, etc.).

It also encompasses health (dust is a major source of lung infections, as is exhaust). Additionally, the arrival of foreign workers increases the risks of disease transmission (HIV and other sexually transmitted diseases). Safety is also a factor to consider (heavy engines moving, etc.).

Involuntary relocations, not only of people who are directly affected by the project, but also those indirectly affected, are also part of this component. These relocations will have effects on soil usage and the reorganization of communities, and possibly on their way of life and local customs.

E. Gender and Development

This criterion aims to ensure that women are treaty fairly and equally in the project with respect to responsibility for the work that women may obtain during the stages of completing the project, as well as during the operating phase. Income-generating activities are important components to consider here.

3.2.7 Analysis of the Anticipated Environmental Issues

Contextual Backdrop

This section assesses the anticipated environmental issues on the interconnections being studied, in accordance with the methodology introduced in the previous chapter.

The 17 subsections that follow give an analysis for each interconnection. For each one, the insignificant effects are justified first. The actual assessment of significant effects follows. A grid illustrating significant and insignificant interactions closes each section.

The description and analysis of the issues are often repeated in their entirety from one interconnection to another whenever the situation allows. We have made this choice so that each interconnection may be assessed independently, even though the redundancy may make each chapter a heavier read.

The primary issues are analyzed her for informational purposes. During the next pre-project studies, a detailed analysis may be written, in accordance with ADB requirements and the legal context of the country affected by the interconnections in question. In the present feasibility study, the results reflect a comprehensive view of the interconnection and the feared environmental impact based on the information and details that are available as of right now.

3.2.7.1 Interconnection Ilaro- Pobè (A1)

Within the scope of the current report, the complete analysis of interconnection A1 is used to illustrate a better approach. As for the other interconnections, the interrelations matrices are presented in a summary fashion; in fact these tables summarize quite well the potential impacts on each of the segments.

3.2.8 Negligible Effects

Of the preparatory works

On the Benin side, swamplands are scattered throughout the corridor between Ilaro and Pobè. For this reason, some activities which will be carried out during the preparatory work may harm the quality of the water. These effects will be mitigated, especially by limiting deforestation to a bare minimum and by delineating buffer zones as protection, where

construction activities will be prohibited. In the event that these guidelines cannot be followed, protective measures should be taken.

During the preparatory work, deforestation and pruning activities will affect all components of the biological environment. However, the impact of these activities on the specific flora, the artificial plantations, the ecologically at-risk areas, and the wildlife and fishery resources will be insignificant in light of the fact that all of these components of the biological environment are uncommon, and that effective mitigation or compensatory measures may considerably reduce the expected effects, despite the risk of draining the wetlands.

As for quality of life, the interrelation is deemed to be insignificant, as activities related to preparatory work will take place over a short period of time, in carefully defined sectors.

Of the site organization

On the construction site itself, certain activities may endanger water quality. There are real risks of pollution associated with maintaining the machinery, supplying vehicles with fuel, storing certain products, etc. However, if construction sites are located at a safe distance from swamplands from the very beginning of work, and maintenance on machinery and fuel supplying are secure, the effects on the quality of water associated with organizing the construction site will be eliminated.

The presence of construction site staff may put pressure on components of the biological environment: overclearing of specific flora, forests, and protected areas; poaching and overuse of the wildlife and fishery resources. These impacts, however, remain insignificant if the construction site staff members undergo awareness training, and appropriate measures are taken to ensure that workers are provided with the energy and animal protein intake they need.

There is also an interrelation between land use and organizing the construction site, as installing a construction site in a specific location along the Ilaro-Pobè line may change the way the land is used and the very structure of the villages where the sites should be located. The impact on certain areas may then be changed by the arrival of the site. However, this remains marginal, and therefore insignificant.

Of the expropriations

Along the line of the Ilaro-Pobè corridor, a limited amount of infrastructure will be affected by the project and will require them to be relocated within the sector (power and telecommunication lines). The effect is therefore insignificant.

Of the cut and fill works

Cut-and-fill also interacts with the cultural heritage/archaeological/traditional activities component in a manner deemed to be insignificant, as no known site is found on the

territory. In the event that a site happens to be discovered, the relevant authorities will be notified. The damage may appear during the expropriation activities instead.

As for the quality of life component, the interrelation is also deemed to be insignificant, as preventing the chances of an accident will be ensured from the beginning of the project by installing appropriate signaling systems, restricting traffic to various work sites, and distributing safety guidelines to residents. In reality, the significant effects are expected to occur more during the organization of the construction site, the expropriation phase, and when machinery is in use.

Using the machinery

As for the use of machinery, it will lead to negative effects on the wildlife, primarily birds, owing to noise. However, the impact resulting from the noise of the machines will not be significant, given the rarity of wildlife in this environment and common mitigation measures which may reduce the expected effects.

Presence of the infrastructures / operation

The operational phase, owing to both the presence of structures and their use and maintenance, will have certain effects on the wildlife and fishery resources. Among these effects, those which must be named include the effect of the wall (disturbing animal migrations); the risk of collisions with animals, especially at night, which would lead to a higher death rate; the noise of travelling vehicles and the risk of contaminating the plants and water that the animals depend on for their nutritional needs. However, because animals are scarce at intersection A1 and because effective mitigation measures may be designed to minimize these effects, the overall effect is not significant.

3.2.9 Significant Effects

Of the preparatory works

- On the forests and protected areas

These components have a certain value, having escaped clearing despite the demographic explosion. What's more, they have significant socio-cultural and spiritual functions for the people living along the route. These islands of woodland are often used as sacred shelters where various religious initiations or funerary ceremonies are periodically held. It should be noted that in this typically Yoruba environment, the Samba, found in this heavily human-impacted wooded area, is especially respect as the "oro" fetish tree. However, these sacred forests are not unique in Benin, where they seem to be relatively common. Nevertheless, as a traditional activity, they will be analyzed among the components of the human environment.

The intensity of the disturbance that may result from clearing the forests and protected areas is medium, because this work may significantly change the functioning of these

biomes, which are relatively common between Pobè and the Nigerian border (gallery forest, dense deciduous forest, reserved forest of Pobè), particularly the sensitive ecosystems that they enclose, though without endangering their sustainability or their long-term use.

The scope would be local, because clearing and pruning, which will be done during preparatory work, will have an effect beyond the right-of-way and the ecological functions of the ecosystems being crossed.

The duration of the impact will be short, because part of the vegetation will grow back after the work is completed. Moreover, this area gets good rainfall.

The importance of the environmental effect is therefore minor.

- On the cultural and archeological heritage and traditional activities

The preparatory work also has a presumed significant interrelation with this component of the human environment, as a few sites have been recognized for their traditional activities (the Sambas: sacred shelters in which religious initiations or funerary ceremonies are periodically held. What's more, in the event of a chance discovery of an archaeological site, the relevant authorities will be notified.

The intensity of the disturbance resulting from the preparatory work may be considered **medium**, because these works will significantly change the affected areas.

The scope of the effect would be local, taking into account the fact that the effects will be felt by a significant portion of the local population.

The duration of the effect will be long in the potentially affected areas.

The environmental impact of clearing and pruning on this component would then be of medium importance.

Of the site organization

- On the quality of life

The populations living along the corridor being worked may be faced with inconveniences during the organization of the construction site (tranquility of the sites, respect for private property, sharing drinking water resources, etc.). What's more, the arrival of a significant contingent of workers in the sector still poses a significant risk of transmitting diseases, mainly STDs and AIDS, which are hard to control despite awareness campaigning.

In this context, the intensity of the disturbance is deemed to be medium, as it compromises a significant segment of the local population.

The scope of the impact is local, as it only involves the population located directly on the line or near the proposed intersection.

The duration of the effect will be felt continuously, over a period that may stretch for several years, and is thus medium.

Based on all evaluation criteria, the importance of the anticipated impact of this component of the project is medium.

- On the gender and development component

The installation of a construction site and its organization may certainly have positive repercussions, ensuring fair and equal treatment for women in the completion of the project. To do so, there will need to be incentives for hiring female staff, as there are numerous pressures involved in hiring female personnel. Beyond the availability of qualified female personnel, there are many prejudices regarding the qualification of women to hold jobs that are considered non-traditional.

For the "organization of the construction site / gender and development" interaction, the intensity of the impact is deemed to be low, as there are unfortunately still too few women who are qualified to hold the positions that will be available.

The scope is regional, as the personnel who are hired to work at the construction sites may be recruited throughout the country.

The duration of the effect will be felt continuously, but over a medium period of time, i.e. the period when the work will be carried out in the sector.

Based on all the evaluation criteria, the importance of the impact of this project activity on the gender and development component is considered to be medium.

Of the expropriations

- On land use

The Ilaro-Pobè stretch is not densely populated. There will therefore be fewer expropriations. Here, we are speaking in terms of family dwellings. However, as emphasized in the description of the native environment, a mosaic of crops and fallow land occupies the corridor. The lots of land to be used should therefore be changed in order to accommodate the relocation of people, as well as to open up new arable land. What's more, the reserved forest of Pobè and its oil palm research station are assets to the development of tourism in Benin. A rearrangement of the land should be planned in the short term.

In Pobè, if the existing train station is retained, the new route would run 300 m from the paved road and would empty out onto the intersection of KP 1+700. This situation would justify a railway crossing before continuing its course alongside the road to the Nigerian border. However, expropriations are inevitable in this situation. If, on the other hand, the old train station is abandoned in favor of a new one, located right before the intersection (less densely populated), the expropriations would be less significant.

For this interrelation, "land use/expropriation," the intensity is deemed to be medium, as it affects only one part of the population and the territory without raising doubts about the integrity or use of this territory.

The scope is local, as only the land directly affected by the project and the sectors used for it are involved.

The duration of the effect is medium, as the rearrangement may take more than a year.

Based on all of the evaluation criteria, the importance of the impact of this project component is deemed to be medium.

- On quality of life

The expropriation of entire families is an important subcomponent to assess regarding quality of life. Living habits will be changed for both the relocated populations and for the people who will receive the new arrivals. Additionally, certain resources will need to be shared (water, timber, public services, etc.). A relocation plan should be designed to have the lowest impact possible.

The intensity of the effect is therefore deemed to be medium, as few families will be displaced along this line outside of Pobè.

The scope is local, as the disturbance may have repercussions on a much broader level than the immediate area.

The duration of the effect will be felt over a limited period of time (during the work in the sector), but may last for more than a year until the situation returns to normal. It is therefore medium.

Based on all evaluation criteria, the importance of the expected issue of this project component is deemed to be medium.

- On the gender and development component

The expropriation of cultivated plots will directly affect the income of families in the affected regions. Women, even when they do not own the plots directly, may nevertheless benefit from harvest income, at least in part. During the expropriations, it is likely that the owners of the plots will be compensated (the man of the household) and that the women would receive no compensation in return.

In such cases, the intensity of the effect is deemed to be medium, as it affects only part of the population.

The scope is local, as the disturbance only affects women in the locations being crossed.

It is likely that the duration of the effect will be felt over a period of more than two years. It is therefore medium.

Based on all the evaluation criteria, the importance of the effect of this component of the project is deemed to be medium.

Of the cut and fill works

- On the soil quality and dynamics

The soil being crossed is largely clayey soil. The terrain is rather flat, and includes numerous large swamplands. One large area of swampland, for instance, stretch over 4.400 km from KP36.700 to KP41.100 km. These swamps will make earthworks more complicated, as this work will be done in waterlogged soil.

This situation calls for either researching an appropriate route that bypasses most of the swampland, or special treatment for the land being crossed in other to ensure the stability and lifespan of the infrastructures that will be installed: building fills that include drainage or anti-contamination layers, building structures for crossing areas where the land is very unstable, etc.

For this interconnection, the intensity of the change is medium, as it significantly changes the "soil" component, but does not endanger its sustainability.

The scope is punctual.

The duration would be long, i.e. the lifespan of the structures.

The importance of the changes for this interrelation is deemed to be medium.

Of the use of the machinery

- On water quality

During construction, the risks that machinery may contaminate water points are possible. It is not rare to witness fuel leaking into streams or onto soil, which sometimes leads to a contamination of water tables when they are present. Moreover, in this case the presence of swamps may be a clue that the groundwater bed may be shallow. If so, the negative effect is very real.

For this interaction, the intensity of the changes is medium, as it significantly changes the "water" component, though without endangering its sustainability or its long-term use.

The scope is local, as it only is localized in only one part of the territory.

The duration would be medium, as it may take more than two years to return to normal.

For this reason, the importance of the change for this interrelationis deemed to be medium.

- ❑ On soil quality and dynamics

Travel by heavy vehicles will cause the soil underneath to compact in some places, as well as lead to ruts. The risks of eroding sensitive slopes are also anticipated effects, as is the contamination of the soil by accidental fuel leakage. Measures must be taken to eliminate certain risks, or at least bring them under control.

For this interconnection, the intensity of the change is medium, as it significantly changes the "soil" component, but does not endanger its sustainability.

The scope is punctual.

The duration would be medium, as mitigation measures will be applied to restore the sites once work is completed.

The importance of the changes for this interrelation is deemed to be minor.

- ❑ On air quality

The construction work will require that all materials (clean stones, etc.) will be transported to worksites, and that cleared materials, waste products, etc. be transported off-site. The transport vehicles are a significant source of greenhouse gas (GHG) production.

Here, the intensity of the effect is medium, as it significantly changes the "air" component, though without endangering its sustainability or its long-term use.

The scope is greater than regional, and the probability that the effect will occur is very real.

The duration would be long.

For these reasons, the importance of the changes for this interrelation is deemed to be major.

- ❑ On infrastructures

Transporting the materials needed for performing the work will require the use of heavy machinery. This activity may therefore lead to the deterioration or premature wear of the "infrastructure" component (roads, bridges, culverts, etc.).

The intensity of the effect is medium, as it affects or compromises the use of this component for a segment of the population, without bringing its integrity or use into question.

The scope of the effect is local, as it is localized in only one part of the territory.

The duration would be short.

For these reasons, the importance of this interrelation is deemed to be minor.

- On quality of life

The use of the machinery, by necessity, means that heavy vehicles will be dispatched, and that sound levels will increase. This will affect the quality of life for people who live along the corridor. Additionally, the dust raised by the trucks passing by and the emission of exhaust are both harmful to human health. However, several mitigation measures will be taken to reduce these effects. There remains a risk that quality of life will drop in certain specific sectors, where the work volume will be higher.

(GHGs are treated under air quality.)

For this interrelation, the intensity is high.

The scope is local.

The duration is short, i.e. the length of time that the work takes in this sector.

For this reason, the importance of the anticipated impact of this interrelation is deemed to be medium.

Of the presence of the infrastructures

- On land use

Based on the examples observed in other ECOWAS member countries, the presence of a railway may change land use. Unlike in Western countries where the population quite often moves away from rail infrastructure, the tendency on the African continent is different. For this reason, despite the nuisances linked to railways (noise, vibrations, dust, etc.), some groups prefer to live along rail lines. The presence of structures may therefore change land use (population displacement) or compromise some of its uses (crops that are sensitive to dust: cotton, food crops, etc.).

Here, the intensity of the effect is medium.

The scope is local.

The duration is long, as the presence of the structure is irreversible.

The importance of the negative environmental impact is therefore medium for this interrelation.

- On quality of life

The very presence of structures in some more densely populated sectors can justify the construction of protective barriers in order to keep residents from travelling over the rails

outside of the crossings. This will affect the quality of life for residents alongside the line, as well as the local population when they relocate from one point to another (longer travel time).

For this interaction, however, the disturbance's level of intensity is low.

Its scope is local.

The duration is long, as the effect will be felt throughout the railway track's life cycle.

This assessment shows that the interrelation has a medium environmental importance.

Of the operation and maintenance of the structures

- On air quality

When the new rail networks are put into service, they may help reduce greenhouse gases on a national level, as well as on a global level, if a large portion of the transportation of passengers and freight is routed using this new method of transportation. The effect is therefore positive.

- On quality of life

The operation of the railway will give rise to inconveniences in the quality of life for those living alongside it. The noise, dust, and risks of accident are only a few of the anticipated negative effects.

For this interaction, the intensity of the effect is deemed to be high.

Its scope is local.

The duration is medium, as the effect will be felt only when trains come past, but will occur throughout the rail's life cycle.

For this reason, the importance of the negative environmental impact is deemed to be medium.

- On gender and development component

When the new railway enters operation, it may improve the population's economic conditions. For this reason, women in the towns and villages that will be served by the railway may develop significant sources of income (small businesses, selling household and craft projects, etc.). What's more, hiring female workers in certain sectors of activity related to operating and maintaining the rails and the rolling stock may be encouraged.

The interrelation between this activity and the "Gender and Development" component therefore has a positive effect.

3.2.9.1 Ilaro – Pobè (A1) Interconnection

Interrelation Matrix Ilaro -Pobé (A1)

Significant Interrelation ● Negligible Interrelation o Positive Interrelation ◊	Receiving Environment Components		Physical Environment			Biological Environment					Human Environment				
			WATER QUALITY	SOIL QUALITY AND DYNAMICS	AIR QUALITY	SPECIFIC FLORA	PROTECTED FORESTS AND AREAS	ARTIFICIAL PLANTATIONS	ENVIRONMENTALLY SENSITIVE AREAS	FAUNA AND FISHERY RESOURCES	LAND USE	INFRASTRUCTURES	CULTURAL, HISTORICAL HERITAGE AND TRADITIONAL ACTIVITIES	QUALITY OF LIFE	GENDER AND DEVELOPMENT
Project Activities	**Pre-construction and Construction Phase**	Site Work	❍			❍	●	❍	❍	❍			●	❍	
		Site and Labour Organization	❍			❍	❍			❍	❍			●	●
		Expropriations									●	❍		●	●
		Cut and Fill		●									❍	❍	
		Use of Machinery	●	●	●					❍		●		●	
	Operational Phase	Engineering Structures Found								❍	●			●	
		Operation and Maintenance of Engineering Structures			◊					❍				●	◊

3.2.9.2 Sègboroué- Aného Interconnection

Interrelation Matrix Sègboroué-Aného (A2)

Significant Interrelation ● Negligible Interrelation o Positive Interrelation ◊	Receiving Environment Components		Physical Environment			Biological Environment					Human Environment				
			WATER QUALITY	SOIL QUALITY AND DYNAMICS	AIR QUALITY	SPECIFIC FLORA	PROTECTED FORESTS AND AREAS	ARTIFICIAL PLANTATIONS	ENVIRONMENTALLY SENSITIVE AREAS	FAUNA AND FISHERY RESOURCES	LAND USE	INFRASTRUCTURES	CULTURAL, HISTORICAL HERITAGE AND TRADITIONAL	QUALITY OF LIFE	GENDER AND DEVELOPMENT
Project Activities	**Pre-construction and Construction Phase**	Site Work	❍			❍		●	●					❍	
		Site and Labour Organization	❍			❍					❍			●	●
		Expropriations									●	●	●	●	●
		Cut and Fill	●	●					❍				❍	❍	
		Use of Machinery	●	●	●					❍		●		●	
	Operational Phase	Engineering Structures Found							❍		●			●	
		Operation and Maintenance of Engineering Structures			◊					❍				●	◊

3.2.9.3 Lomé-Tema Interconnection

Interrelation Matrix Lomé - Téma (A3)

Significant Interrelation ● Negligible Interrelation o Positive Interrelation ◊	Receiving Environment Components		Physical Environment			Biological Environment					Human Environment				
			WATER QUALITY	SOIL QUALITY AND DYNAMICS	AIR QUALITY	SPECIFIC FLORA	PROTECTED FORESTS AND AREAS	ARTIFICIAL PLANTATIONS	ENVIRONMENTALLY SENSITIVE AREAS	FAUNA AND FISHERY RESOURCES	LAND USE	INFRASTRUCTURES	CULTURAL, HISTORICAL HERITAGE AND TRADITIONAL	QUALITY OF LIFE	GENDER AND DEVELOPMENT
Project Activities	**Pre-construction and Construction Phase**	Site Work	❍					●	●					❍	
		Site and Labour Organization	❍						❍		❍			●	●
		Expropriations									●	●	●	●	●
		Cut and Fill	●						●				❍	❍	
		Use of Machinery	●	●	●							●		●	
	Operational Phase	Engineering Structures Found							❍		●			●	
		Operation and Maintenance of Engineering Structures			◊									●	◊

3.2.9.4 Prestea – Abobo Interconnection

Interrelation Matrix Prestea - Abobo (A4)

Significant Interrelation ● Negligible Interrelation o Positive Interrelation ◊	Receiving Environment Components		Physical Environment			Biological Environment					Human Environment				
			WATER QUALITY	SOIL QUALITY AND DYNAMICS	AIR QUALITY	SPECIFIC FLORA	PROTECTED FORESTS AND AREAS	ARTIFICIAL PLANTATIONS	ENVIRONMENTALLY SENSITIVE AREAS	FAUNA AND FISHERY RESOURCES	LAND USE	INFRASTRUCTURES	CULTURAL, HISTORICAL HERITAGE AND TRADITIONAL	QUALITY OF LIFE	GENDER AND DEVELOPMENT
Project Activities	**Pre-construction and Construction Phase**	Site Work	❍			❍	❍	●	●			❍		❍	
		Site and Labour Organization	❍			❍	❍		❍	❍	❍			●	●
		Expropriations									●	●	●	●	●
		Cut and Fill	●	●					●				❍	❍	
		Use of Machinery	●	●	●					❍		●		●	
	Operational Phase	Engineering Structures Found							❍	❍	●			●	
		Operation and Maintenance of Engineering Structures			◊									●	◊

3.2.9.5 Dimbokro – Sanniquellie Interconnection

Interrelation Matrix Dimbokro - Sanniquelli (A5)

Significant Interrelation ● Negligible Interrelation o Positive Interrelation ◊	Receiving Environment Components		Physical Environment			Biological Environment					Human Environment				
			WATER QUALITY	SOIL QUALITY AND DYNAMICS	AIR QUALITY	SPECIFIC FLORA	PROTECTED FORESTS AND AREAS	ARTIFICIAL PLANTATIONS	ENVIRONMENTALLY SENSITIVE AREAS	FAUNA AND FISHERY RESOURCES	LAND USE	INFRASTRUCTURES	CULTURAL, HISTORICAL HERITAGE AND TRADITIONAL	QUALITY OF LIFE	GENDER AND DEVELOPMENT
Project Activities	Pre-construction and Construction Phase	Site Work	❍			❍	●	❍	●	❍		❍		❍	
		Site and Labour Organization	❍			❍	❍		❍	❍	❍			●	●
		Expropriations									●	●		●	●
		Cut and Fill	●	●									❍	❍	
		Use of Machinery	●	●	●					❍		●		●	
	Operational Phase	Engineering Structures Found							❍	❍	●			●	
		Operation and Maintenance of Engineering Structures			◊					●				●	◊

3.2.9.6 Ouangolodougou – Bougouni – Bamako Interconnection

Interrelation Matrix Ouangolodougou - Bougouni - Bamako (B1)

Significant Interrelation ● Negligible Interrelation o Positive Interrelation ◊	Receiving Environment Components		Physical Environment			Biological Environment					Human Environment				
			WATER QUALITY	SOIL QUALITY AND DYNAMICS	AIR QUALITY	SPECIFIC FLORA	PROTECTED FORESTS AND AREAS	ARTIFICIAL PLANTATIONS	ENVIRONMENTALLY SENSITIVE AREAS	FAUNA AND FISHERY RESOURCES	LAND USE	INFRASTRUCTURES	CULTURAL, HISTORICAL HERITAGE AND TRADITIONAL	QUALITY OF LIFE	GENDER AND DEVELOPMENT
Project Activities	Pre-construction and Construction Phase	Site Work	❍			❍	●	❍	❍	❍		❍		❍	
		Site and Labour Organization	❍			❍	❍			❍	❍			●	●
		Expropriations									●	●	●	●	●
		Cut and Fill	●	●					❍				❍	❍	
		Use of Machinery	●	●	●					❍		●		●	
	Operational Phase	Engineering Structures Found								❍	●			●	
		Operation and Maintenance of Engineering Structures			◊									●	◊

3.2.9.7 Kaya – Dori – Niamey Interconnection

Interrelation Matrix Kaya - Dori - Niamey (B2)

Significant Interrelation ● Negligible Interrelation o Positive Interrelation ◊	Receiving Environment Components		Physical Environment			Biological Environment					Human Environment				
			WATER QUALITY	SOIL QUALITY AND DYNAMICS	AIR QUALITY	SPECIFIC FLORA	PROTECTED FORESTS AND AREAS	ARTIFICIAL PLANTATIONS	ENVIRONMENTALLY SENSITIVE AREAS	FAUNA AND FISHERY RESOURCES	LAND USE	INFRASTRUCTURES	CULTURAL, HISTORICAL HERITAGE AND TRADITIONAL	QUALITY OF LIFE	GENDER AND DEVELOPMENT
Project Activities	**Pre-construction and Construction Phase**	Site Work	❍			❍	❍	❍	●	❍		❍		❍	
		Site and Labour Organization	❍			❍	❍		❍	❍	❍			●	●
		Expropriations									●	❍	●	●	●
		Cut and Fill	●	●					❍	❍			❍	❍	
		Use of Machinery	●	●	●					❍		●		●	
	Operational Phase	Engineering Structures Found							❍		●			●	
		Operation and Maintenance of Engineering Structures			◊					❍				●	◊

3.2.9.8 Niamey – Dosso – Kaura Namoda Interconnection

Interrelation Matrix Niamey - Dosso - Kaura Namoda (B3)

Significant Interrelation ● Negligible Interrelation o Positive Interrelation ◊	Receiving Environment Components		Physical Environment			Biological Environment					Human Environment				
			WATER QUALITY	SOIL QUALITY AND DYNAMICS	AIR QUALITY	SPECIFIC FLORA	PROTECTED FORESTS AND AREAS	ARTIFICIAL PLANTATIONS	ENVIRONMENTALLY SENSITIVE AREAS	FAUNA AND FISHERY RESOURCES	LAND USE	INFRASTRUCTURES	CULTURAL, HISTORICAL HERITAGE AND TRADITIONAL	QUALITY OF LIFE	GENDER AND DEVELOPMENT
Project Activities	Pre-construction and Construction Phase	Site Work	❍			❍	●	❍	❍	❍		❍	❍	❍	
		Site and Labour Organization	❍			❍	❍			❍	❍			●	●
		Expropriations									●	●	●	●	●
		Cut and Fill	●	●					❍				❍	❍	
		Use of Machinery	●	●	●							●		●	
	Operational Phase	Engineering Structures Found								❍	●			●	
		Operation and Maintenance of Engineering Structures			◊					❍				●	◊

3.2.9.9 Niamey – Dosso – Parakou Interconnection

Interrelation Matrix Niamey - Dosso - Parakou(C1)

Significant Interrelation ● Negligible Interrelation o Positive Interrelation ◊	Receiving Environment Components		Physical Environment			Biological Environment					Human Environment				
			WATER QUALITY	SOIL QUALITY AND DYNAMICS	AIR QUALITY	SPECIFIC FLORA	PROTECTED FORESTS AND AREAS	ARTIFICIAL PLANTATIONS	ENVIRONMENTALLY SENSITIVE AREAS	FAUNA AND FISHERY RESOURCES	LAND USE	INFRASTRUCTURES	CULTURAL, HISTORICAL HERITAGE AND TRADITIONAL	QUALITY OF LIFE	GENDER AND DEVELOPMENT
Project Activities	Pre-construction and Construction Phase	Site Work	❍			●	●	●	●	●		❍		❍	
		Site and Labour Organization	❍			❍	❍		❍	❍	❍			●	●
		Expropriations									●	●	●	●	●
		Cut and Fill	●	●					❍	●			❍	❍	
		Use of Machinery	●	●	●					❍		●		●	
	Operational Phase	Engineering Structures Found							❍	❍	●			●	
		Operation and Maintenance of Engineering Structures			◊					●				●	◊

3.2.9.10 Kaya – Dori – Ansongo Interconnection

Interrelation Matrix Kaya - Dori - Ansongo (C2)

Significant Interrelation ● Negligible Interrelation o Positive Interrelation ◊	Receiving Environment Components		Physical Environment			Biological Environment					Human Environment				
			WATER QUALITY	SOIL QUALITY AND DYNAMICS	AIR QUALITY	SPECIFIC FLORA	PROTECTED FORESTS AND AREAS	ARTIFICIAL PLANTATIONS	ENVIRONMENTALLY SENSITIVE AREAS	FAUNA AND FISHERY RESOURCES	LAND USE	INFRASTRUCTURES	CULTURAL, HISTORICAL HERITAGE AND TRADITIONAL	QUALITY OF LIFE	GENDER AND DEVELOPMENT
Project Activities	Pre-construction and Construction Phase	Site Work	❍						●	❍		❍		❍	
		Site and Labour Organization	❍							❍	❍			●	●
		Expropriations									●	❍		●	●
		Cut and Fill	●	●									❍	❍	
		Use of Machinery	●	●	●					❍		●		●	
	Operational Phase	Engineering Structures Found									●			●	
		Operation and Maintenance of Engineering Structures			◊					❍				●	◊

3.2.9.11 Kano – Maradi Interconnection

Interrelation Matrix Kano - Maradi (C3)

Significant Interrelation ● Negligible Interrelation o Positive Interrelation ◊	Receiving Environment Components		Physical Environment			Biological Environment					Human Environment				
			WATER QUALITY	SOIL QUALITY AND DYNAMICS	AIR QUALITY	SPECIFIC FLORA	PROTECTED FORESTS AND AREAS	ARTIFICIAL PLANTATIONS	ENVIRONMENTALLY SENSITIVE AREAS	FAUNA AND FISHERY RESOURCES	LAND USE	INFRASTRUCTURES	CULTURAL, HISTORICAL HERITAGE AND TRADITIONAL	QUALITY OF LIFE	GENDER AND DEVELOPMENT
Project Activities	Pre-construction and Construction Phase	Site Work	❍			❍						❍		❍	
		Site and Labour Organization	❍			❍				❍	❍			●	●
		Expropriations									●	●	●	●	●
		Cut and Fill	●	●									❍	❍	
		Use of Machinery	●	●	●					❍		●		●	
	Operational Phase	Engineering Structures Found									●			●	
		Operation and Maintenance of Engineering Structures			◊					❍				●	◊

3.2.9.12 San Pedro – Diléya – Man Interconnection

Interrelation Matrix San Pedro - Dileya - Man (C4)

Significant Interrelation ● Negligible Interrelation o Positive Interrelation ◊	Receiving Environment Components		Physical Environment			Biological Environment					Human Environment				
			WATER QUALITY	SOIL QUALITY AND DYNAMICS	AIR QUALITY	SPECIFIC FLORA	PROTECTED FORESTS AND AREAS	ARTIFICIAL PLANTATIONS	ENVIRONMENTALLY SENSITIVE AREAS	FAUNA AND FISHERY RESOURCES	LAND USE	INFRASTRUCTURES	CULTURAL, HISTORICAL HERITAGE AND TRADITIONAL	QUALITY OF LIFE	GENDER AND DEVELOPMENT
Project Activities	**Pre-construction and Construction Phase**	Site Work	❍			●	●	●	●	●		❍		❍	
		Site and Labour Organization	❍			❍	❍		❍	❍	❍			●	●
		Expropriations									●	●	●	●	●
		Cut and Fill	●	●						●			❍	❍	
		Use of Machinery	●	●	●					❍		●		●	
	Operational Phase	Engineering Structures Found								❍	●			●	
		Operation and Maintenance of Engineering Structures			◊			●						●	◊

3.2.9.13 Blitta-Fada Ngourma – Niamey Interconnection

Interrelation Matrix Blitta-Fada Ngourma - Niamey (C5)

Significant Interrelation ● Negligible Interrelation o Positive Interrelation ◊	Receiving Environment Components		Physical Environment			Biological Environment					Human Environment				
			WATER QUALITY	SOIL QUALITY AND DYNAMICS	AIR QUALITY	SPECIFIC FLORA	PROTECTED FORESTS AND AREAS	ARTIFICIAL PLANTATIONS	ENVIRONMENTALLY SENSITIVE AREAS	FAUNA AND FISHERY RESOURCES	LAND USE	INFRASTRUCTURES	CULTURAL, HISTORICAL HERITAGE AND TRADITIONAL	QUALITY OF LIFE	GENDER AND DEVELOPMENT
Project Activities	**Pre-construction and Construction Phase**	Site Work	❍			●	●	●	●	●		❍		❍	
		Site and Labour Organization	❍			❍	❍		❍	❍	❍			●	●
		Expropriations									●	●	●	●	●
		Cut and Fill	●	●						●			❍	❍	
		Use of Machinery	●	●	●					❍		●		●	
	Operational Phase	Engineering Structures Found							❍	❍	●			●	
		Operation and Maintenance of Engineering Structures			◊					●				●	◊

3.2.9.14 Bougouni Mandiana – Kankan Interconnection

Interrelation Matrix Bougouni - Mandiana - Kankan (C6)

Significant Interrelation ● Negligible Interrelation o Positive Interrelation ◊	Receiving Environment Components		Physical Environment			Biological Environment					Human Environment				
			WATER QUALITY	SOIL QUALITY AND DYNAMICS	AIR QUALITY	SPECIFIC FLORA	PROTECTED FORESTS AND AREAS	ARTIFICIAL PLANTATIONS	ENVIRONMENTALLY SENSITIVE AREAS	FAUNA AND FISHERY RESOURCES	LAND USE	INFRASTRUCTURES	CULTURAL, HISTORICAL HERITAGE AND TRADITIONAL	QUALITY OF LIFE	GENDER AND DEVELOPMENT
Project Activities	Pre-construction and Construction Phase	Site Work	❍			●	●	❍	❍	●		❍		❍	
		Site and Labour Organization	❍			❍	❍		❍	❍	❍			●	●
		Expropriations									●	❍		●	●
		Cut and Fill	●	●						●			❍	❍	
		Use of Machinery	●	●	●					❍		●		●	
	Operational Phase	Engineering Structures Found							❍	❍	●			●	
		Operation and Maintenance of Engineering Structures			◊					●				●	◊

3.2.9.15 Man – Mandiana – Kankan Interconnection

Interrelation Matrix Man - Mandiana - Kankan (C7)

Significant Interrelation ● Negligible Interrelation o Positive Interrelation ◊	Receiving Environment Components		Physical Environment			Biological Environment					Human Environment				
			WATER QUALITY	SOIL QUALITY AND DYNAMICS	AIR QUALITY	SPECIFIC FLORA	PROTECTED FORESTS AND AREAS	ARTIFICIAL PLANTATIONS	ENVIRONMENTALLY SENSITIVE AREAS	FAUNA AND FISHERY RESOURCES	LAND USE	INFRASTRUCTURES	CULTURAL, HISTORICAL HERITAGE AND TRADITIONAL	QUALITY OF LIFE	GENDER AND DEVELOPMENT
Project Activities	Pre-construction and Construction Phase	Site Work	❍			❍	●	●	●	●		❍		❍	
		Site and Labour Organization	❍			❍	❍		❍	❍	❍			●	●
		Expropriations									●	●	●	●	●
		Cut and Fill	●	●						●			❍	❍	
		Use of Machinery	●	●	●					❍		●		●	
	Operational Phase	Engineering Structures Found							❍	❍	●			●	
		Operation and Maintenance of Engineering Structures			◊									●	◊

3.2.9.16 Niamey – Fada Ngourma – Ouagadougou Interconnection

Interrelation Matrix Niamey - Fada Ngourma - Ouagadougou (C8)

Significant Interrelation ● Negligible Interrelation o Positive Interrelation ◊	Receiving Environment Components		Physical Environment			Biological Environment					Human Environment				
			WATER QUALITY	SOIL QUALITY AND DYNAMICS	AIR QUALITY	SPECIFIC FLORA	PROTECTED FORESTS AND AREAS	ARTIFICIAL PLANTATIONS	ENVIRONMENTALLY SENSITIVE AREAS	FAUNA AND FISHERY RESOURCES	LAND USE	INFRASTRUCTURES	CULTURAL, HISTORICAL HERITAGE AND TRADITIONAL	QUALITY OF LIFE	GENDER AND DEVELOPMENT
Project Activities	**Pre-construction and Construction Phase**	Site Work	❍			❍	●	❍	❍	❍		❍		❍	
		Site and Labour Organization	❍			❍	❍			❍	❍			●	●
		Expropriations									●	●	●	●	●
		Cut and Fill	●	●					❍	❍			❍	❍	
		Use of Machinery	●	●	●					❍		●		●	
	Operational Phase	Engineering Structures Found								❍	●			●	
		Operation and Maintenance of Engineering Structures			◊					❍				●	◊

3.2.9.17 Dabola – Tambacounda Interconnection

Interrelation Matrix Dabola - Tambacounda (C9)

Significant Interrelation ● Negligible Interrelation o Positive Interrelation ◊	Receiving Environment Components		Physical Environment			Biological Environment					Human Environment				
			WATER QUALITY	SOIL QUALITY AND DYNAMICS	AIR QUALITY	SPECIFIC FLORA	PROTECTED FORESTS AND AREAS	ARTIFICIAL PLANTATIONS	ENVIRONMENTALLY SENSITIVE AREAS	FAUNA AND FISHERY RESOURCES	LAND USE	INFRASTRUCTURES	CULTURAL, HISTORICAL HERITAGE AND TRADITIONAL ACTIVITIES	QUALITY OF LIFE	GENDER AND DEVELOPMENT
Project Activities	Pre-construction and Construction Phase	Site Work	❍			❍	●		●	●		❍		❍	
		Site and Labour Organization	❍			❍	❍		❍	❍	❍			●	●
		Expropriations									●	●	●	●	●
		Cut and Fill	●	●						●			❍	❍	
		Use of Machinery	●	●	●					❍		●		●	
	Operational Phase	Engineering Structures Found							❍	❍	●			●	
		Operation and Maintenance of Engineering Structures			◊					●				●	◊

3.2.10 Discriminant Issues

In the previous chapter, the anticipated environmental issues were analyzed. The following table lists the discriminant issues related to the 17 interconnections. During the detailed analysis of the environmental impacts, the interconnections which will have been chosen will undergo a detailed assessment, in accordance with the requirements from the African Development Bank.

INTERCONNECTION	COUNTRY	KM	Discriminant Environmental Issues
A1 : Ilaro–Pobè	Nigeria-Benin	23	• Numerous wetlands therefore, the fish risk losing their habitat and the quality of the water is at risk. • Expropriation of sacred sites reserved for traditional ceremonies (Sambas). • Fragile soils (claylike) not suitable for earthworks.

INTERCONNECTION	COUNTRY	KM	Discriminant Environmental Issues
A2 : Sègboroué–Aneho	Benin-Togo	49	• Large wetlands to be crossed (Lake Ahémé and Aneho Lagoon) therefore the quality of the water is at risk as well as the fish habitat. • Numerous plantations to cross therefore there is a risk of loss of revenue. • Important population shift.
A3 : Lomé–Téma	Togo-Ghana	147	• Numerous wetlands to cross including the Volta, therefore the quality of the water is at risk as well as the fish habitat. • Numerous plantations to cross therefore there is a risk of loss of revenue. • Important population shift. • Expropriation of sacred sites reserved for traditional ceremonies.
A4 : Prestea–Abobo	Ghana-Ivory Coast	222	• Large wetlands to be crossed such as the Bia River, the Comoé river and the Tanoe river as well as numerous swampy areas therefore the quality of the water as well as the fish habitat is at risk. • Numerous plantations to cross therefore there is a risk of loss of revenue. • Difficult conditions for earthworks, are is quite rugged and the nature of the soils is not suitable to earthworks (clay).
A5 : Dimbokro–Man–Sanniquellie	Ivory Coast-Liberia	535	• Numerous wetlands therefore, the fish risk losing their habitat and the quality of the water is at risk. • Loss of forests and protected areas therefore, loss of wildlife habitat. • Important population shift. • Difficult conditions for earthworks, are is quite rugged and the nature of the soils is not suitable to earthworks (clay).
B1 : Ouangolodougou–Bougouni–Bamako	Ivory Coast-Mali	569	• Large wetlands to be crossed such as the Niger River in Bamako, Baoulé in Bougouni and Bagoé in Koumantou therefore, the quality of the water is at risk as is the fish habitat. • Loss of forests and protected areas (gallery forests and tree savannas) therefore, loss of wildlife habitat. • Important population shift. • Expropriation of sacred sites reserved for traditional ceremonies. • Risk of overexploiting the water resource during the earthworks (dry soil).
B2 : Kaya-Dori–Niamey	Burkina Faso-Niger	397	• The crossing of the Niger river (Niamey) and the numerous wetlands put the fish at risk of losing their habitat and puts the quality of the water at risk. • Important population shift.

INTERCONNECTION	COUNTRY	KM	Discriminant Environmental Issues
			• Expropriation of sacred sites reserved for traditional ceremonies. • Risk of overexploiting the water resource during the earthworks (dry soil and insufficient water resource). • Numerous ecologically sensitive areas (sahelian region). • Difficult pedologic conditions for earthworks (dry soil and risk of sand-covering).
B3 : Niamey–Dosso–Kaura Namoda	Niger-Nigeria	450	• Ecosystem already heavily degraded. • Important population shift. • Risk of overexploiting the water resource during the earthworks in Niger (dry soil and insufficient water resource). • Difficult conditions for earthworks in Nigeria as the nature of the soil is not suitable (clay).
C1 : Niamey–Dosso–Parakou	Niger-Benin	625	• Important particular flora which requires that protective measures be put in place. • Loss of forests and protected areas therefore, loss of wildlife habitat. • Diversified fauna making it necessary to put protective measures in place. • Numerous wetlands therefore, the fish risk losing their habitat and the quality of the water is at risk. • Important population shift. • Numerous plantations to cross therefore there is a risk of loss of revenue. • Risk of overexploiting the water resource during the earthworks (dry soil and insufficient water resource in certain areas).
C2 : Kaya-Dori–Ansongo	Burkina Faso - Mali	363	• Environmentally sensitive area (sahelian region). • Important population shift. • Risk of overexploiting the water resource during the earthworks (dry soil and insufficient water resource). • Difficult pedologic conditions for earthworks (dry soil and risk of sand-covering).
C3 : Kano–Maradi	Nigeria- Niger	241	• Poor ecosystem (forest relics) therefore, there is a need to apply protective measures. • Expropriation of cultivated plots and pasture areas.
C4 : San Pedro–Man	Ivory Coast	399	• Important particular flora which requires that protective measures be put in place. • Loss of forests and protected areas therefore, loss of wildlife habitat. • Numerous wetlands therefore, the fish risk losing their habitat and the quality of the water is at risk.

INTERCONNECTION	COUNTRY	KM	Discriminant Environmental Issues
			• Important population shift. • Rugged terrains and difficult conditions for earthworks.
C5: Blitta–Fada Ngourma–Niamey	Benin-Burkina Faso-Niger		• The crossing of the Niger river (Niamey) and the numerous wetlands put the fish at risk of losing their habitat and puts the quality of the water at risk. • Important particular flora which requires that protective measures be put in place. • Loss of forests and protected areas therefore, loss of wildlife habitat. • Diversified fauna making it necessary to put protective measures in place. • Expropriation of plantation leading to loss of revenue. • Important population shift. • Rugged terrains and difficult conditions for earthworks.
C5 (1) : Blitta–Fada Ngouma–Ouagadougou	Benin-Burkina Faso		• Numerous wetlands therefore, the fish risk losing their habitat and the quality of the water is at risk. • Important particular flora which requires that protective measures be put in place. • Loss of forests and protected areas therefore, loss of wildlife habitat. • Diversified fauna making it necessary to put protective measures in place. • Expropriation of plantation leading to a loss of revenue. • Important population shift. • Rugged terrain and difficult conditions for earthworks.
C6 : Bougouni-Mandiana-Kankan	Mali-Guinea	261	• Numerous wetlands therefore, the fish risk losing their habitat and the quality of the water is at risk. • Flore particulière importante donc application de mesures de protection exigées; • Loss of forests and protected areas therefore, loss of wildlife habitat. • Diversified fauna making it necessary to put protective measures in place. • Expropriation of cultivated plots leading to loss of revenue. • Loss of pasture areas. • Loss of hunting and fishing areas. • Disruption of tourism related activities leading to a loss of revenue.

INTERCONNECTION	COUNTRY	KM	Discriminant Environmental Issues
C7 : Man–Mandiana–Kankan	Ivory Coast-Guinea	571	• Numerous wetlands therefore, the fish risk losing their habitat and the quality of the water is at risk. • Loss of forests and protected areas therefore, loss of wildlife habitat. • Diversified fauna making it necessary to put protective measures in place. • Expropriation of plantations leading to a loss of revenue. • Expropriation of cultivated plots leading to a loss of revenue. • Loss of pasture areas. • Loss of hunting and fishing areas. • Disruption of tourism related activities leading to a loss of revenue.
C8 : Niamey - Fada Ngourma – Ouagadougou	Niger - Burkina Faso	492	• The crossing of the Niger river (Niamey) and the numerous wetlands put the fish at risk of losing their habitat and puts the quality of the water at risk. • Loss of forests and protected areas therefore, loss of wildlife habitat. • Expropriation of cultivated plots leading to a loss of revenue. • Important population shift.
C9 : Dabola – Tambacounda	Guinea-Mali-Senegal	646	• Numerous wetlands therefore, the fish risk losing their habitat and the quality of the water is at risk. • Loss of forests and protected areas therefore, loss of wildlife habitat. • Diversified fauna making it necessary to put protective measures in place. • Loss of hunting and fishing areas. • Expropriation of sacred sites reserved for traditional ceremonies. • Important population shift. • Expropriation of cultivated plots leading to a loss of revenue. • Loss of pasture areas. • Disruption of tourism related activities leading to a loss of revenue. • Intrusion in a reserve located in the biosphere (Niokolo Park – Komba).

3.2.11 Socio-economic Analysis

3.2.11.1 Main Socio-economic Characteristics of the Whole Area

The seventeen (17) new railway interconnections are divided among 10 countries, members of the ECOWAS. They are: Benin, Burkina Faso, Ivory Coast, Ghana, Guinea, Mali, Niger, Nigeria, Senegal and Togo.

The Economic Community of West African States (ECOWAS) is a regional group of fifteen West African countries, founded in 1975. Its mission is to promote economic integration through the promotion and development of all economic activities, such as industry, transport, telecommunications, energy, agriculture, natural resources, commerce, monetary and financial as well as social and cultural issues.

Following is a table with the main characteristics of the 10 countries affected by the study.

Country	Population (millions of inhabitants – 2004)	Geographic Size (km^2)	GDP/per capita FCFA	Demographic Growth Rate 2004-2020
Benin	8.2	112,620	253,577	2.8
Burkina Faso	12.8	274,000	198,884	2.9
Ivory Coast	17.9	322,462	417,656	1.7
Ghana	21.7	238,587		1.8
Guinea	9.2	248,860		2.3
Mali	13.1	1,240,000	188,940	2.9
Niger	13.5	1267,000	119,300	3.2
Nigeria	128.7	923,768		1.9
Senegal	11.4	196,720	353,019	2.1
Togo	5.2	56,790	174,024	2.4

Sources: WAEMU, ECOWAS, World Bank

Of these countries, five are part of the Gulf of Guinea, surrounding Nigeria (Ivory Coast, Ghana, Togo and Benin) mostly located on a shallow coastal margin. In this margin is where most of the regional market activities take place, it is in this margin that we find the greatest potential for regional exchanges. At the center of this system, Nigeria alone accounts for 50 % of the regional GDP and its mining wealth ensures its long term prosperity; this is the heart of the regional economy. To this day, it is the most prosperous area in West Africa due to its agricultural and mining resources; it is at the center of the insertion of the region into the globalization movement by way of its business activities and the resulting monetary flow.

Senegal and Guinea are part of the countries on the Atlantic (Cape Verde, Mauritania, Senegal, Gambia, Guinea, Guinea-Bissau, Sierra Leone and Liberia). These countries make up a relatively autonomous group in terms of regional market and are more concerned with the global marketplace, namely the European market. In this group, the coastal Sahelian countries are remarkably outward-looking compared t the rest of the region; on average they receive more help than the other groups (even more than the enclaved countries of the Sahel, who are poorer). Their future depends largely on their ability to diversify their sources of revenue. This area is probably one of the most fragile of the region. The forest coastal countries have experienced numerous decades with a succession of political crises, despite this fact, the potential is still there given the abundant resources. In the medium-term, this group of countries can progress in numerous ways. It can connect itself progressively to the Ivory Coast, at the heart of the regional market or it can join the Sahelian coastal countries in adopting a more extroverted approach.

The major enclaved countries, which include Mali, Burkina Faso and Niger, face numerous constraints linked to being enclaved, the vastness of their territories correlated to the sparseness of their population and the important ecological constraints. However, in the southern part they have large agricultural areas with remarkable potential and important rivers. For more than a decade their agricultural progress has enabled them to shed their image as a country devastated by famine, brought on by the painful droughts of the 1970s and 1980s.

Despite the possibilities offered by these three ecological, economic and social groups, these countries remain among the poorest although they have made sustained efforts over numerous decades. In fact, the GDP per capita is still low in each of the affected countries, there is a relatively high growth rate and access to basic services and infrastructures is limited. In anticipation of changing this trend in these countries, the last decade has been the scene for preparing and implementing a poverty reduction strategy.

These Poverty Reduction Strategy Papers (PRSP) are now being extended to include the regional aspects of poverty and the efforts require to reduce same, this is in anticipation of an accelerated economic growth of each country based both on promoting local initiatives and the regional complementation to be reinforced and developed.

Each country, based on its natural potential given its geographical location (coastal or enclaved countries) and its economy anticipates having a performing transportation sector. On the economic front, transportation activities contribute to the economic growth of these countries. By offering a developed transportation network which is in good working condition, performing and competitive services, this sector can contribute reducing poverty, creating jobs, supplying the markets, developing business activities, access to natural resources, to production tools and opportunities.

On a social level, the transportation infrastructures that are in good condition provide access to basic services. In order for the transportation sector to play its role as a supporter of

business activities and access to basic services, the poverty reduction strategies currently under way in the countries affected by this study anticipate to:

- Develop the basic transportation infrastructures.
- Implement the reforms to promote private investments.
- Reinforce the railway transportation capacity.
- Rehabilitate the existing tracks.
- Concession of the existing railway businesses.

The project is in consistent with the poverty reduction strategies, of which the main fields aim to improve access to basic services for the population related to health, water, sanitation, transportation and education.

Of course, these Poverty Reduction Strategy Papers (PRSP) are largely documented and based on consultations of varying degrees with the populations. The PRSP provide a detailed profile of the poverty and issues relating to the economic and social growth of the women within a development framework. However, when completing each of the new railway interconnections, a detailed socio-economic study must be conducted in the area affected by the project.

In contrast, in order to update and guide the strategic choices, the investigations conducted on new segments covering five countries (Benin, Burkina Faso, Mali, Niger and Senegal) made it possible to analyze the socio-economic components of the project while taking into account the points of view of the political administrative and technical stakeholders, the professional groups and the populations. These elements are developed in the sections that follow.

3.2.11.2 Socio-economic Features of the Targeted Areas

On a socio-economic level, the research works conducted in a certain number of countries as well as the examined documentation have contributed to establish a typology of the following issues: administrative and political background, socio-demographic context and means of transportation within the project area. The elements of this typology are introduced through the next sections.

General Features

Socio-administrative and Political Background

It is marked by a deconcentration of the administration and a political decentralization. In the last few years, municipal elections have been held in all or substantially all of the countries addressed in this study, therefore contributing to an active administrative and political decentralization. Hence, these countries now have self-sufficient administrative bodies, otherwise known as communes, whose purpose is to promote democracy and

bottom-up development. To ensure this, political power is decentralized and exercised by the local elected officials.

Let us not forget that following the independences (60's), focus has been put on the building of the National State with the idea that the national unity had to take precedence over diversity. In the course of time, and predominantly at the beginning of the 90's, many of the region's countries have strongly prioritized the promotion of local initiatives and decentralization. This new approach thoroughly modifies the delivery conditions of several national sector based policies, especially in the field of health services, education and infrastructures.

The implementation of a local decision-making process, in complement to that of national authorities, has an impact upon the construction of the regional integration in West Africa, provided that political cooperation, monetary integration, establishment of common rules in customs, financial and insurance fields remain the exclusive competencies of the states.

As individual and community states, the concerns of local border authorities as to the competencies, which are now their own, will have to be more and more taken into account at the national and levels.

To reflect this new dynamic, it is important in the framework of this project to maintain the participative approach that has already been adopted at all levels of project development.

Economic Activities

Among the economic activities, agriculture ranks first almost over the entire country, as is shown through research conducted on numerous railway links in the countries affected by the study. Other than agriculture there are: fishery resources and livestock production, trade, industries, and transportation

As for the industries, mining, oil and forest resources play an important role in the regional economy. In terms of perspectives, the development of the sector is closely linked to the development of railway transportation. Solely for illustration purposes, the results of a few investigations conducted along some segment are presented in Volume 2B: Socio-economic Analysis.

Socio-demographic Background of the Area

Socio-demographically speaking, the project will affect a significant part of the population within the countries concerned by this project, either because the selected legs crosses the territories on a very long distance (Burkina Faso and Benin, Ivory Coast), or because they crosses more populated areas (Mali, Niger and Ghana). The research works conducted on various legs expose some socio-demographic characteristics that are common to the different legs spread over the ten countries, notably a demographic growth rate that varies between 1.7% and 3.2%, an almost equal population distribution between men and women,

a significant portion of a young population living a rural environment, a significant migration of the rural youth towards the urban centers. These elements are very important for this project and they need to be thoroughly analyzed during the complete social and environmental impact assessments. The following tables provide as an example the socio-demographic indicators of the Parakou-Mananville (Benin) leg through the Parakou – Niamey (Niger) and Bamako – Bougouni (Mali) links.

Socio-ethnic and cultural Groups

What is particular to the African society, especially in West Africa, is the socio-ethnic and linguistic diversity. The research works conducted in many gateway cities (Bougouni (Mali), Gaya (Niger), Parakou (Benin) bring out this feature. As an indicator, here is the situation for the above towns:

- **Bougouni (Mali)** - In Bougouni, all the Malian ethnic compositions are represented: Peulh, Bambara, Sarakole, Malinke, Senoufo, Peulh, Minianka, Sonrhai, Sarakole – Kassonke, Dogon, Bozo, Somono, Maures, and Tamasheq. That reflects the socio-cultural diversity encountered in every African country.
- **Gaya (Niger)** - In Gaya, the following ethnic compositions are represented: Dendi, Djerma, Haoussa, Peulh, Yoruba, Fon, and Tamasheq. That reflects the socio-cultural diversity encountered in Niger, Benin, Nigeria, and Togo.
- **Parakou (Benin)** – The following socio-cultural groups are represented :
    - Bariba ethnic group in the Parakou, N'Dali, Bembéreké, and Gogounou Communes;
    - Peulh ethnic group: Fulfude Peulh and Gando, notably in Bembereke (Gando), Gogounou, and Kandi (Peulh);
    - Dendi and Djerma ethnic group: everywhere within the two departments, but in particular in Kandi, and Malanville;
    - Yoruba group: everywhere in the area (but in minority) and the Mokole in the Kandi Commune;
    - Otamari and Gourmantche group, in minority within the departments but especially in the Malanville Commune.

The other groups encountered are Fon (0.8%), Yoa-Lokpa (0.4%), Adja (0.18 %) and others.

Ethnic diversity is a great source of cultural wealth, economic activities and social values, which contribute to the miscegenation between the people of the different ethnic groups of this sub-area. These features are also factors of competitive spirit regarding the social and economic development of West Africa.

Access to Basic Social Services

Setting up basic quality infrastructures that are better distributed geographically, as well as putting indispensable social services at the population's disposal are the prerequisites to strengthen human capital stock and to bring viable solutions to social demand through

important investments in the following fields: education, health, hydraulics, energy and transports.

Education

In all of the ECOWAS countries, education and training programs are in place and set the directions to take in this field. These programs are generally implemented by States in collaboration with financial and civil partners, as well as institutions and agencies from the education sector, to encourage a qualitative and quantitative development of the educative system and of training. The programs are reinforced by international objectives like the "Education for All Program".

Therefore, within the framework of the new rail links' development, it is important to evaluate the needs in education and training of communities that will benefit from infrastructures. Education and training will help them benefit to a maximum from the positive economic dynamic that will ensue.

To understand the magnitude of this issue, the elements stemming from on-the-ground investigations that will ensue on the Parakou–Malanville (Benin) rail link, illustrate the education situation along certain countries' lines.

Populations' instruction level in the area is low. In fact, according to the 2002 census done by the INSAE (National Institute of Statistics and Economic Analysis), eight (8) out of 10 people from 15 years old and above have never gone to school, as well as 84.3 % of young people aging from 15 to 24 years old. This is the highest rate of uneducated people in Benin.

The net school enrolment rate (6-14 years) is evaluated at 25.5 % for the area. Though daring actions are taken by the Benin government for girls' school enrolment (free primary school education, for example), the girls' school enrolment rate is still lower than the boys'. It should be noted however that there is an improvement of the phenomenon with the help, on a national level, of USAID and of the international NGO Benin Plan, which are involved in a remarkable way in financing the primary school education program in the country.

Amongst others, last year's action focused on school enrollment for girls.

The literacy rate of young people and adults is very low in Benin: only 12.7 % of young people from 15 to 24 years old and 10.7 % of adults (25 years and more) are literate.

Health

Investigations conducted on a sanitary level on several projected rail links reveal the presence of various tropical pathologies, with a strong predominance of endemoepidemic ailments. The most common are paludism, gastroenteric illnesses (diarrhea, cholera, etc.). But there are also target illnesses of the Expanded Program on Immunization, like measles, poliomyelitis, tetanus, whooping cough, tuberculosis, meningitis.

Numerous prevention programs against these pathologies are in place or will be in all the ECOWAS countries. They need to be taken into account when building each rail link by conducting specific investigations on the health of populations living along shorelines.

HIV/AIDS and STD are still present in regions concerned by the project. They are a permanent threat to populations' health. Since building the axis's railroad will make it easier for people to travel, it is feared that the phenomenon could spread if depletion measures are not advocated in support to the efforts deployed to find solutions to this problem as soon as building the infrastructures starts.

We also note a deficit when it comes to cleaning up in rural and urban areas along the different sections. An evaluation will have to be done when building each new rail link, to identify actions that deal with cleanup and the promotion of hygiene.

Infrastructures

As for infrastructures, access to drinkable water, to energy, to telecommunication and transport services are part of national priorities, as well as those of the ECOWAS. The deficit in these fields is still very important, particularly in rural areas.

Of course, major progress has been made. Unfortunately, there are still important problems which partly explain the high poverty index in countries concerned by the study.

Important programs are under way in the ECOWAS countries to improve the coverage rate of basic infrastructures: water, electrical energy and hydrocarbons, telecommunication and transport.

Rail link development is a major component in this dynamic. A priori, the project takes into account the actions to adopt to reach objectives set in the development of the region's basic infrastructures.

It is important to plan an evaluation in this field when building each new rail link to identify which infrastructures can improve the efficiency of the railroad development project.

- Gender Issue

The stake is to insure woman's best economical and social growth through a structure that guarantees equity between a nation's different components, in particular between men and women.

The promotion of women, children and the family is taken into account in all the ECOWAS countries. In all of them, there is a Ministerial Department in charge of questions related to women's involvement in economical and social development.

Women, through their different socio-professional organizations, fight fiercely to improve their life conditions.

Also, the question of gender is discussed first and foremost in all forums and women achieve encouraging results.

It is important to include this dimension within this large-scale project. At this stage of it, there have been meetings with women's groups to understand women's situation and identify the actions to take in the course of the project that will insure their effective involvement every step of the way (studies, construction and exploitation).

Some of this intervention's results are shown below to illustrate the gender dimension issue in some of the project's regions.

Parakou–Malanville (Benin)

In the area, considering the results of the third General Population and Housing Census (GPHC) in 2002, women make up 50.2 % of the population.

Whether it is in a rural or urban area, the woman is invested of important social and esoteric roles: maternity, children's education and domestic chores. On top of these responsibilities, she is an excellent economic agent. For example, in rural areas, the woman is involved in agricultural production work, next to the head of household in the family business, or on her own farm. Availability of cultivable lands in the project's area helps women manage their own farm if they so desire.

They are also part of associations and economic interest groups (women's groups for food-processing or food production.

Moreover, on market days, and in the absence of a family budget for food, the woman in rural areas temporarily transforms herself into a merchant who buys or sells agricultural products and animals to earn an income that will allow her to get supplies of bare necessity products (soap, salt, sugar, oil, matches, etc.) for the household or the family.

Some women who live along the Parakou–Malanville road trade food-producing products, including yam, on a permanent or a seasonal basis (towns of Parakou, N'Dali and Bembéréké).

They also trade firewood and charcoal along the line (from Parakou to approximately North Bembéréké).

In urban areas, a woman's concerns are not the same as in rural areas. Some women are salaried workers; others hold sewing or hairdressing workshops to insure an income that is almost regular. Others permanently specialize in agricultural product or animal trade, or in manufactured product trade. In other words, the woman is very present in small food-producing product, animal or manufactured product trade in the project's area.

- Fight Against Poverty Component

The ten countries concerned by the study, including Benin, Burkina Faso, the Ivory Coast, Ghana, Guinea, Mali, Niger, Nigeria, Senegal and Togo, have all elaborated Poverty Reduction Strategy Papers (PRSP) in complement to reinforcement measures of their macroeconomic framework. These PRSP based on a thorough diagnosis of the socioeconomic situation have helped define the poverty phenomenon and propose actions that allow its reduction. These actions aim to improve populations' income and access to services and basic infrastructures.

The rail network interconnection project of the ECOWAS State members take these perspectives into account. It is important when building each rail link to conduct detailed socioeconomic studies to take into consideration the needs of populations affected by the project.

Already, when it comes to PRS, indicators whose improvement is indispensable to fight against poverty have been defined.

The most commonly used are national indicators (poverty line, social indicators, access to housing, services and basic infrastructures, etc.) adopted by decision-makers at the macroeconomic level. Poverty indicators are also increasingly used in a broken down way, which is at a sub-regional and local level.

These types of tools exist in all of the countries concerned by the study and will need to be used as a reference to identify measures and actions to take when building each specific rail link. These levels of detail need to be considered during the detailed environmental and social studies that will ensue. In this future intervention, it is important to target vulnerable groups (women, children and youngsters).

3.2.12 Population Displacement

Railroad projects can lead to an involuntary displacement of populations for public safety reasons that will require setting up a corridor or buffer area. To reduce all risks for the Railroad network interconnection project to cause the people's displacement from certain target areas or from land acquisitions in target communities and/or to cause constraints on resource access, a clear resettlement/compensation policy must point out beforehand the investigation's framework of all the land acquisitions and of the identified constraints' mitigation.

The Involuntary Population Displacement Policy (November 2003) encourages the Bank's procedures to align with those of multilateral development banks, particularly with those of the World Bank. Consequently, the *Guidelines on Involuntary Displacement and Resettlement in Development Projects (May 1995)* will be completed by the World Bank Operational Policy 4.12 on Involuntary Resettlement (2001).

In accordance with the Bank's policy when it comes to the resettlement of displaced populations and of the ECOWAS country members' legislation on acquiring lands, a Global

Population Resettlement Policy Framework is required because of possible land and goods losses, of restricted access or of resource diminution. The objective of the Resettlement Policy Framework (RPF) is i) to set population resettlement and damage compensation principles, damages that will be caused by the project's components at the moment of implementation, ii) to suggest organizational arrangements and set up procedures that governments will follow, once reception areas and components that cause displacement will be identified.

The Consultant expects three types of management tools which, according to the level of available information on components, will help evaluate the people to displace or compensate, to determine the related costs to prepare the displacement and compensation process and see it through: a Resettlement Policy Framework (RPF) and a Full Resettlement Plan (FRP) or Summary Resettlement Plan (SRP) and a Functional Framework (FF) for the restricted access to natural resources.

Definition of the Terms

Resettlement Policy Framework (RPF): Document presenting principles that guide the development of a Resettlement Action Plan (RAP), once the investment is defined well enough to be able to determine its impacts.

Receiving community: Community living in the area where affected people must be displaced to, or near this area.

Full resettlement cost: Compensation based on the actual replacement value of lost goods, resources or income, without taking into account a provision for depreciation.

Involuntary displacement: A development project leads to inevitable losses of such a magnitude that the affected populations have no other choice but to rebuild their lives, their income and their economic base elsewhere. Involuntarily displaced people are of all ages, all social standings and all aptitudes. A lot of them have no choice but to abandon their possessions. The Bank's policy qualifies involuntarily displaced people as people needing help.

Displacement: Full resettlement and rehabilitation process caused by the project-related activities.

Voluntarily displaced people: Voluntarily displaced people are generally in search of new opportunities. Voluntary displacement can be integrated to the resettlement plan, if measures aiming at taking charge of involuntarily displaced people's particular situation are included.

Rights : Group of measures, including compensation, income restoration, help for transfer, income replacement and resettlement, owed to affected people in function of the nature of their losses, to restore and improve their economic and social base.

Expropriation: A State's action, done to exercise its sovereignty, that consists in confiscating or modifying an individual's property rights.

Disadvantaged groups: Specific groups of people that could suffer inconsiderately from project-related activities (for example, households where the head is a woman, children, the elderly, ethnic, religious and linguistic minorities, handicapped people).

Vulnerable group : Group of people who is most at risk of being affected and has a reduced capacity to react to negative impacts, like vulnerable ethnic minorities, refugees, displaced people, children, the elderly, handicapped people, etc. Poor people and women are normally regarded independently.

Primary stakeholders: The primary stakeholders are the beneficiaries of a development initiative or those that are directly affected by it (positively or negatively). They include local populations (individuals and community organizations) present in the project's or program's area, in particular poor people and marginalized groups that have traditionally been excluded from taking part into development efforts.

Secondary stakeholders: Secondary stakeholders influence a development project or are indirectly affected by it. They include the borrowing government, the ministries concerned, and staff from the project, executing agencies, local governments, civil partnership organizations, private companies, the Bank and its shareholders, as well as other development agencies.

Impact of displacement: Direct physical and socioeconomic consequences of the activities related to displacement into the project's area or reception area.

Compensation: Money amounts or payments in kind that populations affected by the project can receive, according to the country's rules and laws, to replace lost goods, resources or income.

Resettlement plan : Action plan with a calendar and a budget, laying down the strategy to follow, the objectives to attain, the rights to grant, the responsibilities, the follow-up and evaluation modalities, in the course of resettlement.

Population affected : People who, because of the project, risk losing part or all of their material and non material possessions, like houses, community goods, productive lands, resources as forests, pastures, fishing areas, important cultural sites, commercial properties, rentals, sources of income, networks, as well as social and cultural activities.

Rehabilitation: Rebuilding income, means of subsistence, lifestyles and social systems.

Resettlement: Rebuilding houses and resources, including production lands and public infrastructures, in another place.

Project's area: Area located inside or near construction sites and other areas that will be modified by the project (e.g.: impounding reservoirs, right of way for infrastructure projects, irrigated areas).

3.2.12.1 Resettlement Policy Framework

- Goals, Objectives and Guiding Principles

The Involuntary Displacement Policy is the Bank's commitment to promote environmental and social integration as a means to stimulate poverty alleviation, economic development and social welfare in Africa. It is the foundation of the **human's dignity**. This policy also focuses on the gender aspect of the question, as proper handling of gender issues relating to land and production means may help to reduce disparities to a minimum. It applies to any project that causes a loss in resources or a deterioration of the means of livelihood, without moving or resettling of affected populations.

- Basic principles and vision of the resettlement programme

The Bank places the people at the centre of development and it makes poverty reduction its overarching goal. In all operations, projects likely to require the displacement and resettlement of populations, especially when they involve disadvantaged groups such as the elderly, children, women-headed households, most deprived and marginalized communities receive special attention.

The purpose of the Bank's policy as to *involuntary displacement* is to ensure that when people leave their property they are treated in a fair manner and receive their share of the benefits of the project that caused their displacement. Therefore, it would be necessary to encourage governments to adopt laws and regulations that have a long-term perspective of development rather than focus on short-term solutions that may impoverish the people affected by resettlement.

- Resettlement Policy Guidelines
  - Reducing Displacement

The plan to reduce displacement follows first and foremost a **zero displacement** policy: it is necessary to avoid it as much as possible. When it is unavoidable, consequences must be reduced to the minimum while exploring all viable projects.

Serious consideration should be given **not to pursue the project** when a large number of people or an important group of the population risk to be displaced or undergo considerable damages that are difficult to quantify and compensate.

The socio-cultural considerations- such as religious or cultural value of the land, the vulnerability of the affected populations, or the availability of replacement goods, especially when the loss of assets to replace has a significant tangible impact, should be treated seriously.

- Development Programme

When a physical displacement of populations and a loss of economic assets are inevitable, the borrower must develop a resettlement plan. This plan should be designed to minimize the displacement and provide the displaced persons with assistance before, during, and after the physical resettlement. It should aim at improving living conditions of the displaced persons, their ability to earn their living and their level of production. It must be conceived and executed as part of a **development program**. Resources and adequate opportunity must be given to the displaced persons so that they can get their share of the impact of the project. Project's planners must ensure that affected communities are able to give their verifiable consent to the resettlement plan and the development programme, and that any necessary displacement is made in the context of negotiated settlements with the affected communities.

- Consultation

The displaced and host communities must be **consulted** at an early stage of the planning process and be encouraged to participate in it and in the implementation of the resettlement program. They must be informed of their rights and the options available to them. True alternatives must be given among technically and economically viable solutions. In this regard, special attention should be given to the location of the resettlement site and the sequencing of activities. To ensure that the consultation was useful, information on the proposed project and plans for resettlement and rehabilitation should be provided, in time and in an appropriate form, and understood by local people and the National civil society organizations; the meetings must also be meticulously organized. In addition to the joint meetings, it would be necessary to consider holding separate meetings for women and ensure fair representation of the women who are head of household. In addition, it is necessary to carefully plan the modalities of information dissemination, literacy levels and networks of relationships that may vary according to sex.

- Identification of Disadvantaged Groups

There should be special attention to the needs of **underprivileged groups** among the displaced populations, especially those whose income is below the line of poverty, those who have no land, the elderly, the women and children; there are also the ethnic minorities, the religious and linguistic minorities, as well as those who have no legal titles to property, and women head of household. Appropriate assistance must be provided to these underprivileged groups so that they can cope with the effects of the displacement and improve their condition. The delivery of health care, particularly to pregnant women and young children, may be important during and after the resettlement to prevent increasing the morbidity and mortality rates due to malnutrition, psychological stress associated with dislocation and the increase in risks of disease.

- Integration into Receiving Communities

Displaced people must be socially and economically integrated into the **receiving communities** to minimize possible negative impacts on these communities. All payments due to the host communities must be carried out promptly. Conflicts may arise between the host and displaced populations in as much as land, water, forest, and service claims increase, or if services and housing of superior quality are only provided to the displaced persons. These impacts must be carefully analyzed through feasibility and cost assessments within any project involving a displacement of populations, and adequate resources should be provided in a budget to mitigate these impacts.

- Compensation for Displaced Persons

Displaced persons shall be **compensated** at full replacement cost before their actual displacement, or expropriation of their land and related property, or at the start of the works, whichever of these events occurs first.

- Total Economic Cost

Therefore, the total project cost must include the **full cost of all resettlement activities**, that is, taking into account the loss suffered by the affected people as to means of livelihood and gain opportunities. This attempt to calculate "the total economic costs" must also take into consideration the social, health, environmental and psychological impacts of the project, and the displacement which may affect the productivity and social integration. The costs of resettlement should be considered in the light of the economic benefits of the project, and any net benefit applicable to internally displaced persons must be added to the stream of benefits of the project.

- Additional Mitigation Measures

The resettlement requires the implementation of several measures:

  - As part of the project, displaced persons receive resettlement assistance to improve their living conditions, their ability to earn a living and their production levels;
  - Explicit guidance is given to the staff of the Bank, and borrowers, under some conditions that must be met regarding the involuntary displacement. This guidance aims to reduce the negative impacts of the transfer and resettlement, establish a viable economy and society, establish a mechanism to monitor the implementation of resettlement programs as part of the Bank's operations, and solve problems as they arise to prevent poorly prepared or executed plans.
- Regulatory Framework

This policy deals with the economic and social impacts directly associated with projects which require involuntary acquisition of land or other property and result in:

- Displacement or loss of housing for residents in the project site;
- Loss of income or involuntary restriction of access to resources including;
- National parks, protected areas and natural resources; or
- Loss of income or means of livelihood, whether the people affected must be relocated or not.

There are three categories of displaced persons in the population affected by the project activities:

a) Persons who have formal legal rights over land, or other assets, recognized by the laws of the country. In this category, there are those who physically reside at the project site and those who have to be moved or may no longer have access to resources, or those who lose their means of means of livelihood as a result of the project ; and

b) Persons who have no formal legal rights over land or other property at the time of the census, but who can prove that they have a right on this land or property that could be recognized by the customary laws of the country. This category covers: (i) persons who do not live physically on the project site and do not directly acquire means of livelihood from it and who have spiritual and / or ancestral links with this site (e.g. cemeteries, sacred forests, places of worship); (ii) sharecroppers or tenant farmers, seasonal migrants or nomad families who lose their use right, according to the customary rights of the country in terms of land use. Moreover, should displaced people lose access to resources such as forests, rivers or pasture, they could be given resource replacement assets.

Displaced persons forming part of groups (a and b) are entitled to compensation for their land or other resources confiscated during the project;

c) Persons who have no legal or any other right that might be recognized on the lands they occupy, and who do not fall into the two above-mentioned categories. These people will be offered resettlement assistance, instead of compensation, to enable them to improve their living conditions (compensation for the loss of means of livelihood-generating activities, property on common resources, cultures, etc.), provided that they have occupied the project site before a deadline that is set by the borrower and considered as reasonable by the Bank. Under the Bank's policy (and without infringing the borrower's legislation) at least plots of land, housing and infrastructure should be provided to marginalized populations, including indigenous groups, ethnic, linguistic and religious communities, and farmers who may have a right of usufruct over land and other confiscated resources. The deadline must be clearly communicated to the population affected by the project. People who encroach on the project area after the deadline are not entitled to any form of resettlement assistance.

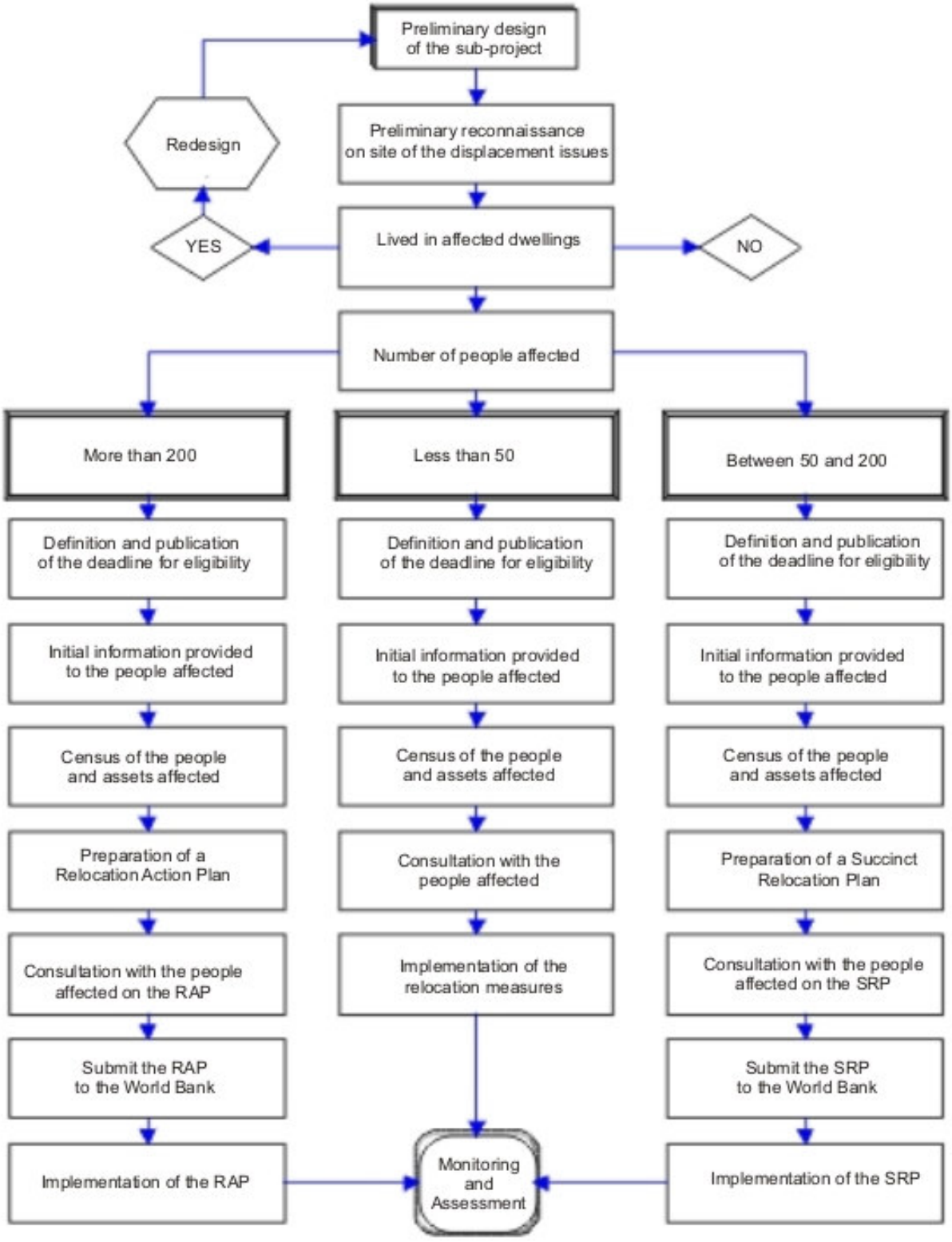


Figure 1 Process for Preparing the Relocation

- Monitoring-Assessment
  - Operative

The monitoring-assessment of plans for resettlement is an important phase of the project cycle. The goal of monitoring is to ensure that all the PAPs are compensated, moved and resettled in the shortest amount of time possible and with the least negative impact.

Resettlement is a complex procedure, which may be simple or complicated depending on the multitude of stakeholders, the socio-economic scope of the operation in the four different countries, and the number of actions which contribute to the achievement of such resettlement as is envisioned by national regulations and policies of the World Bank in this regard.

The complexity of monitoring depends on the nature of the relocation project. Average or limited relocation and large resettlements generally accentuate the same issues: participation; negotiating compensation, identification of a new site; removal, relocation, economic rehabilitation (if necessary), and satisfaction of the PAP. The difference between the limited relocation and resettlement in general is the number of people affected. Limited relocation involves very few people and can be set in motion by the Public authority itself, with the assistance of NGOs.

By contrast, general resettlement may involve the displacement of a large number of dwellings and businesses, which could exceed the capacity of a local community. Therefore, an agency must be contracted by the Public authority to help set up a monitoring system. Moreover, a distinction must be made between the relocation of residences, where income is not normally affected, and the relocation of businesses (even informally) where income is a fundamental consideration. But in both cases, investigations will be conducted to identify the persons affected by the program as well as the losses experienced as a result. The socio-economic profile of these people will be clearly established to determine whether the objectives of the CRP are being met.

- Indicators

The table below refers to possible indicators that could be used to monitor the implementation of a railroad project.

Table 2 Monitoring Indicators - Assessments

Population	
Demographic Trends	**Population Growth and Ethnic Composition**
Population migration and displacement	Types of living quarters and services accessible to displaced men and women before and after project implementation. Level of immigrant integration in the local communities (survey). Number of informal establishments built by the immigrants.

Population	
Demographic Trends	**Population Growth and Ethnic Composition**
Management of natural resources and land	Surface of developed land due to easier access. Distance to reach natural resources (such as fire wood) and farming land. Price fluctuation of land.
Quality of life	Number of claims submitted by the local populations relating to noise, dust, landscape, additional traffic, etc. Number of disputes among local populations and immigrants. Deviation of access to goods and services (markets). Accumulated wastes along the roadsides (number of sites or square meters).

- Consultation and Information Distribution

Persons displaced involuntarily from their land must participate in the planning and implementation of the resettlement program. They must be consulted in a constructive manner. The persons impacted should define the efforts required to improve and reconstitute their means of existence and living standards in the most advantageous way as possible considering the cost of living.

At the same time, it must be accepted that the methods of participation depend on the type and complexity of the resettlement operation.

Such participation, in terms of consultation and implication, supposes that the persons impacted by the involuntary resettlement enjoy the opportunity to take part in the decision-making, design, planning and operational implementation processes of the projects. Sub-projects are initiated and led upon the « demand » of the local communities. The success of resettlement projects depends on the degree of enlistment of the local communities and their knowledge-capital of local conditions, which are highly instrumental to the project. Consequently, particular attention must be paid to public meetings with individuals/ households potentially affected where resettlement is not intentional.

The participation strategy will highlight the implication plan of the persons involved. Such process shall not be disconnected from the overall program for which the basic options articulate around the necessity of the genuine enlistment of the base communities. Within this logic, public meetings will be performed throughout the entire period required to achieve the program. Such meetings will take place during the ground works of the (i) socio-economic survey, (ii) the involuntary resettlement plan and (iii) the environmental impact assessment and (iv) the negotiations involving compensations payable to displaced persons (drafting and reading of the compensation agreement).

Public participation and consultation will be organized according to the type of operation by way of meetings, radio programs, and requests for written suggestions/ comments,

populating questionnaires and forms, public conferences and developing sub project ideas and needs, etc. Documents shall be made available at local and neighborhood levels, at appropriate locations such as the headquarters of associations and socio-educational centres. These measures will take into consideration the literacy level of these communities while providing sufficient time for feedback.

Facing the absence of applicable rules or the extremity of the law, the strategy for the participation of the parties involved and impacted will be privileged and retained in order to create full opportunity to implicate the parties (Cf. Annex 6, Participation Form).

- Institutional Strategy
  - Responsibilities for the Implementation

The organizational and managerial responsibilities constitute a significant function in determining the success of the resettlement project. They help centralize information inputs and they also ensure overall coordination and coherence, proper monitoring and assessments, and transparency in the implementation of the plan at all regional, national and local levels.

The success of the implementation of the resettlement plan relies essentially on the availability to the Interstate connection Project of:

  - Efficient and determined institutions;
  - A partnership among the various participants (Administration, private operators, associations and groups and the targeted populations) based on the ideal of a participative approach.
- Implementation Plan

Resettlement will be handled and achieved within the framework of the global management of the project and the sequential completion of sub projects. The implementation plan is based on the logical articulation of the process from start to finish, for which the ties linking the resettlement plan, the validation of sub project, the payment of compensations and the work designs require mastering. No sub project implying unintentional resettlement will be validated without a duly established and an ADB-approved compensation plan. No investment implying relocation will be carried out without prior compensation.

The implementation plan includes three development phases: accomplishing resettlement, monitoring activities and observing the stages described in the implementation timetable.

Retrospective Monitoring and Assessment from the Bank

Tableau 3 Preparation, Execution and Monitoring of the Resettlement Plan

Activity	Type	Period	In charge of the activity	In charge of follow-up	Tools or Product
1. Establishing the necessity for resettlement and compensation plans	Punctual	Project groundwork	Specialist (promoter or provider)	Technical Services, promoter, and qualified provider	Terms of reference and Resettlement Plan and Compensation schedules
2. Accordingly: identifying resettlement sites, development works and required legal provisions			Promoter + provider		Report including lists of beneficiaries, assets and payable compensation; resettlement plan and compensation; responsibilities and costs including mitigation measures and accompanying projects
3. Socio-economic study					
4. Establishing eligibility criteria, compensation methods and measures and compensation scales.					
5. Inventory of persons and assets. Deadline.			Provider + local authorities		
6. Developing a template of impacts, compensation measures and accompanying projects.			Promoter + provider		
7. Implementing follow up mechanisms					
8. Implementing a dispute resolution system, registering complaints, arbitrage procedures			Promoter + Competent services + providers		Existing institutionalised mechanisms, and budget
9. Consultation and information Program directed to the persons affected	Continuous	Project groundwork and throughout the entire operations		Follow up committee – dispute and complaint resolution	Minutes of meetings
10. Developing resettlement sites	Punctual	Before starting resettlement	Competent department + providers		Activity report

Activity	Type	Period	In charge of the activity	In charge of follow-up	Tools or Product
11. On-the-spot compensation		Before starting works			Receipts
12. Resettlement					Activity report
13. Drafting the schedule of implementation activities	Continuous	Throughout the project	Providers, services, enterprises, services involved	Providers, services, enterprises, services involved	Follow up files
14. Monitoring operations	Continuous	Throughout the project	Promoter	Technical services	Follow up files
15. Ex post assessment	Punctual	At the end of operations and after a determined stage	Providers		Reports

- Budget and Financing
  - Indications

Items	Cost (USD)	Remarks	Schedule	Source of funds	Origin of withdrawals
Operational Services					
Wages	100 000	Supervisory staff from the project personnel and support staff.	1/97 – 11/99	Promoter	Promoter
Administration/ Offices	40 000	Materials, supplies and communications.	1/97 – 11/99	Promoter	Promoter
Transport	70 000	Including vehicles, petroleum products, lubricants and maintenance	1/97 – 11/99	Promoter	Promoter
Consultant Services	90 000	Preparation of the Action Plan for Resettlement (APR) — cartography, census and surveys, consultations, community development plans, follow up and logistic assessment, etc.	3/97 – 12/97		Promoter
Miscellaneous Promoter	20 000	Travel allowances, public meetings, etc.	1/97 – 11/99	Promoter	
Compensation					
Compensation to land owners in payment of their farm land	590 000	Based on the average price of land per hectare as determined in the market study, multiplied by the number of hectares considered for purchase from the overall households involved.	5/98	Promoter	Government – Expropriation Offices (BDE)
Compensation to owners and lessees in payment of loss of crops	32 200	Based on the average monthly turnover value of crops for each type of land, multiplied by 8 months (time span between the most recent harvest and the beginning of the employment opportunities associated to the project), for all land owned by the overall households affected.	3/98	Promoter	Promoter
Compensation in payment of housing and structures	32 000	Based on the estimated replacement value per square meter, multiplied by the total surface of lodgings and structures, multiplied by the total number of households affected.	5/98	Promoter	BDE
Compensation in payment of housing plots	39 900	Based on the average price of land per hectare, multiplied by 2 ha, and multiplied by the total number of households	5/98	Promoter	BDE

		affected.			
Compensation in payment of trees	17 000	Based on the inventory of trees for each household affected and the market value for each variety.	5/98	Promoter	BDE
Compensation in payment of businesses	24 000	Based on a lump estimate of loss of income experienced during relocation of the business on the new site, determined by the resettlement committee.	5/98	Promoter	Promoter
Compensation in payment of resettlement and inconveniences experienced	3 000	A USD 200 allowance per family or business (e.g. 15 % of the average value of the family/ business).	5/98	Promoter	Promoter
	Land Acquisition and Development of the Resettlement Site				
Land acquisition	80 000	200 ha of land with comparable production potential @SD 400/ha.	9/97	BDE	BDE
Site development	5 790	Land surveying, land occupancy study, master plan, delimitation and registering of plots in consultation with the resettlement committee.	10/97	Promoter	Engineering services company
Infrastructure	34 000	Drainage works, water points, pavements, community centre, public lighting, in consultation with the resettlement committee.	1 – 4/98	Promoter	Construction company

Monitoring and Assessment					
APR follow up	15 000	Quarterly follow up over 6 quarters @ USD 2 500/qtr.	6, 9, 12/98 3, 6, 9/99	Promoter	Local consulting NGO
APR Assessment	4 000	Assessment during the last quarter.	10 – 11/99	Promoter	Service Provider
Community Development					
Agricultural popularisation services	40 000	Agricultural inputs, training, post-production services and commercialisation.	6/98 – 12/99	Promoter	Service Consultant - Provider
Training for small enterprises	25 000	Small production-manufacturing businesses and services.		Promoter	Local NGO
Renewable Credit.	50 000	Business development		Promoter	Local NGO
Total		Overall items			
Total partial	1021890				
Provision for unforeseen items	102 189	10 % of partial total			
Total	1 124 079				

Source: IFC - Manual for drafting Action plans for resettlement

3.2.13 Potential Socio-economic Impacts

3.2.13.1 Comments from the Socio-professional Groups

Meetings with various social and socio-professional classes were held in the context of this work to gather, by any means, their opinions concerning the project. These are listed as follows.

1) Political, administrative and technical officers

The achievement of interstate railway connections in West Africa constitutes for this category of players a very old dream entertained by African populations. It is therefore a salutary project in many aspects. Its achievement would allow, among many issues, preserving the current road systems. Indeed, still nowadays, because of the absence of a developed railway system, heavy-duty vehicles are obliged to truck to the main ports to collect goods. The traffic density of these types of vehicles causes the premature degradation of roads, encumbers cities and provokes many inconveniences and accidents.

2) Socio professional group of cattle traders and butchers

This group is in favor of the project. Its development would offer better conditions for transporting cattle and a reduction of transport costs compared to roadways, while avoiding harassment (state police, police force, customs officers) and hijackings.

3) Passenger Transporters' Unions (inter-city taxis)

At first, the members of this corporation believed that the building of the railway would without doubt increase competition mainly because of the low cost of this mode of transportation. However, after discussions, they finally acknowledged the fact that only one train would be running at a precise time. On the other hand, persons need to travel at all times of the day. They live with the opinion that their corporation already suffers factual competition with the arrival of busses and mini busses that charge lower fares compared to light 5 or 9-seat vehicles. They are unable to compete with busses due to the cost of fuel and the limited capacity of their vehicles.

While in general expressing their support regarding the construction of the railway, they hope that accompanying measures will be implemented to ease the transition.

4) "Heavy duty" transporters

At this level, the fear caused by the road/rail competition and the possible disappearance of this socio-professional category, is at the highest point. Some believe that the construction of the railway will mark the end of their economic activities. They further believe that trains will carry the entire volume of goods to the hinterlands and inland in their countries. On the other hand, some transporters feel that trains will not be capable of transporting everything and that the railway companies will subcontract the transportation of specific commodities to them. They were somewhat appeased by the example of developed countries where the density of the railway system has not overrun "heavy duty" transport. This fear is widespread among the socio professional class in all of the project locations.

They acknowledge the necessity to reorganize themselves as Economic Interest Groups by creating « road transport agencies » instead of pursuing the management of their small enterprises individually.

5) Traders of manufactured products

These traders highly support the construction of railways. They foresee numerous advantages and not the least. For instance, they believe the use of railway would certainly reduce the cost of transport of their goods compared to road transport. Moreover, they strongly insist on the points concerning the avoidance of road hassles (customs, state police, police, price control, etc.) and hijackings.

6) Traders in food crops

They express the same advantages as the other players, particularly with respect to the cost of transport and the concerns regarding road hassles and hijacking.

Concerning their turnover, they believe that the increased number of travelers due to the railway would certainly increase the sales volume of their products.

They would also enjoy the freedom of marketing their goods in urban centers, and, in return, deliver manufactured products to their localities, hence diversifying their range of products and increasing their income.

7) Agricultural producers

The impact arising from the development of railways on agricultural production will be evidenced by the fact that because of the ease with which agricultural products would

reach urban centers and other domestic localities, and even beyond the borders, consumer demand and consequently production will increase. Past slumps in sales of certain productions would then be long forgotten. But the contrary should also be feared. The railway offering more ease for trade exchange could facilitate flooding the markets and agricultural areas with imported products of vegetable and animal origins.

3.2.13.2 Socio-economic Impacts and Mitigation Measures

3.2.13.3 Classification of Socio-Economic Impacts

Component	Potential Positive and Negative Impacts	Bonus and Mitigation Measures
Economy	Increased economic activities and diversification of revenue sources. Increased opportunities to generate revenue for the local population due to the presence of non-resident workers and travelers. Increased local development and employment. Improved access to markets for sales and input acquisitions. Losses experienced by the populations affected (men and women) that are unable to pursue their normal activities (temporary loss in most cases). Variation of base prices due to changes in transport costs.	Support as much as possible local hiring of workers (men and women) and purchase of local products (food, basics). Minimize land expropriation and compensations by considering various project deviations. Implement appropriate compensation mechanisms that acknowledge the loss of revenue and assets. Provide sufficient space to set up new businesses. Ensure that poor persons and other vulnerable groups preserve or improve their capacity to satisfy their fundamental needs, particularly in case of price increases.
Natural and cultural patrimony	Loss of cultural, religious and historical assets and aesthetic resources. Discordance with the traditional authorities regarding resources and cultural, religious, historical and aesthetic sites.	Prior to construction, perform an archaeological inventory in the areas likely to contain valued items and protect discovered objects. Negotiate with the traditional authorities the safeguarding of sites and resources evidencing cultural, religious, historical and aesthetic importance and agree upon the potential compensations payable to the communities. While uprooting trees ensure archaeological monitoring in the areas likely to contain valued items and where discoveries are made, contact the pertinent authorities. Obtain the implication of the traditional authorities in the monitoring of sites and resources evidencing cultural, religious, historical and aesthetic importance during the construction activities.
Demographic tendencies	Population increase due to visitors, travelers and immigrants.	Work closely with the local communities for the purpose of facilitating integration and acceptance of the immigrants.

Component	Potential Positive and Negative Impacts	Bonus and Mitigation Measures
	Increase of ethnic diversity due to migration. Temporary unbalance between men and women due to male workers and immigrants, possibly causing an increase in sexually transmitted diseases.	Establish workers' campsites within a reasonable distance from the villages. Wherever possible, hire married women or men whose families live in the vicinity. Help non resident workers to encourage their family to move in with them.
Population migration and relocation	Decrease in the living standards of persons relocated involuntarily. Inappropriate living conditions of non resident workers and their family. Difficulties in adapting to the resettlement and changes in the level of productive activities. Demographic pressure due to the arrival of non resident workers and immigrants attracted by new economic opportunities. Chaotic development of human establishments (village, neighborhood, city).	Guarantee equivalent or improved housing and accessory conditions to women and men relocated involuntarily, in compliance with consultation results, prior to repossessing their land. Cleverly organize housing and basic utilities (water and sanitation) for non resident workers and their family. Temporarily ensure food supplies to persons relocated involuntarily, according to needs. Offer training and additional support to women and men in order to facilitate their adaptation during the transition period. In compliance with the priorities of relocated persons, cover resettlement costs and offer compensations for productive land to the women and men owning, occupying or farming land. Establish access mechanisms for the purpose of controlling anarchic development.
Natural resource and land management	Development of agricultural and pastoral land thanks to easier access. Disturbances or changes in the use of land, which can cause social conflicts. Loss of productive land to the road, railway or works. Loss of territory for the local populations. Reduction of the quantity and quality of natural resources due to demographic explosion. Variation of the price of land and property alongside roads.	Prior to works, identify productive areas in order to minimize losses of farming land. Avoid heavy machinery traffic on farming land. Implicate the traditional authorities in the concept of the project. Integrate territorial management priorities to the planning instruments in order to take into consideration the various land uses. Offer appropriate compensations for the loss of farm land to men and women owning, occupying or farming the land. Plan for land occupancy along the roadside and limit access in order to protect farming land and pastures.

Component	Potential Positive and Negative Impacts	Bonus and Mitigation Measures
Living conditions	Improvement of living conditions due to new business opportunities and appropriate compensation for losses incurred. Better access to goods and services. Deterioration of living conditions due to nuisances such as noise, dust vibrations and traffic. Degradation of the landscape due to land clearing, construction work, new infrastructures, etc. Disturbances caused by non motorized transport modes. Disturbances of living conditions compromising traditional cultural values. Social conflicts caused by the presence of non-resident workers and immigrants (divorces, ethnic tensions, etc.) Increase of wastes along the roadside.	Implement a formal mechanism for consultation with local authorities for the purpose of discussing issues disturbing the inhabitants and develop solutions that satisfy all participants. Train workers (men and women) in the area of environmental protection. Develop an appropriate communication plan in order to inform the local populations (men and women) of the works planned and opportunities offered to them. Support architectural concepts that allow the integration of new infrastructures in the landscape. Promote the installation of pathways for pedestrians, cyclists and animal-powered conveyances. Bypass human establishments, where the population agrees. Plan secured crossing points and mechanisms allowing reducing speed. Ensure the appropriate support from welfare services to facilitate the transition and avoid conflicts within families and among the various groups. Integrate the management of wastes into the project.
Transmissible diseases	Increased incidence of HIV and other sexually transmitted diseases associated with construction works, transit and economical changes. Increased vector-induced transmissible diseases (malaria, trypanosomiasis and schistosomiasis). Increased incidence of gastro-intestinal infections (diarrhea, cholera) associated with the presence of informal human establishments.	Implement HIV/AIDS prophylaxis for men and women by promoting health and largely distributing condoms and inciting their use, particularly in hotels and other frequented places, by offering employment opportunities to the women affected by the project and family lodging to construction workers. Ensure environmental management to control disease vectors, particularly near drainage works; fill up bank passages; apply insecticides and molluscicides in targeted areas. Ensure the adequate supply of drinking water and the use of sanitation installations, and equipments for storing food provisions in human establishments. Strengthen medical services in order to ensure rapid diagnostic and treatment. Refer to measures suggested in other cross topics dealing with multiple determining health factors in the case of transmissible diseases.
Activities	Occasions to increase revenue or diversify	Inform the men and women of employment opportunities; encourage the women

Component	Potential Positive and Negative Impacts	Bonus and Mitigation Measures
generating revenue (cash or in kind)	sources of revenue inferred by development. Weak local employment opportunities for women during the construction or exploitation phases. Development or increase of prostitution. Loss of revenue linked to disturbances in agricultural activities and exploitation of natural resources.	to apply, and select candidates according to competences. Guarantee that women have access to the same installations as men allowing benefiting from new business opportunities. Offer working alternatives to women in order to reduce prostitution. Set up campsites for workers at a reasonable distance from villages. Offer adequate compensations or alternative sources of revenue to the women affected by the project.
Consultations	Integration of women and men's concerns at project conception. Incremented support to the project among the affected populations. Exclusion of specific groups during consultations, in particular women.	Consult with the affected persons (men and women) throughout all the stages of the project. Offer opportunities to all affected groups to participate in the project development process by proposing adapted consultation mechanisms. Inform the persons consulted (men and women) on how their concerns have been considered.
Strengthen the civil society	Creation of user organizations. Extension of transporter organizations. Lack of cooperation among new and existing transporter organizations. Traditional authorities lose power.	Ensure that men and women enjoy the opportunity to organize groups representing their interests. Promote the integration of new organizations within those already existing or established means for cooperation. Promote the creation of road maintenance associations in order to prevent waste accumulation along roadsides (particularly in urban environments). Establish consultation mechanisms with traditional authorities in order to ensure that their opinions are taken into consideration during the planning and development phases.

- Positive Economic Impacts

1) The opening up of the areas involved in the project compared to other areas of the countries enjoying direct access to the sea and the hinterland countries. This will ease trade among the countries of the region

2) Increase in consumption demand. The facility of movement of persons and goods will increase the number of travelers. The volume and rate of consumption of the local and foreign populations will increase and accelerate consumption levels of food and non food items.

3) The increase in consumption should launch and accelerate economic growth in the area. The populations will acquire new consumption habits with respect to foods and non-food goods, materials and services.

4) Increase of agricultural and animal production. With the growth of consumption demand, notably for food, the agricultural producers and animal farmers will be concerned with increasing agricultural and animal production, inasmuch as it is likely that they will not experience any slump in product sales. Such increase will certainly generate the creation of small and medium food-processing industries, therefore certainly create permanent and periodic employment.

- Development of Female Oriented Economic Activities

5) Small -scale food-processing in the area is generally a woman's prerogative; women will surely be the first to recognize the necessity to modernize this sector, which would employ a greater number of local manpower and raw materials, all representing factors participating in the creation of employment and accelerators of agricultural and animal production.

6) Increased revenue for the populations. The various positive economic impacts recently identified will certainly contribute to improve the revenue of the economic agents employed in the various activities.

7) The economic growth generated by the railway construction will allow the townships to increase their tax income arising from newly-installed economic activities, such as collecting local development taxes and other miscellaneous taxes.

- Negative Economic Impacts
  - Although there are few negative impacts, some do exist.

1) The route of the railway in the project areas will privilege the development of food crops and their consumption in their present condition or after processing.

2) The increase in agricultural farming will develop into an extensive production system with consequences such as itinerant farming that destroys cultivable surfaces.

3) The high demand for food crops and animal production will trigger the economic phenomena of inflating the price of foodstuffs. One of the consequences will be the incapacity of a certain fringe of the population to access proper nourishment. Thus, a dietary pauperization could develop in the area among non-farming and even farming populations.

4) The facilitation of trade exchange because of rail transportation could develop the flooding of markets and faming environments of the area with imported products of vegetable and animal origins.

- Social Impacts
  - Positive Social Impacts

1) The railway will undoubtedly open up the area from a social standpoint. The populations will enjoy greater travel facilities and at cheaper fares to discover other regions of the country and abroad.

2) The construction of the railway will surely accelerate the electrification of the areas, the densification of fixed telephony due to the new services accompanying the implementation of railways (trains stations, broker services, etc.).

3) Creation of employment: Both qualified and unqualified employments will be created during and after the railway construction. Consequently, the various categories of workers hired in the localities where train stations shall be erected will express their need for housing.

- Negative Social Impacts

1) The facility with which people will move around due to the advantage of the railway could become a source of propagation of sexually transmissible diseases (MST), notably HIV/ AIDS.

2) Such facility could possibly incite the youth to leave the project area, in search of better paid non-farming employment in the urban centers. From a family standpoint, this phenomenon could constitute the potential risk of experiencing the social disintegration of the family unit, and consequently, the liquefaction of the social tissue within the area.

3) The mobility of persons from one region to another, or one country to another, may also become a source of insecurity in the host localities.

4) The eventual risk of youths dropping out of school, especially females. They may be prematurely attracted by the economic activities supported by the railway passing in their localities. The rate of school abandonment could become significant, especially in rural environments.

- Impacts on the Sub-regional Integration

This project is part of the overall regional interstate railway network project in the ECOWAS countries. At the level of each of the member states of this institution, a component of the project involves the construction of new railways and the other constituent aims at rehabilitating existing railways. Once the project is completed, the interconnection of domestic railways will offer a compact railroad network to the West African sub-region; this will be considered as the resultant of the economic integration policy of the sub region and of one of its objectives, mainly the free circulation of goods and persons.

- Socio-Cultural Impacts of the Project on the Intervention Area

The achievement of the project will respect cultural symbols and infrastructures as well as the customs of the communities that will be affected by the project.

3.2.13.4 Mitigation Measures for the Negative Impacts

The major problems resulting from the analysis of the potential negative social impacts may be summarized hereafter: the mass departure of the youth, the premature drop out from school, especially females, the propagation of sexually transmissible diseases, notably HIV/AIDS and the concern involving insecurity among the populations.

Regarding negative economic impacts, the major problems identified relate to the eventual unbalance between food crop farming and income-based production, the acceleration and development of an extensive production system, the likely inflation of the prices of agricultural products that could constitute a source of dietary insufficiency.

The mitigation measures planned are summarized hereunder:

Table 3 Mitigation measures concerning the potential negative impacts of the project

Nature of the Impact	Major Potential Problems Identified	Planned Mitigation Measures
Negative Economic Impacts	Unbalance between food crop farming and income-based production	Intensification in the project area of the policy supporting the diversification of productions by the Ministry of Agriculture, in consultation with the professional agricultural organizations and the municipality.
	Acceleration and development of an extensive agricultural production system	Acceleration of the implementation by the Ministry of Agriculture of its programs for light mechanization farming and small-scale irrigation in order to modernize farming activities by an intensive exploitation system.
	Eventual Inflation of prices for agricultural products, source of dietary insufficiency	The departments in charge of nutritional education must intensify their programs in the project area and stress healthy diets among the populations. Fighting inflation is difficult, especially in a country like Benin where prices are uncontrolled. Overabundance of production may help to regulate inflation.
Negative Economic Impacts	Premature drop outs from School	The government's policy regarding free tuition in primary schools deserves increased support in order to alleviate educational costs borne by the parents.
	Propagation of sexually transmitted diseases, notably HIS/AIDS	The Ministry in charge of Health must pursue its sensitization actions regarding preventive means associated to sexually transmitted diseases and other types of common diseases in the area
	Insecurity among the populations	Each member country within ECOWAS should strive to apply the salutary policy aiming for free

Nature of the Impact	Major Potential Problems Identified	Planned Mitigation Measures
		circulation of goods and persons at a reduced cost. The Ministry of the Interior and Security must tend to implementing all necessary actions guaranteeing the security of residents and non residents. Cooperation between the security forces and the populations is absolutely necessary.

3.2.13.5 Conclusions and Recommendations

Based on this socio economic review, it should be retained that the railway interconnection project will cause significant positive impacts on the various socio-economic populations of the region, even though a certain portion of the population still underestimate the positive impacts it could bring to their activities. At first glance, it provides a solution to supply issues in terms of cost and delays. It will impact the entire supply chain as well as labor, the communities and consumers. The eventual reduction in transportation costs will lead to the increase in exports of food crops and natural resources.

The development of new railroad liaisons is part of the interstate connection policy of railroad networks within the ECOWAS countries.

This highly appreciated project of the political and administrative authorities of the ECOWAS countries constitutes a powerful instrument for the economic and social development of the region.

The various social and socio-professional players of the areas involved fully share the same opinion as the political and administrative officers. They believe that the construction of the railway will significantly stimulate economic activities from a societal standpoint. Nevertheless, they express some concerns regarding the future of certain corporations involved in passenger and commodity transportation in the areas that are overwrought with rail/road competition.

The various analyses stemming from this study reveal the importance of including in the project documentation an Information, Education and Communication (IEC) program that will serve as a base for informing, training and educating the populations on the various aspects of the eventual identified impacts of the project in order to prepare them to manage as best as possible the ultimate advantages and risks. With this notion in mind, all of the players must actively participate in the implementation of the project so as to obtain social mobilization and create awareness among the populations.

It is pointed out that at the current stage of the project, the socio-economic analysis has allowed updating data and has contributed to strategic and economic choices within the multi-criteria analysis. This analysis must be furthered in the framework of the detailed

impact assessments, which must be performed for the rail links that will be retained, and in compliance with the current domestic and international standards on the matter.

3.3 Volume 3: Analysis of the Institutional Aspects

3.3.1 Institutional Component Overview

The institutional component of the study for the interconnection of railway networks in the member states of the ECOWAS looked at numerous facets of the railways in the ECOWAS while paying special attention to the state of the current organization of the railway administration for each country, their institutional framework, existing regulations and their level of preparation in view of the future interconnection of the network, with an aim to propose institutional reforms for a unified network. The collection of the data required to analyze the current state of the railways and the methodology adopted to study this industry within the backdrop of an interconnection are described in parts 1 and 2 of the final report. The data was collected using a questionnaire prepared by the members of the institutional team. Next, the data protocol was administered by the team lead in charge of the institutional component and the local teams. Additional data and pertinent documents were provided by the countries, national organizations and railway companies. The analysis of the data enabled us to: a) make an inventory of the proposed structures (part 3 of the final report), b) diagnose the current situation (part 4 of the final report) and c) make recommendations (part 5 of the final report. Part 6 of the final report concludes with a summary of the situation while highlighting the key elements to be considered when adopting an appropriate institutional framework for an interconnected network, particularly the framework based on public-private partnership (PPP) contracts.

3.3.2 Inventory of Organizations Operating Existing Networks – Analysis of Institutional Frameworks and Capacity Building of ECOWAS Countries

In part 3 of the final report, we have put together an inventory of the organizations in the ten countries to be interconnected and described, for each, the institutional framework and the how the railway companies operate. For each country, we have described the skills acquired on which we must rely and the skills that need to be strengthened and this, on an institutional level (of the system), for the entities (railway companies) and the human resources. Moreover, within the scope of the revitalization of the railway industry, the skills required are defined in order to make suggestions as far as the actions and steps to take are concerned and to set up strong institutions that could contribute to developing the interconnected network and the economic growth of the area.

Generally, the organizations in each country will have to put in a lot of effort to ensure capacity building to promote the railway interconnection, mainly because of the current lack of interconnection (except for the links between Senegal and Mali and between Ivory Coast and Burkina Faso) and the overall low level of railway activities in the sub-region.

The construction of each of the segments proposed in the study lead to the creation of numerous jobs whether it be for construction, production of material and equipment or within the framework of the operation of the railway companies. The need for human resources with a wide range of skills will thus increase dramatically in the medium and long term in the area.

Today, the human resources and institutional capacities are not sufficient to meet the needs of such a railway interconnection project. A spotlight will be placed on training the young and specific training dealing with the railway industry, particularly as most of the training centers in the railway field have disappeared or are operated at reduced speed.

Today's youngsters will become the resources which will be able to, in the long term, meet the needs generated and their ability to intervene in these projects are linked to the availability of training on occupations related to railway techniques, which can be coupled with the professional training already in place or the creation of a school dedicated to railway occupations by the ECOWAS to meet the needs in terms of specialized labor in each of the countries that have a railway.

The implementation of the interconnections will make it possible to open up the landlocked countries such as Mali, Burkina Faso, and Niger. The ports used today by these countries are the ports of Dakar, Conakry, Abidjan, Tema, Lomé and Cotonou, and most of the transportation of merchandise is done by truck, a costly proposition, with major risks of road accidents and harmful to the environment. The new interconnections and the strengthening of the existing interconnections will make it possible to make substantial savings which will make the landlocked countries more competitive and ensure the growth of their economy.

The institutional frameworks that each ECOWAS country can use to make its network more efficient are:

1. The **public model** was the management norm until the nineties (and it remains so in many countries). According to this model, ownership, operation and all risks are the responsibility of the state.
2. The **technical support model** is similar to the public model as it does not transfer any risk to the intervening party. Normally, the intervening party, a private business, only offers a technical support to the operator (the state owned railway business)
3. The **fixed fee management model** is interesting as based on the methods of the model; the private operator who manages a railway business receives a guarantee of a fixed fee without being subject to any constraints in terms of its performance.
4. The **self-serving management model** consists of transferring to a private operator the management of the railway business and the latter receives an annual fee which varies based on his performance. However, none of the operating risks are transferred to the private operator.
5. The **operating convention model** with guarantees of revenue consist of transferring to a private operator the management of the railway business while transferring all the operation risks on the costs. However, based on the terms of the contract, there is the guarantee of an annual remuneration.

6. The **leasing model** consists of transferring to a private operator the management of the railway business as well as the operating risks on the cost and products. However, the investment risk and the financing risk remain under the responsibility of the state.
7. The **concession model** consists of transferring to a private operator the management of the railway business as well as all the risks.
8. The **private model** consists of transferring the ownership and management an operator who would be a private owner as well as to transfer all the risks.

- Diagnosis of the needs in terms of institutional reforms and required skills

An interconnected railway system requires a number of institutional reforms from a human technical, economic, financial and management perspective. The side benefits generated from the interconnection are maximized when the institutions play the role of a facilitator between the players, by offering the possibility for people and merchandise to travel freely and by creating an added value for the interconnected countries. An interconnected railway system increases the commercial exchanges between the countries and reduced unemployment and has a positive impact on the development of the countries. To achieve all this, it is necessary to have harmonious policies as far as restructuring the national railways is concerned, as well as in terms of policies related to railway safety, flexibility of the labor, participation of the private sector in the railway service offer activities. To reduce the dependence of the ECOWAS countries on industrialized countries, it is necessary to further develop local skills and focus on capacity building from a legal and institutional standpoint as well as management, finance and engineering.

The trend towards globalization and market integration requires a solid infrastructure in terms of transport and the ECOWAS countries are able, through the interconnection of their railway transportation system, secure economies of scale, encourage the participation of the private sector (PPP), attract foreign investments as well as technologies to strengthen local skills. The current situation is far from being efficient in the ECOWAS region. There are wide disparities between the ECOWAS countries in terms of the structure of the railway sector, its operation, its efficiency and its economic and financial performance. Some interconnected networks (Burkina Faso-Ivory Coast-Senegal-Mali) have a more or less proper operation. On the other hand, the efforts of the other countries, namely Benin and Niger, have suffered humiliating defeats. This unbearable situation increases the cost of commerce between the ECOWAS countries by significantly reducing the mobility of the production elements and the investments. Accordingly, the international competitiveness of the region is significantly reduced. There is an urgent need to develop a tenable rail transportation infrastructure in order to be able to provide basic services to the population, that are safe, reliable, efficient and affordable, particularly for the less fortunate people. This interconnected network must meet the environmental norms and offer the landlocked countries the possibility to compete with other countries on a regional and international level.

The public model is no longer bearable for many ECOWAS countries, namely Ghana, Nigeria, Benin, and Niger. These countries must restructure their sector as soon as possible and adopt a model which corresponds to their situation. Given the progress made and the prospects of Ghana, the concession model is the most appropriate. On the other hand, for

Benin-Niger, the concession model does not seem to be the ideal model. Given the state of the situation and the lackluster progress made over the years from an institutional standpoint, a public-private partnership that would transfer numerous risks to the private sector is not conceivable. The operating convention model with a revenue guarantee is therefore more realistic.

The PPP enable the state to free itself from some or all of the responsibilities related to the financial, investment, management and operating risks. The PPP are built depending on the degree of waiver exercised by the state and the level of risk acceptance of the operator. At the extremes we find the public model and the private model and, between these two extremes are the structures with variable risks. Some models can be contemplated depending on the nature of the interconnection. For example, the technical support model is interesting when the operation of the segment is essential for the proper operation of the entire interconnected system but not profitable enough to contemplate another form of PPP. The state holds full responsibility and risk but, it allows the private business to offer technical support. This is a model that aims to reduce the subsidy from the state which is typically awarded for the survival of the segment and the viability of the entire interconnected network.

In order to complete the interconnection, the governments must focus on policies and regulations related to rail transport and reduce their direct intervention in the management of the services infrastructures. Moreover, they must put together regulatory policies which provide access to the infrastructures and other rail transport services. The governments must also create institutions that allow for the monitoring of the liberalized markets. The will to cooperate when it comes to rail transport is evident throughout the ECOWAS communities but, the region lacks the skills and resources to make this a reality. Therefore, it is important to develop a proper institutional and regulatory framework which inspires confidence and brings lenders to invest in and develop this sector. The PPPs are interesting institutional structures and if they are designed and use appropriately, they can contribute to reducing (and in some cases solve) the railway infrastructure and operating issues in the ECOWAS. It is true that the PPPs did not work out in a satisfactory manner but it is important to mention that the boundary between the successful and failed PPPs is the institutional framework which regulates these structures. The theoretical literature and all practical experiences confirm that the success of the PPPs is in the design of a solid, clear, reasonable and efficient institutional framework. Therefore, the ECOWAS countries must:

- Prove the potential importance of the PPPs and their benefits for the private businesses and their communities.
- Prove that they agree to have the PPPs become the instrument through which the development of the railways in their region will be promoted.
- Initiate discussions with donors and other lenders in order to promote the PPP model and obtain firm commitments for the implementation of these structures
- Develop, with the railway associations, a database which will be used by the PPPs thereby contributing to their proper operation.
- Develop monitoring and regulatory organizations that will be mandated to review, annually, the results of the PPPs and assess their contribution to the integration and

development of the countries.

- Request technical and financial support from the technical and financial partners in order to promote the proper operation of the PPPs.
- Hold training workshops on PPPs in order to strengthen human skills in the region.

The capacity building skills required are:

- A technical expertise of the maintenance methods of both the infrastructures and the rolling stock.
- An adequate management of the purchases of spare parts as well as the inventory management and provisioning processes.
- A management of the operations and the logistics to optimize the traffic of the rolling stock.
- A commercial management centered on the market needs and in synergy with the technical departments, supported by goods follow-up tools and costs calculation.
- An expertise in management in a general way to apply modern management methods.
- The availability and expertise of the trainers in various fields of expertise to meet the training and adaptation needs of an increasing basin of resources and in the context of the implementation of new interconnections.
- Skills in the management of information technologies. The exchange of information both from a point of view of management systems, operational data, marketing, and dashboards and strategic information represent a huge importance on the performances of the sector and the efficiency of the links between all the actors.
- Legal skills to support the recasting of the texts governing transportation in each country, and for the establishment of the operational rules of each interconnection.
- Finally, to ensure a good regional coordination, the international institutions, the participating states and the involved international organizations must have the skills and strategic knowledge related to the railway sector.

3.3.3 Recommendations

A large number of strategies and recommendations are presented in part 5 of the final report. Each recommendation aims to provide a clear indication to the affected countries in order to help them identify their strengths and weaknesses in terms of capacity building. These same recommendations are useful when developing a transportation and institutional framework implementation policy. The recommendations, presented in the form of strategies, are:

3.3.3.1 Strategy 1 - Support and Training

The goal of this strategy is to bring an additional support and training for the reinforcement of the institutional capacities.

The objectives of the institutional capacities reinforcement are identical for all the countries, but each one has a different advancement degree for each objective. We describe below the principal objectives and the countries where we will need to emphasis:

Objectives	Significant Progress already accomplished. Improve the capacities	Capacities to be developed, and to be reinforced
To provide the railway company with more management autonomy	Senegal, Mali, Ivory Coast, Burkina Faso, Ghana, Togo	Guinea, Niger, Benin, Nigeria
To distinguish the public service obligations from commercial activities	Senegal, Mali, Ivory Coast, Burkina Faso, Ghana, Togo	Guinea, Niger, Benin, Nigeria
Cleansing of the organizational structure	Senegal, Mali, Ivory Coast, Burkina Faso, Ghana	Guinea, Niger, Benin, Nigeria, Togo
Adoption of the new policies based on private management and the consideration of the customers' needs	Senegal, Mali, Ivory Coast, Burkina Faso, Ghana	Guinea, Niger, Benin, Nigeria, Togo

The revitalization of the railway sector will go through an institutional reform, and the implementation of regulatory agencies at the national or regional level. The new texts and regulations, the studies, the negotiations and exchanges between partners require skills and competencies in the legal, economic and administrative fields.

Among the actions to undertake to follow this strategy, we recommend elaborating an exchange and training program of the institutions of each country to accompany them in the realization stages of the interconnections. This program will want to be a joint institutions action, including, in particular, the African Union of Railway (UAC) whose mission is, among others, the coordination of railway activities and the implementation of an interconnected African network, the United Nations Economic Commission for Africa (UNECA), the Economic Community of West African States (ECOWAS), and international institutions. This program should take into account of the priorities that will be given to the various interconnections.

Strategy 2 – Improve Organizational and Technical Competencies

The goal this strategy is to help improve the organizational and technical competencies of the railway companies.

This strategy is centered mainly on the rehabilitation or the reinforcement of the training centers and educational establishments.

A French-speaking training center has been in operation since 1987 in Brazzaville: the *École Supérieure Africaine des Cadres de Chemin de Fer et de Gestion des Transports (ESACC-GT)*. After the June 5, 1997 events in the Republic of Congo, the center was the subject of many damages and plundering.

Another training center in West Africa is the Nigerian Railway Institute for Transport Technology (NITT), located in Zaria, Nigeria; it was created by the Federal government of

Nigeria. It is an Anglophone training center, its activities are financed by the Federal government, and the services are provided to public and private companies.

We recommend that the capacity of these centers be reinforced to make the trainings and the specialized improvements to the members of railway companies in West Africa more accessible.

We further recommend that the railway companies of each country develop partnerships with technical and management educational establishments to promote the railway industry. These partnerships might be, for example, in the forms of contribution to research, training courses.

Strategy 3 – Implement Mitigation Measures

The goal of this strategy is to set up inciting measures in the development of the capacities of the local private sector.

This strategy aims, on the one hand, at stimulating the use of the local private sector for the realization of works or the supply of goods and services, which today are systematically entrusted to foreign companies, and on the other hand, to entrust to the private sector secondary activities and services to the first mission of railways, and that are held today by railway companies.

To achieve these goals, we recommend that the institutions responsible for the economic development of each country, in liaison with the railway companies, develop transfer activities programs to the private sector. Inciting measure, which will be put in place, will be able to take the form of financing, transfer of equipment, technical support.

Strategy 4 – Share Training Experience and Protect Acquired Skills

The goal of this strategy is to share training experiences, and to protect the assets. The human resources specialized in Railway of each country, in particular the senior civil servants, the managers, the directors of Railway Company, the technical directors, the specialists…, have an expertise and vital experience from their realization and their participation in the networks development, and the advance of the interconnected networks projects. This strategy aims to preserve and to share these assets.

The UAR regularly organizes experience sharing meetings for the members of the railway industry. These meetings were in the form of symposium from 1978 to 1992, and later, in the form of annual roundtables. We believe that these meetings are beneficial and constructive. But, the sharing of the experience must also be done by the means of documentation.

We recommend setting up a department that will centralize information on the studies, the management systems data, the laws and regulations, the technical data, the references to the regional resources (repertories of experts, suppliers, etc.) and all relevant, regional or

specific information to each country. The accesses to these sources of information should be facilitated to the leaders of the industry.

Strategy 5 – Define Strategic Orientations

The goal of this strategy is to bring a support to lay down the strategic orientations.

The passage of the management of a public company to the management of a commercial company does not only require a recasting of the regulations, the formulation of the strategic orientations will allow the company to better direct its resources for the achievement of its objectives. Either it is by an institutional support to governments and/or a technical support to railway companies, we recommend calling upon the experts in strategic orientation to establish or validate the strategic plans of organizations.

Strategy 6 – Bring New Material and Financial Resources

The goal of this strategy is to bring new material and financial resources.

In the context of studied interconnections, it is obvious that, given the state of rail networks and the equipments, it will more necessary to bring important material and financial resources for the revitalization of the sector.

3.3.4 Conclusions

All the ECOWAS countries currently face two dilemmas: on the one hand they must rehabilitate their railway network and on the other, they must build new segments. The additional investments would make the interconnection easier and contribute to increasing the traffic on and efficiency of the network. However, the completion of these projects requires important investments which to date are beyond the reach of the affected countries. It is therefore important for these countries to find alternative means of financing and managing their interconnected networks.

There are a host of alternative methods from which the ECOWAS countries could choose, namely, the models that use the resources and expertise of the private sector for the management and administration of the network. The options are found at both ends of the spectrum from privatization and nationalization or railway corporations by way of outsourcing some specific operations, public-private partnerships (PPPs), partial privatization and the creation of not-for-profit integrated management businesses. However, it is important to mention that this model does not necessarily guarantee the success of the network. Regardless of the model chosen, it is the institutional and regulatory framework that will determine, on a large scale, the results of the reforms. Simply modifying a law is not sufficient to change the traditional way in which the network is operated. Each member of the ECOWAS must adopt a clear transportation policy that takes into account all the modes of transportation (not only rail transport) and sets clear objectives in a realistic time frame. Also, it is important to mention that no matter which model is chosen, the role of the state does not end with the adoption of a transportation policy but, the state has the

obligation to continue monitoring the sector and promoting its integration and its growth. The monitoring and follow-up organizations created by the state must be plan an active role in the operation of the new transportation entities and help them grow while ensuring a balance between its own interests and those of the public.

3.3.4.1 Key Strategic Elements

In an interconnected system, efficiency must be the main goal of the institutional framework and the transportation policy.

A change in the transportation system is not acceptable if the existing structure is replaced with a structure that is equally or even less efficient than the existing structure. The criterion on which to base the selection of a model must then be an increase in efficiency. Efficiency is defined as the maximum social benefits generated when taking into account all the costs and benefits during the entire life span of the railway network. For some ECOWAS countries (Guinea, Benin, Mali) the PPP model with a great contribution from the state is only profitable if the governments of these countries abandon the processes of allocating investment funds in the railway network that have short term goals. Given the current state of their railway network, these countries must be responsible for a large part of the investments in order to attract private partners. Private funding would bring the necessary funds to implement the required infrastructure but it would not generate new sources of funding for the government. Consequently, no matter what model is chosen, there will always be repercussions on the budgets and government deficits but this would not alter the structure of the PPPs or their efficiency.

PPPs can offer possibilities to secure savings in terms of costs related to the management of the interconnected railway system.

The most attractive feature of the PPPs is that they offer the possibility to secure important savings where railway management is concerned. These savings can be use both downstream (operations and maintenance) and upstream (network organization and management services). Time and time again, efficiency is belittled in favor of quality. The institutional framework must anticipate such behavior from the operator and must provide guidelines and establish standards for quality, security and environment soundness. The regulatory bodies must anticipate a penalty scheme for offenders and a reward system for a performance that surpasses the norms. Anticipating a certain amount of competition, particularly in the invitation to tender process, encourage businesses to lower their costs. If the ECOWAS countries want to benefit from the advantages of such structures, they must then design the most appropriate institutional framework. The concessions of Burkina Faso-Ivory Coast and Senegal-Mali can serve as examples for other ECOWAS countries.

Appropriate Institutional Framework for Successful PPPs

The risks inherent to the PPPs make them less attractive for private operators if there are no guarantees for compensation which make up for the risk. The ECOWAS countries have a high

risk (political instability, ethnic conflicts, civil wars, natural disasters, etc.) and an interconnected rail transportation system is not necessarily safe from these risks (the Ivory Coast is a prime example). The operators must take the risks over which they have control and the risks must be divided based on each project and it can vary from country to country. For example, the request for rail transportation can vary for reasons over which the operator has no control. If these risks are assigned to the operator in an unrealistic manner, it is quite likely that the operator may not be able to honor its contractual obligations. Likewise, the operator will not be responsible for investments related costs if it anticipates a change on the government's policy. Such being the case, the institutional and regulatory framework must be clear, solid and must engender confidence from the investors. The risks and how they will be divided must be specified beforehand and must be self explanatory.

PPPs and the State's Role

The PPPs are quite complex railway network organization structures and they require sophisticated negotiations before and after the projects. There is a need for capacity building in this field in all the ECOWAS countries in order to make the negotiations between the private operators and governments clear and to ensure that the stakeholders are not surprised by the final results. Acquiring this expertise is a rather long process and the regulatory, legal and institutional frameworks are essential to guide the use and application of the PPPs. The PPPs must be guided by principles of good governance and efficiency. However, there is very little information on this type of institution and the ECOWAS countries must look for the advantages and disadvantages in order to define the institutional frameworks that regulate these institutions. The independence enjoyed by the political systems in the decision making process varies depending on the model chosen. However, in spite of the use of private management structures, the PPPs and other institutional types depend on the state and the users to make their operations profitable. The issues related to the fixing of a price scale for services must also be part of the debate. The fixing of a price scale based on the marginal cost, despite its efficiency, does not provide adequate revenues to make the operations profitable. Other rate structures (and even subsidies) must be anticipated in order to attract private capital. That said, depending on the institutional framework chosen by each ECOWAS country, the intervention of the state in the development of the railway network and the interconnection remains essential.

3.3.5 Institutional Plan in the Framework of Interconnection B2 and B1 – Recommendations for the lines B2 and B1

At the present time, applying a unified institutional model for all the ECOWAS countries is not conceivable. There are numerous reasons for this, on the one hand the level of development of the railway network is totally different from one country to another and on the other, and it is obvious that the complete integration of the network will not take place immediately.

However, in accordance with our analysis schema which proposes a ranking based on the current state of the network, we propose an institutional analysis per scenario. Accordingly,

our institutional analysis will not focus on the development of a single strategy and unified institutional plan for all the ECOWAS countries but rather on the development sequences of a unified network.

Thus, based on the results of the feasibility study for the interconnection of railway networks in the ECOWAS, of which the current analysis is a component, lines B2 and B1 were chosen by the ECOWAS and the WAEMU as having priority and their completion seems more convincing than the rest of the interconnections, at least for the time being. In what follows we propose an institutional analysis in this hypothesis.

Institutional plan for the priority interconnection B2 - Kaya (Burkina Faso)– Dori (Burkina Faso)- Niamey (Niger)**:**

The extension of the priority interconnection B2 will link the existing network, operated by SITARAIL (between Burkina Faso and the Ivory Coast) to Niger's future network. By the same token, it will enable the economic development of the region by reducing transportation costs, increasing exports towards foreign markets and increasing the regional market. The completion of this interconnection will open up Niger and give SITARAIL the possibility to expand its operation in a country completely without railway services on its territory but which operates the Cotonou-Parakou line along with Benin. This new scheme will introduce competition among the various modes of transportation in use in the area. Thus, the transportation costs could further be reduced given the new intermodal competition, a situation which is more beneficial to railway transportation.

As for the institutional framework, this interconnection creates a special case. Since 1994, a concession convention was signed by the states of Ivory Coast and Burkina Faso and SITARAIL which concedes the operation of the railway transportation between the two states to SITARAIL.

With regard to this concession, each state created a heritage society to manage the railway infrastructures and railroad equipment. In the Ivory Coast, the SIPF was created in 1995. That same year the SOPAFER-B was created in Burkina Faso.

Niger's situation is completely different, in fact, based on the Benin-Niger pact dated 1959, which led to the creation of the *Orgnaisation commune Dahomey-Niger* which, in 1975, became the *Organisation Commune Bénin-Niger des Chemins de Fer et des Transports* (OCBN), a multimodal business which has two transportation systems in place: the Cotonou-Parakou railway (438 km) and the Parakou ground transportation towards countries of the hinterland such as Mali, Burkina Faso and Chad but mostly Niger.

Based on what was previously said, we can see that the completion of the Kaya-Dori segment for example, will give way to a new situation which will require that the affected countries harmonize their institutional framework. For example, it seems desirable that new conventions be concluded between the three countries to enable a greater harmonization of the railway transportation policies to cover operating mode, customs procedures, adoption of

common technical standards and legal instruments to regulate freight traffic and eventually passenger traffic. Such agreements typically rely on a preliminary negotiation of separate protocols covering the different aspects of transportation which range from customs procedures to traffic requirements for the trains.

Even if it was possible to contemplate, from a theoretical point of view, numerous network operators, the fact remains that the reduced size of the market and the economies of scale and economies of scope remain important constraints for such a choice.

Under these conditions, it is clear that it is preferable to limit the number of operators to only a few who, while retaining the monopoly, could render the operations cost effective faster than if they were in a competitive environment. Although the intermodal competitiveness could prove to be efficient and could reduce the efforts of the monopoly to abusively set the prices, still it remains that the creation of a regulatory agency is highly recommended. Its purpose would be to exercise a certain control on the business and to influence the behavior of those holding the monopoly in the right direction to reach the goals in terms of reforms. Experience shows that the monopolies do not necessarily behave according to the competition rules. Thus, there is no guarantee that the existing companies will abide by the competition rules if there is no regulatory agency and/or monitoring. Therefore, the presence of bodies that would see that the competition rules and existing regulation are applied is critical. In that case, the creation of a regulatory body becomes important as its goal would be to prepare a regulatory plan that would impose the rules in terms of the business' behavior. Moreover, each interconnected country must have its own anti-monopoly or competition law as well as a competition bureau.

All in all, the extension of the B2 - Kaya (Burkina Faso)-Dori (Burkina Faso)-Niamey (Niger) priority interconnection will bring significant advantages to the interconnected countries. To support this new development of the railway networks of the Ivory Coast, Burkina Faso and Niger, the Consultant recommends:

Recommendation 1: It is recommended that the three affected countries implement a harmonized institutional framework which would facilitate the integration of the new link to the existing networks. Specifically, the implementation of a heritage society in Niger and the expansion of the SITARAIL concession to Niger's new railway network.

Recommendation 2: It is recommend that the three countries create a transportation regulatory body and pass a law on competition.

Institutional Plan for the Interconnection of line B1 - Bamako (Mali)-Ouangolodougou (Ivory Coast):

The situation is somewhat more complex for the B1 interconnection, particularly as the Senegal and Mali railway company, TRANSRAIL, could be in direct competition with the other integrated network, SITARAIL, of the Ivory Coast and Burkina Faso. Moreover, the serious financial hardships of TRANSRAIL (for the fiscal year 2006, it had losses totaling more than 8

billion CFA francs, that is 50% of its own funds) forced both states to reopen the concession and to accept *Vecturis*, the new Belgian technical operator in replacement of Canac. According to the commitment agreed to during the negotiations in Paris in December 2007, the states of Mali and Senegal agreed to sign, no later than December 31, 2007, the contractual documents and to accompany the concession holder in the take over of the heritage of the conceded railway network[1]. With this agreement, the concession holder will implement a programme:

- for investing in the infrastructures to improve traffic safety;
- to improve the availability of equipment;
- to organize a passenger transportation service;
- for investments which guarantee the capacity of the future railways in order to better meet transportation needs and contribute to the development of both countries.

In these circumstances, given the economic frailty of the transportation system in the area, the operation of an interconnected network can only be viable by having two or more operators at the same time, at least in the short and medium terms. The affected countries must prepare a legal and regulatory framework which would make it possible to restructure their railway network on a purely commercial base. This framework would provide the legal flexibility for both of these railway companies (and others in the long term) to find an ownership structure that would enable them to attain the level of profitability they seek in order to contribute to the development fo the countries in the area. In as far as this interconnection comes to light, issues related to the safety in passenger and freight transportation, to the right of passage, to the grant of a safety certificate to the operating companies, to the technical and interoperability requirements, to the suspension of licenses, to the technologies used, to signalization, to the speed limits, to the travel of crew members, etc. then become even more important the greater the number of countries involved. Therefore it is recommended that, during the transition phase, an ad hoc committee including representatives of the affected countries be created to monitor the following:

- progress in terms of legislation and the regulation that each country must put in place to support the new railway structures and the new organizational schemes (public-private partnerships or other types);
- the legislation and legal framework that would reduce waiting times at the border crossings and make passenger and freight traffic easier;
- policies on pricing (which are currently quite different from country to country) to improve transparency in practices;
- funding plan and investment programme for infrastructures; and
- implementation of regulatory bodies responsible for applying the new regulation among the interconnected countries.

In this light, in as much as the railway network of these five countries is truly interconnected, the creation of a regional regulatory body is acceptable. The creation of this body is deemed essential in the context of a true interconnection and its usefulness was recognized by all stakeholders during the various meetings organized as part of this study.

[1] http://www.rsbiko.com/L-augmentation-du-capital-de.html

During the transition period, the agency can coordinate all activities related to technical and regulatory issues for the interconnected system and then, once the interconnection is completed, the agency can assume full responsibility for monitoring the inter-state sector. The academic empirical studies and the World Bank have shown that the creation of regulatory institutions before the structural reforms is an indispensable condition for successful restructuring activities.

The completion of the priority interconnection B1 will boost the interconnection of the railway networks of the ECOWAS member countries and be the first step towards the true integration of five countries in the area. However, this new development will require that the five countries affected and the current operators (concession holders) adjust the current operating conditions. To do this, the Consultant has the following recommendations:

Recommendation 3: Given the economic frailty and reduced size of the market, it is recommended that this new network be operated by **only one operator**.

Recommendation 4: It is recommended that the regulatory framework and law on transportation in these countries be modified to enable the companies SITARAIL and TRANSRAIL to find a commercial agreement that would enable both of them to grow and contribute to the development of these countries.

Recommendation 5: It is recommended that the five countries create a regional regulatory agency that would be responsible for inter-state traffic. As the rest of the interconnections come to be, the other countries can join this regulatory body.

3.4 Volume 4 - Multicriteria Analysis

3.4.1 Methodological Approach

Prioritizing the interconnections of the ECOWAS Master Plan means to establish an order for completing the various projects, by comparing them to each other. In order to have a fair comparison, we must first identify the criteria which will make it possible to make a value judgment based on the merits of each project, based on the pre-established goal. As the ECOWAS objectives take into account both qualitative and quantitative factors, the challenge is to develop a credible method that makes it possible to make and aggregate the judgments. The multicriteria analysis was designed for this purpose. It calls upon the knowledge, experience and vision of a team of experts to model the case to the study, make judgments and establish a ranking.

The steps consist of:

- Defining, ranking and weighing the criteria.
- Judge each solution against each criteria.
- Aggregate these judgments to establish a priority order.

There are numerous multicriteria analysis methods. The difference is mainly in the way the last step is performed. The last step being the evaluation of the solutions based on the chosen criteria. The method most suited to the present case is the Analytic Hierarchy Process (AHP).

3.4.2 Presentation of the Results

- Modeling Elements

The first operation consists of identifying, defining and weighing the criteria. These criteria are strategic, economic, technical, institutional and environmental. They can be summarized as follows, in the order of importance as set by the experts:

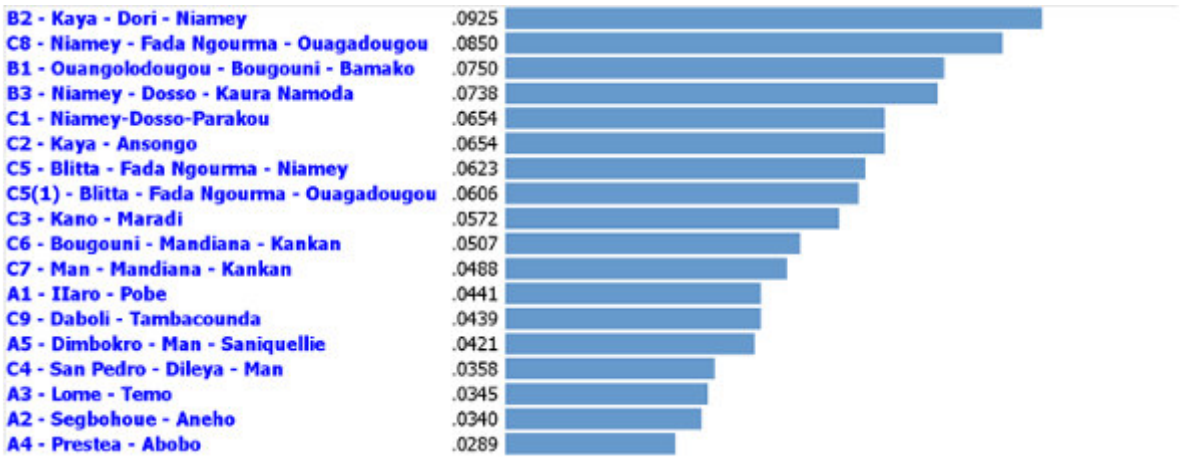
- The opening-up criterion relates to the ability of each project to improve access to the landlocked countries as well as the isolated areas. Weight: 9.39%.
- The economic viability criterion related to the capacity of each project to generate discounted earnings to benefit the collectivity in the zones of influence. Weight: 9.39 %.
- The formulation of a transportation policy relates to the ability to level the playing field between the various modes of transportation, making the border crossing formalities easier and the free travel of people and merchandise, unifying the railway networks and harmonizing the management, the restructuring of the national railways. Weight: 8.49 %
- The regional integration criterion relates to the ability of each railway interconnection to promote the physical integration of the sub-region. Weight: 8.32%.
- The networking criterion is the ability of each project to promote the linking of existing and future lines, as described in the ECOWAS Master Plan. Weight: 6.95%.
- The ambient air criterion relates to the impact of the projects on the emission of greenhouse gas that contribute to global warming. Weight : 6.00%
- The regulatory reform criterion in support of the projects under study, particularly in terms of railway safety, labor laws, flexibility in labor management, participation of the private sector in the completion of the works and in providing services. Weight: 5.73%.
- The financial return criterion relates to the ability of the projects to be self financing in whole or in part, in such a way as to determine the possibilities for financing using private capital and possibility using operational or administrative concessions. Weight: 5.25%.
- The promotion of potentials criterion relates to the ability of the projects to promote and support the operation of mining resources, the intensification of the agricultural production and the implementation of industries. Weight: 4.67%.
- The economic cooperation criterion relates to the ability of each project to promote exchanges between the affected countries. Weight: 4.51%.
- The interconnection routes criterion relates to the ability of the new railways to offer passenger and freight services which meet the current and future needs. Weight: 4.22%.
- The human environment criterion relates to the impact of the projects on the population, dwellings, heritage, gender and development issues, fight against poverty, education and health. Weight: 3.75%.
- The railway infrastructures criterion relates to the adequacy of the structures and facilities proposed to meet the transportation objectives in the zones of influence. Weight: 3.06 %.

- The population mobility criterion relates to the ability of the projects to ease the travels of passengers in the zones of influence, as a result of the implementation of new national and international links. Weight: 2.93%.
- The modal distribution criterion, expressed in terms of the projects' ability to contribute to the improvement of global competitiveness in the zones of influence, by reducing the transportation costs because of a modal distribution that is more efficient and better suited to market forces. Weight: 2.91%.
- The biological environment criterion relates to the impact of the projects on the fauna and flora. Weight: 2.37%.
- The administrative reform criterion in support of the projects under study, particularly in terms of capacity building in the management and local skill development fields. Weight: 2.33%.
- The permanent job creation criterion relates to the ability of the projects to generate new long term jobs in the zones of influence, directly attributable to the operation and maintenance of the network or indirectly related to complementary activities as a result of these activities. Weight: 2.29%.
- The railway rehabilitation criterion relates to the adequacy of the upgrade of the current assets and the development of new lines to provide the anticipated services. Weight: 2.15%.
- The physical environment criterion is the impact of the projects on the water and soil resources. Weight: 1.85%.
- The temporary job creation criterion relates to the ability of the projects to generate sort-term work in the zones of influence, directly attributable to the construction of the infrastructure or indirectly related to the complementary activities as a result of these operations. Weight: 1.72%.
- The rolling stock criterion relates to the compatibility of the locomotives, cars and wagons. Weight: 1.53%.

All in all, the decision makers estimate that in terms of the goals set by the ECOWAS, the strategic (29%) and economic (29%) criteria are of equal importance. Next are the institutional criteria: institutional (17%), environmental (14%) and technical (11%). It is clear that the emphasis is on the fundamental missions of the ECOWAS, namely in terms of economic development, regional integration and intra-community exchanges.

3.4.3 Classification of the 17 Proposed Lines

The next step consists of determining how each interconnection project meets the requirements of the criteria. To make these judgments, the experts used data from various components of the study and fact sheets related to the criteria. The aggregation of the judgments leads to the following classification, on a normalized scale of 1 to 1.



3.4.4 Multicriteria Analysis Conclusions

As shown in the previous diagram, the B2 (Kaya-Dori-Niamey) interconnection ranks first with a priority of 0.0075 point (8.8%) over the second (C8 Ouagadougou-Fada Ngourma-Niamey). The latter edges B1 (Bamako- Bougouni-Sikasso-Ouangolodougou) by 0.01 point, that is 13.3%. The B1 interconnection is ahead of the fourth (B3 Niamey-Dosso-Sokoto-Kaura Namoda) by 0.0012 point, or 1.6%. Finally, the B3 interconnection outscores interconnections C1 (Niamey-Dosso-Parakou) and C2 (Kaya-Asongo) by 0.0084 point, or 12.8%. These observations lead us to a first conclusion: the missing links in the sub-sahelian network rank among the first four choices of the evaluators in classifying the interconnection projects.

All in all, the B2 interconnection has few weaknesses. It ranks first on strategic, economic and institutional grounds. It ranks third in terms of environmental and social criteria, eighth in terms of technical criteria. In terms of strategy, B2 intensifies the regional integration and economic cooperation of Niger, Burkina Faso and the Ivory Coast, links Niamey to the port of Abidjan via the extension of a railway able to perform in an outstanding manner under normal conditions, and sets the groundwork of an important network throughout the hinterland. The B2 interconnection has a good benefit/cost ratio. Moreover, it is one of the best performers from a financial standpoint, with a net present value slightly above the profitability crossover rate and an expected risk factor lessened with the improvement of the sociopolitical climate in the Ivory Coast. The fact that it is so close to the Tambao mines makes it possible to service the region using unit trains, a feature which may attract private investors to enhance the deposits and the laying out of the lead track. From a technical standpoint, B2 will benefit from the Ouagadougou-Kaya line and a long railway right-of-way already in place. From an environmental and social viewpoint, the route is located in a pre-established transportation corridor which runs along the routes N3 and R6, to service Tougouri, Yalgo, Dori, Tera, Dargol and Gotheye before curbing towards the south to reach the Niamey terminal on the west shore of the Niger river. All in all, B2 is a winner not only in terms of the strategic and socioeconomic aspects but also for its financial profitability.

The C8 interconnection is an interesting alternative, although it has an interconnection route some 25% longer, which affects the capital costs for laying out the infrastructures. Moreover, its geographical location is not well suited to developing the potentials of northeast Burkina. However, it makes it possible to service the deposits of Say and Diapaga.

The B1 interconnection creates a network of which the zone of influence covers 3 034 km, linking the capitals of Senegal, Mali, Ivory Coast and Burkina Faso. Well ranked on numerous aspects, this route is heavily disadvantaged in the current study because it does not service Niger.

The B3 interconnection is handicapped by its length, which affects the financial parameters. Because it only favors the bilateral Niger-Nigeria relationship, B3 is deemed less relevant in terms of regional integration and economic cooperation. It is also deemed more risky from a financial standpoint given the instability of the areas crossed.

The sensitivity tests show that B2 remains in first place regardless of the weight given to all the strategic, economic and institutional criteria. Based on these results, the Consultants recommend that the integration of the ECOWAS railway networks start with the B2 interconnection, linking Kaya to Burkina Faso in Niamey (Niger) via Dori. It is interesting to note that such a choice considerably alters the circumstances in terms of future developments of the ECOWAS integrated network. Therefore, interconnection B8 (Ouagadougou-Fada Ngourma-Niamey) becomes less important for the development of the integrated network. Furthermore, the opening-up of Niger through the Niamey-Abidjan latitude considerably diminishes the potential for traffic for the competing projects; which essentially aim for the same goal (B3, C1 and C5). Moreover, projects such as the Bamako-Bougouni-Ouangolodougou interconnection that contributes to the completion of the trans-sahelian corridor gain status.

In closing, the Consultants wish to mention that these conclusions and recommendations have roots to the past. The *Plan Communautaire de Transport de la Communauté Économique de l'Afrique de l'Ouest*, which was made public in 1987, recommended that the implementation of the Kaya-Dori-Niamey link be done first (Analytical Report from the SETEC-DEUTSCHE EISENBAHN Consultants, May 1987). Two decades later, the situation has not changed much. The B2 project would bring about some changes if it were imitated.

3.5 Volume 6: Database

3.5.1 Background

This report is a follow-up to the one submitted in June 2007 and to the guidelines sent by CIMA/UMA following the meeting held on the first week in October in Cotonou (Benin) with the ECOWAS Steering Committee.

As stated in the action plan for conducting the feasibility study for the interconnection of the railway networks in the ECOWAS, CIMA/UMA proposed creating a database to gather all the

data collected in the field by the Research Units. The tasks assigned to the database team can be summarized as follows:

1) Create a database structure which meets the requirements of the various data collection protocols provided by the team of experts.

2) Create, develop, configure and implement a database.

3) Write a user guide.

4) Train the person who will be responsible for managing the database in Abuja (Nigeria).

5) Ensure that the data is made available to the experts.

6) Provide system support to the experts for the data analysis phase.

7) At the end of the project, transfer the database to the ECOWAS.

This database with an autonomous interface, created using Microsoft Access, was designed and developed by Mr. Léonce Adico, Database Expert. Mr. Adico relied on the field data collection files developed and validated by the CIMA/UMA experts.

Following a two (2) week mission in Cotonou (Benin) from June 3, 2007 to June 15, 2007, the following tasks have been completed:

- Installed the database.
- Modifications and changes following feedback in order to structure the database based on current situation in the field.
- Trained the data processing agent, Mrs. Amina Ali Hima and the Abuja office secretary Ms. Berthe Tama.

3.5.2 Methodology and Task Execution Process

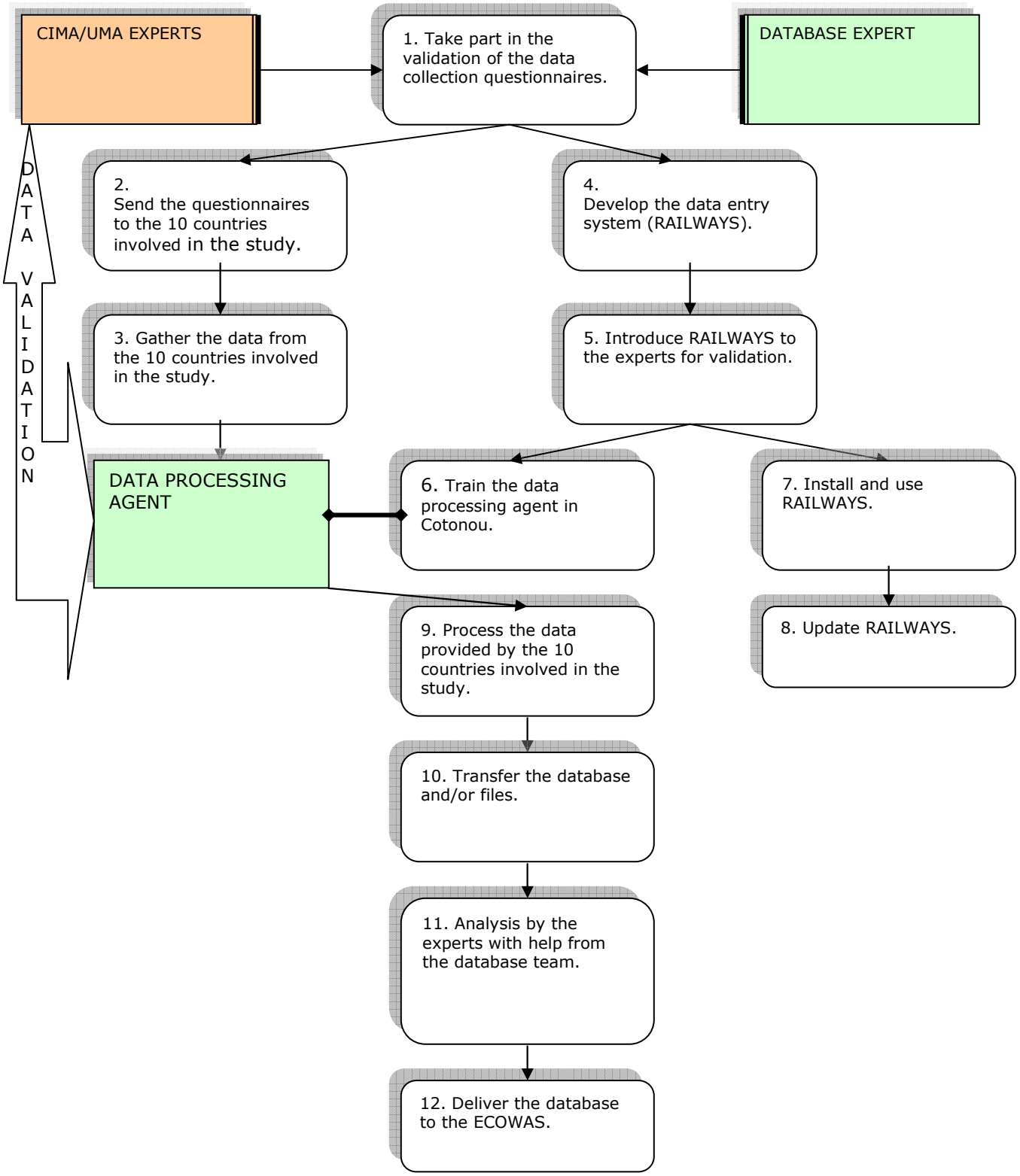


Figure 2 Methodology

In this section we take a look at the various steps involved in the task execution process previously defined, in order to highlight the activities completed, the operating faults as we see them, and the lessons to be learned.

3.5.2.1 Validation of the Data Collection Questionnaires

The database team's involvement in preparing the data collection protocols must include ensuring that the questionnaires prepared by the experts are adapted to a proper computerized database structure which would allow for a better design.

Consequently, each wording of the questions must be linked to a field in the database. The wording, the various attributes and codifications must be specified by the experts in both French and English. The questions must be easily understood by those who will be using the data.

As a result, only a few CIMA-UMA experts submitted their data collection protocols for analysis by the database team in order to ensure an adequacy between the paper questionnaires and the design feasibility in terms of a traditional database structure.

Therefore, the database team has validated the questionnaires for the following components with feedback from the appropriate experts:

- Environmental component
- Institutional component
- Socio-economic component

Despite the fact that the experts for the other components were not able to provide feedback or simply did not submit their questionnaires, the database team designed and integrated all the components of the questionnaires in the computerized database structure.

3.5.2.2 Sending Questionnaires

The questionnaires were sent to the Research Units on the field; they began collecting data once the route proposed by CIMA-UMA was validated by the ECOWAS Steering Committee.

3.5.2.3 Data Collection

Data collection was done as follows:

- Using the Internet for electronic data sent to the data processing agent, with a copy to Dr. Salifou Seini Modi.
- By mail for data provided in paper form.
- On a CD for electronic data (which could not be sent using the Internet).
- By phone for all additional information.

Once this data was collected, they must be validated by the experts for each component.

During the last update of the data reception list for the various countries (see appendices for monitoring submission of questionnaires), we can see that most of the data has been sent to the database team.

3.5.2.4 Data Processing System (RAILWAYS)

The RAILWAYS system was developed, completed and installed during the mission in Cotonou from June 3, 2007 to June 15, 2007. The system makes it possible to manage access rights for the users and includes:

- A Microsoft Access database which includes all the data collected on the field, in the various countries.
- A data entry interface in both French and English.
- An installation guide as well as a user's guide.

The system is set in such a way that it can be used in a central administrative structure (e.g. ECOWAS head offices) as well as in each of the 10 countries involved in the study and Liberia.

The system and the data dictionary were presented in full in the June 2007 mission report and, all the components were addressed. The component menus and their sub-menus for data entry are presented as follows:

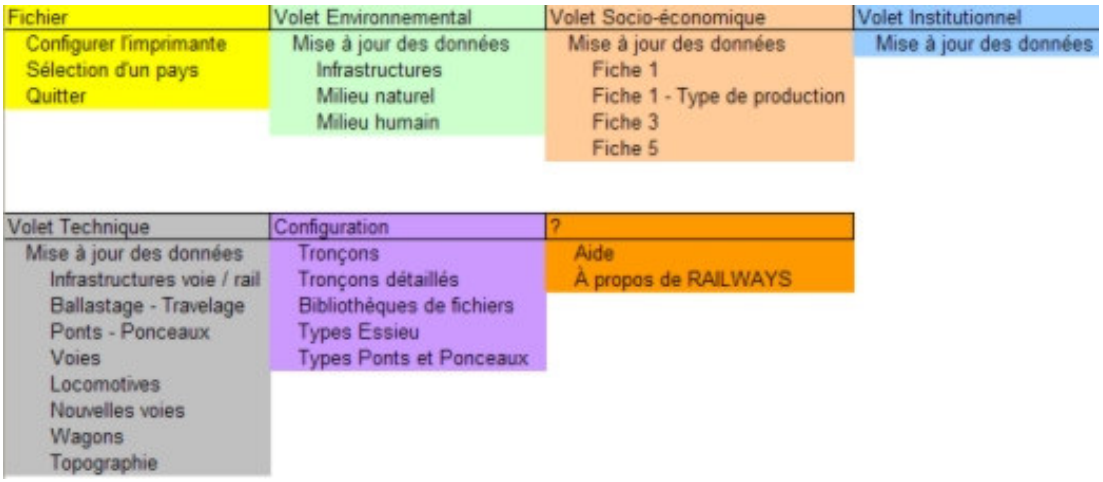


Figure 3 Menus

3.5.2.5 Introducing RAILWAYS to the Experts

RAILWAYS was introduced to the experts by Mrs. Josée Marcoux in the first week of May 2007 in Cotonou. We would like to take this opportunity to thank her for her help which was very much appreciated.

The database team gave her a sample copy which she presented to the other members of the CIMA/UMA team as well as the Head of Research Units in Benin. Everyone found the system to be user friendly. However, the UMA engineers did mention a few changes to be

made to a few of the technical component files. The database expert was only informed of the changes during the installation and training phase in Cotonou. These changes were done on site, in a newer version of the system before the final version was completed.

3.5.2.6 Training in Cotonou

A training session was held in Cotonou for the Abuja office. This training aimed to:

- Meet the main stakeholders involved in the data entry and use of the database.
- Introduce the database to the involved stakeholders.
- Test and begin the operation of the database.

The training was prepared for the data processing agent, Mrs. Amina Ali Hima and the Abuja office secretary Ms. Berthe Tama.

This meeting made it possible to reach the set goals and meet the participants' expectations. Here are a few highlights:

- The meeting between the stakeholders and the CIMA/UMA experts went well. Each party gained an understanding of the background and specific conditions under which the data must be entered into the database. The initial discussions were between the experts and stakeholders who understood the many technical aspects, and who provided their feedback for designing the database.
- A good analysis of the data already received made it possible to correct a few misunderstandings on how the tables were to be filled by the Research Units on the field.
- With help from an OCBN[2] agent, Mr. Sanoussi Amadou, work sessions were held to help us obtain more information on the data and, most of all, to understand how they must be presented in order to be entered into the database.
- E-mails were sent to the Research Units for a better explanation and correction of the data already collected.
- More e-mails were sent to the UMA experts (Mr. Joseph Zadel and Mr. Antoine Lemieux) to obtain their feedback on the data already collected
- A lot of thought was given to how to implement a better import method for the data sent by the Research Units which is in Excel sheets. This led to the creation of a sample table to help with the import process because, rather than entering the data for hundreds of files, it is easier to import the files. In doing so, data entry errors are reduced and above all, a lot of time is saved.
- Import modules for the data in the form of Excel sheets were put in place in order to automate the process.
- A list of the segments was reviewed and changes were made to the development of the database in order to link the segments based on the country

3.5.2.7 Installing and Using RAILWAYS

The RAILWAYS system was installed on the computers of the database team in Abuja, during the training held in Cotonou. The various updates were made in order to make the system operational.

[2] Organisation Commune Bénin-Niger.

At this time the system's only use is for data entry and for storing data; the interface was designed with this in mind.

In time, other menus can be developed so that the system can be used as a tool to analyze railway, environmental, institutional, economic and socio-economic data, a requirement which was not included in the current mandate given to the database expert.

The Microsoft Access database enables the database team to answer in a timely fashion, with answers to searches, formal requests by other CIMA/UMA experts. These requests must be made in writing to the database team.

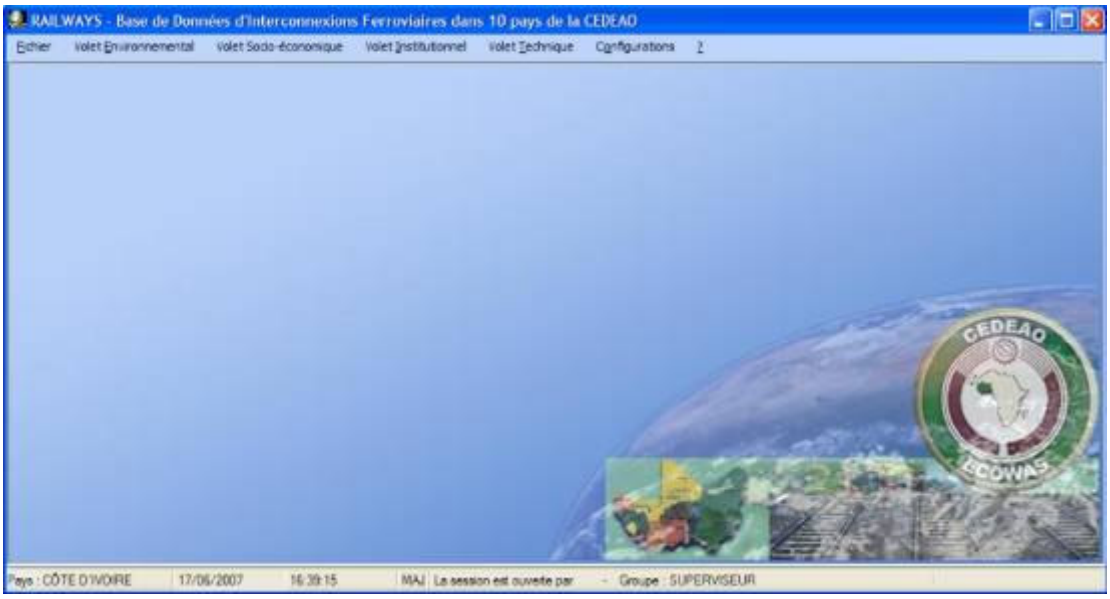


Figure 4 Interface

3.5.2.8 Updating RAILWAYS

Updates are still taking place in order to improve on what we have and ensure that it works around the data being submitted by the Research Units.

Given the distance which separates the database expert and the team in Abuja, the newer versions of RAILWAYS were sent via the CIMA FTP site provided by Mr. Mathieu Chagnon from the Computer Services department at CIMA. The FTP interface looks as follows:

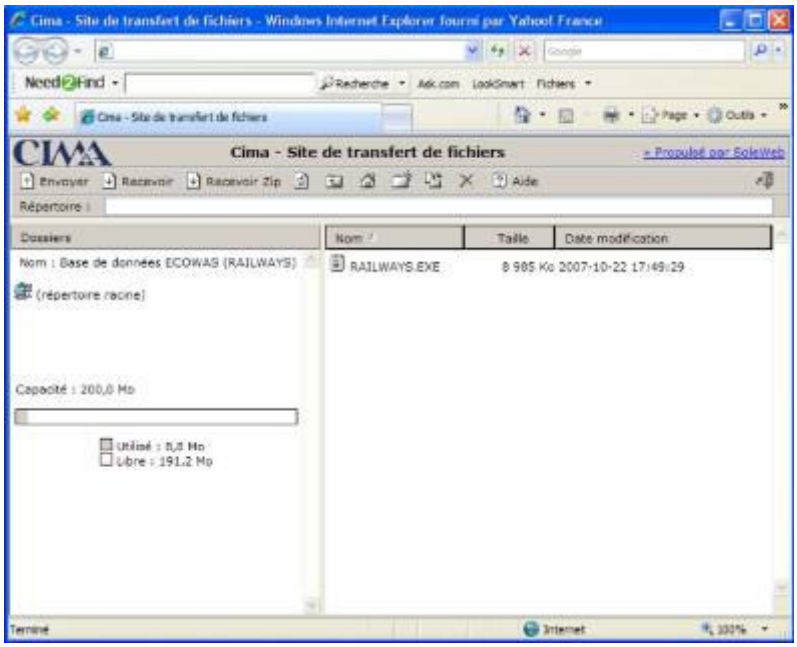


Figure 5 Transfer

3.5.2.9 Processing Data Received

Import modules to be used from the Excel sheets were put in place in order to automate the process. As such, the database team makes less and less data entry to focus on the elements which will add value to the activities, for example, data validation, correcting erroneous data, communicating with the Research Units to speed up data transmission.

The data which is sent to the data processing agent are properly sorted and analyzed based on the segments for each corresponding country.

The processed data is then put in a sample table to be imported into the database.

All additional documents, other than data tables, are included into the archive library in the database.

The original files which were not processed are also included in the database according to the component, country and table.

Various problems were encountered:

- Delays in receiving the data from the Research Units.
- Data not being validated by CIMA/UMA experts.
- The reliability of some of the data (for some countries, data was sent back to be corrected).
- The failure of some Research Units to understand the data collection process (numerous e-mails were exchanged before it became clear).

3.5.2.10 Transferring the Database and Files

A data transfer system must be put in place to ensure a flow in acquiring the data. Given that the data entry is done in Abuja, it is necessary that both the experts and the database team have the final version of the database in order to use the system and analyze the data.

We will use two data transfer methods.

Method 1: Small size files (less than 5 MB depending on the mail program)

With small files (text files Word, Excel, PDF) which have been compressed (in .zip format), they can be sent using the usual mail programs.

Method 2: Large size files (greater than 5 MB)

When the database is greater than 5 MB after being compressed, its contents can be transferred using the CIMA FTP site.

This method is the one currently used by the database expert to transfer the newer versions of the RAILWAYS system to the data processing agent in Abuja.

3.5.2.11 Analysis

Each expert is responsible for analyzing the data which is available to them. The database team must provide technical support in defining searches, extracting data and producing information based on the raw data contained in the database.

The Microsoft Access database enables the database team to answer in a timely fashion, with answers to searches, formal requests by other CIMA/UMA experts. These requests must be made in writing to the database team.

The requests coming from the experts may touch on all the study components: environmental, institutional, socio-economic and technical.

3.5.2.12 Delivery of RAILWAYS to the ECOWAS

At the end of the study, CIMA/UMA will deliver the database to the ECOWAS. This database, created using Microsoft Access, will be provided along with the autonomous interface known as RAILWAYS, which will enable the team to update the data.

Many other developers will be able to, from the database, put in place a system which will help process data, analyze data and aid in decision-making.

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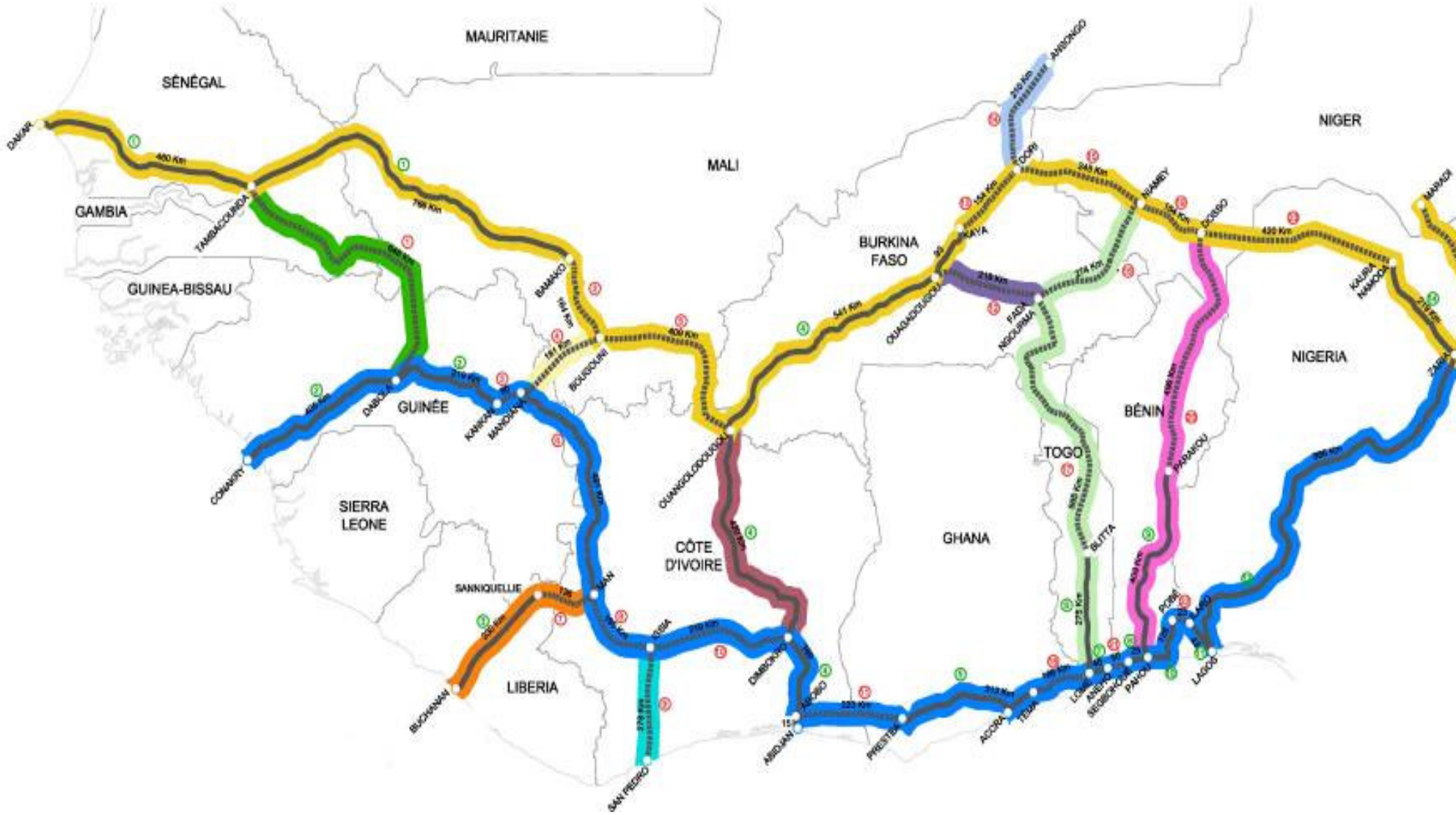
APPENDICES

APPENDIX A. INTERCONNECTION MASTER PLAN

(See following page)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GHANA
CÔTE D'IVOIRE
SIERRA LEONE
LIBERIA
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TAMBACOUNDA
BAMAKO
BOUGOUNI
KAYA
OUAGADOUGOU
FADA NGOURMA
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KAURA NAMODA
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YAMOUSSOUKRO
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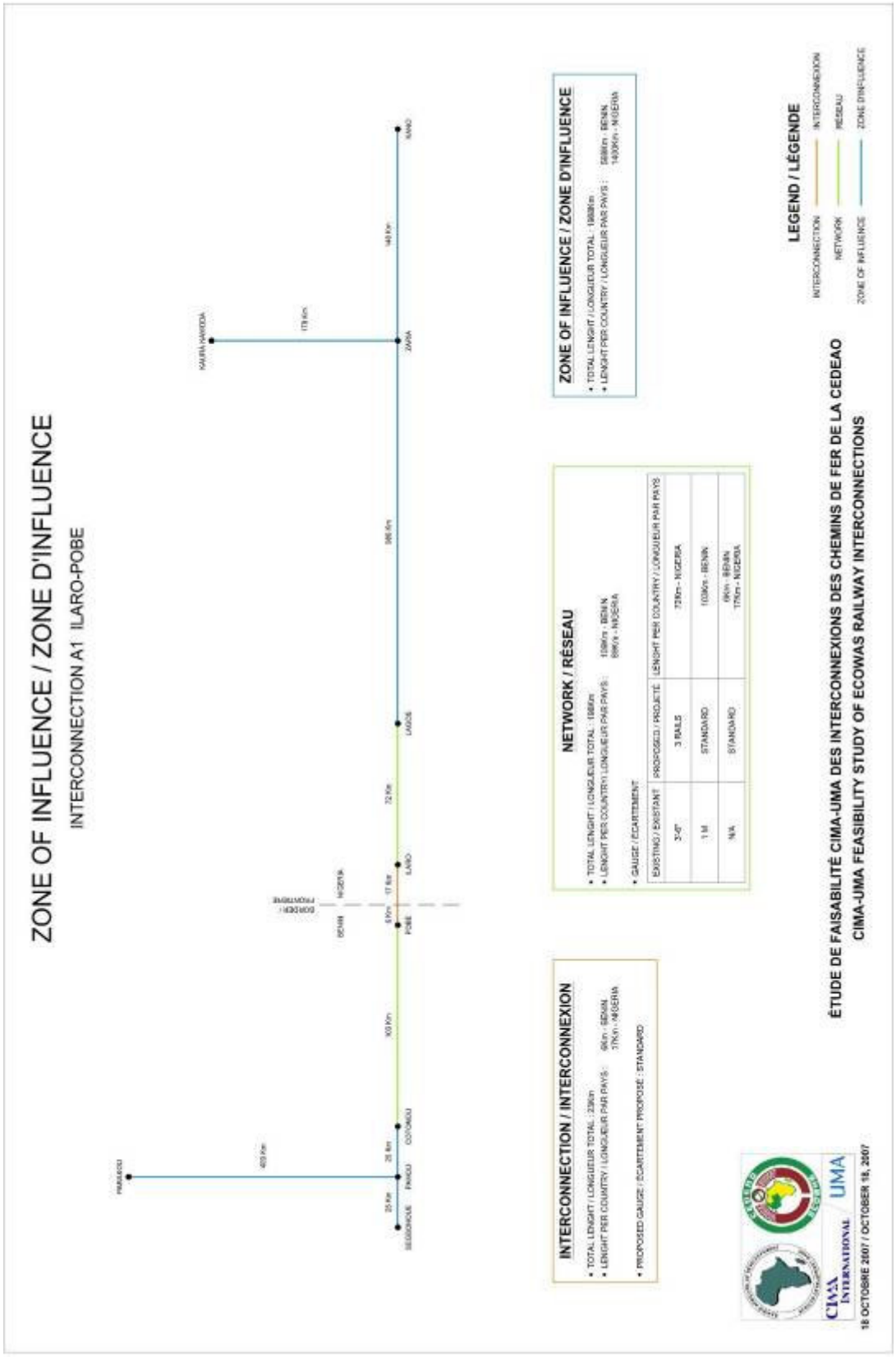
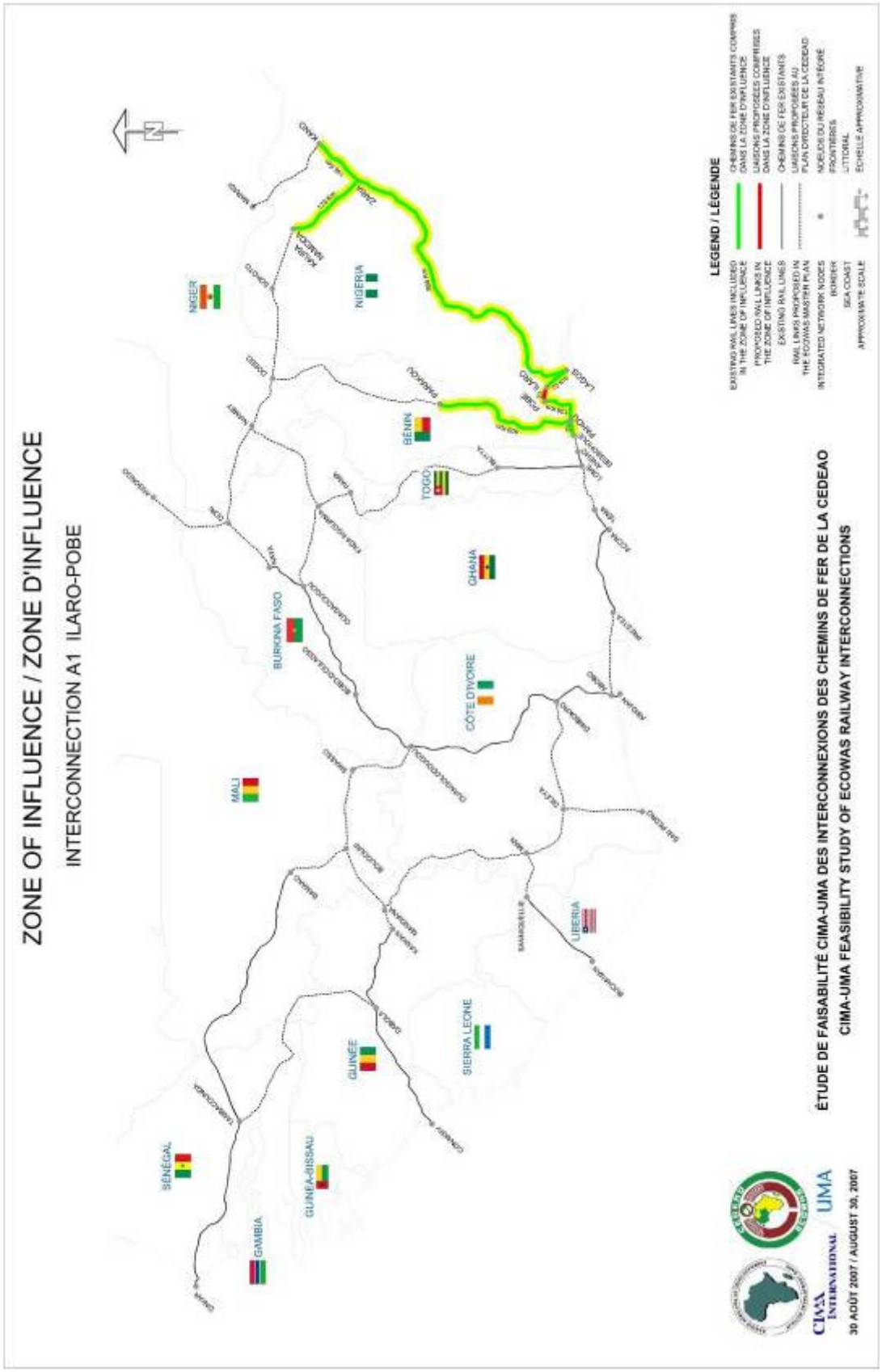
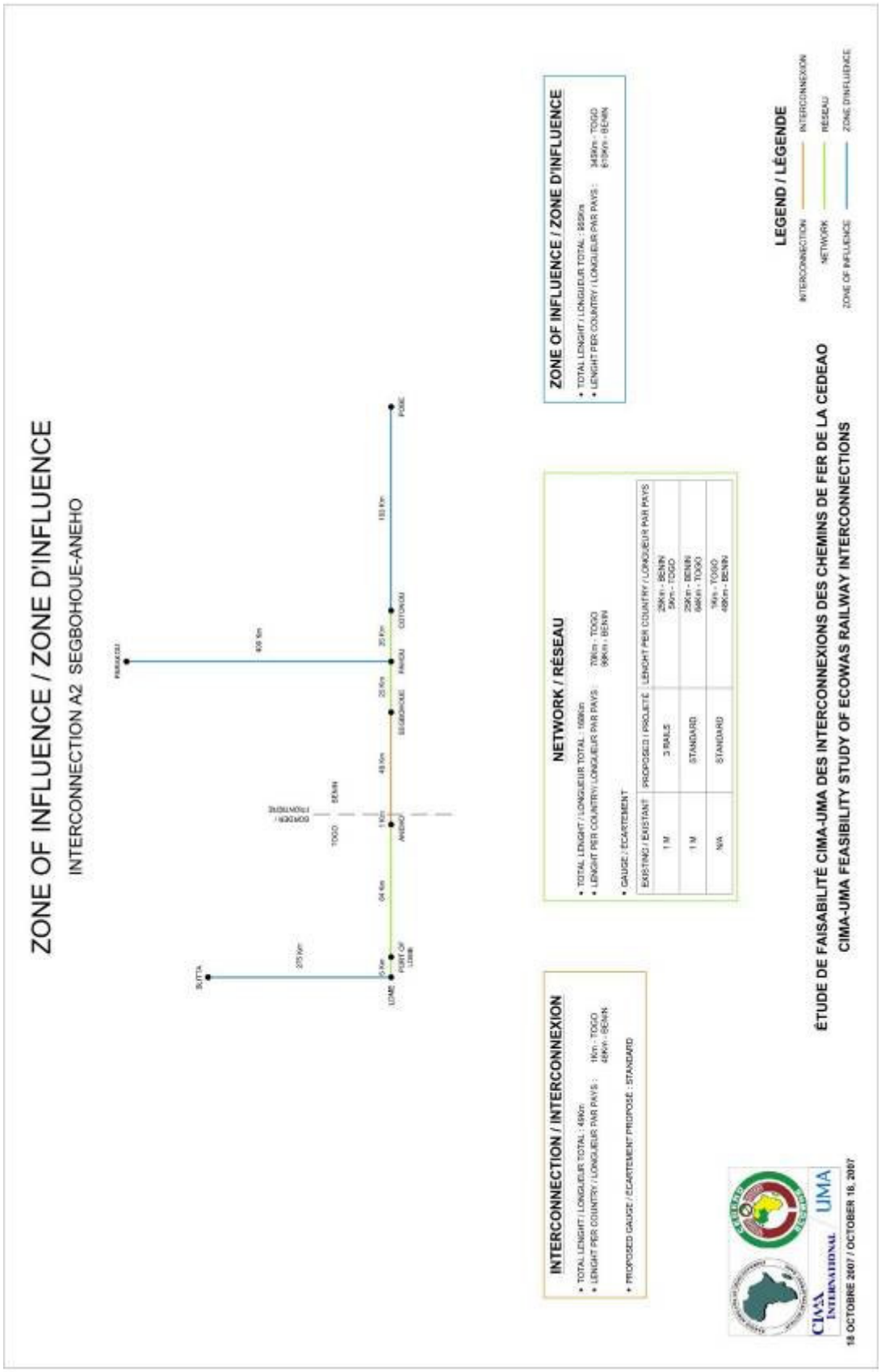
BUTTA
PARAKOU

APPENDIX B. ZONE OF INFLUENCE MAPS




ZONE OF INFLUENCE / ZONE D'INFLUENCE
INTERCONNECTION A1 ILARO-POBE
LEGEND / LÉGENDE
NIGERIA
BÉNIN
TOGO
GHANA
BURKINA FASO
CÔTE D'IVOIRE
MALI
LIBERIA
SIERRA LEONE
GUINÉE
GUINÉE-BISSAU
GAMBIA
SÉNÉGAL
ÉTUDE DE FAISABILITÉ CIMA-UMA DES INTERCONNEXIONS DES CHEMINS DE FER DE LA CEDEAO
CIMA-UMA FEASIBILITY STUDY OF ECOWAS RAILWAY INTERCONNECTIONS
30 AOÛT 2007 / AUGUST 30, 2007


ZONE OF INFLUENCE / ZONE D'INFLUENCE
INTERCONNECTION A2 SEGBOHOUE-ANEHO
INTERCONNECTION / INTERCONNEXION
• TOTAL LENGHT / LONGUEUR TOTAL : 49Km
• LENGHT PER COUNTRY / LONGUEUR PAR PAYS : 1Km - TOGO 48Km - BENIN
• PROPOSED GAUGE / ECARTEMENT PROPOSE : STANDARD
NETWORK / RÉSEAU
• TOTAL LENGHT / LONGUEUR TOTAL : 1668Km
• LENGHT PER COUNTRY / LONGUEUR PAR PAYS : 70Km - TOGO 98Km - BENIN
• GAUGE / ECARTEMENT
EXISTING / EXISTANT
PROPOSED / PROJETÉ
LENGHT PER COUNTRY / LONGUEUR PAR PAYS
1 M
3 RAILS
25Km - BENIN 5Km - TOGO
1 M
STANDARD
25Km - BENIN 64Km - TOGO
N/A
STANDARD
1Km - TOGO 48Km - BENIN
ZONE OF INFLUENCE / ZONE D'INFLUENCE
• TOTAL LENGHT / LONGUEUR TOTAL : 855Km
• LENGHT PER COUNTRY / LONGUEUR PAR PAYS : 345Km - TOGO 510Km - BENIN
LEGEND / LÉGENDE
INTERCONNECTION
NETWORK
ZONE OF INFLUENCE
INTERCONNEXION
RÉSEAU
ZONE D'INFLUENCE
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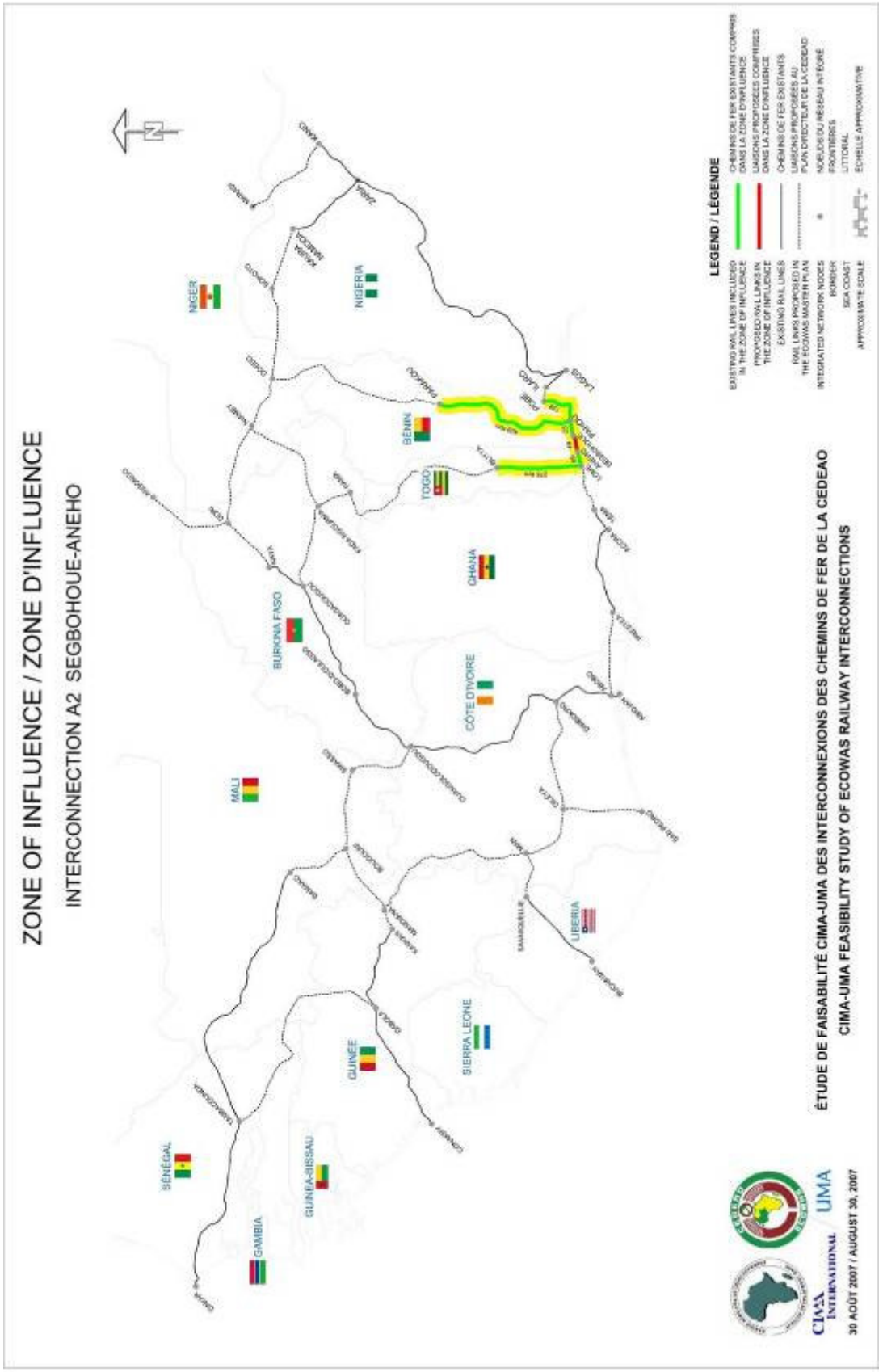
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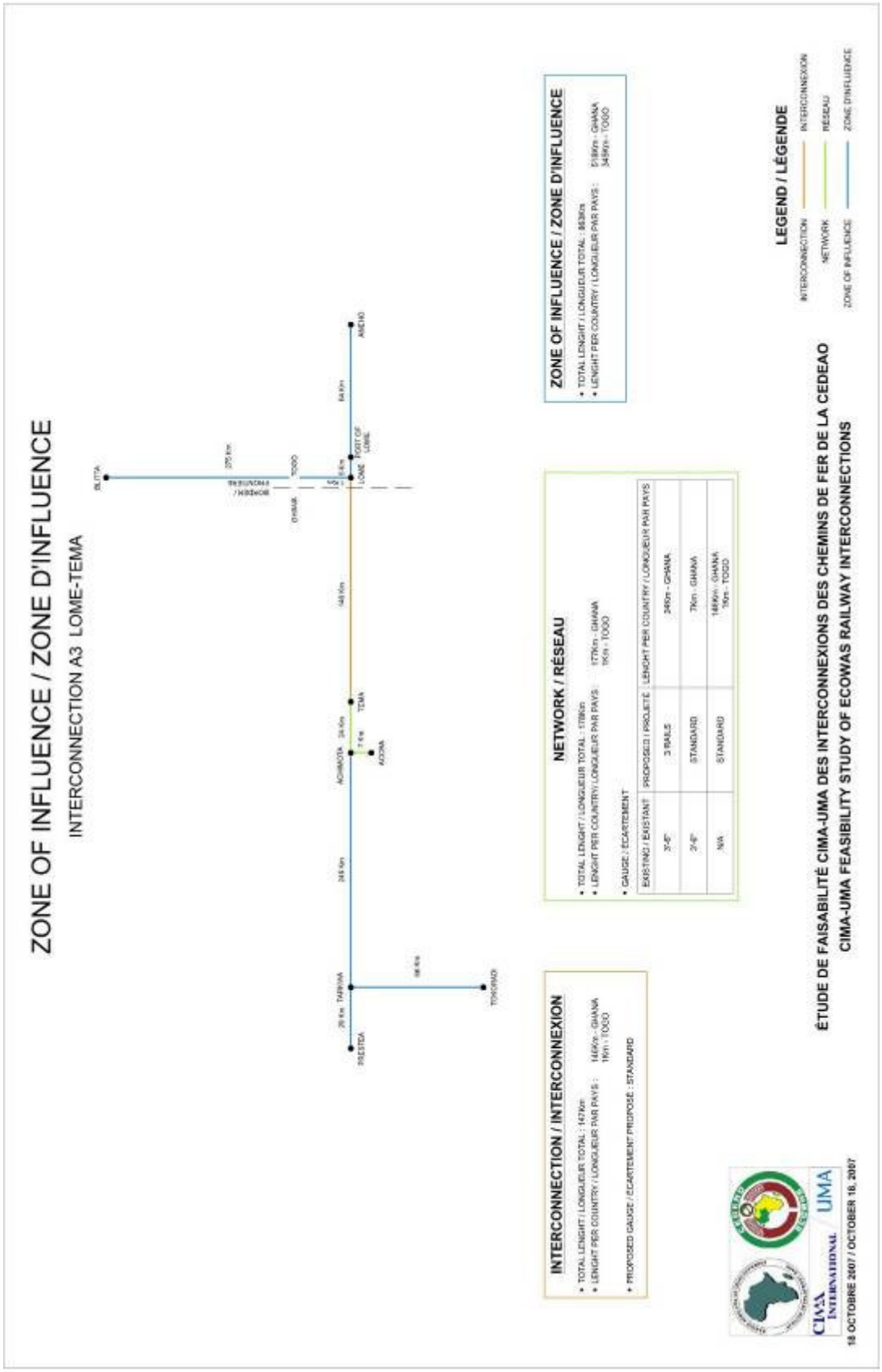
ZONE OF INFLUENCE / ZONE D'INFLUENCE
INTERCONNECTION A3 LOME-TEMA
BLITTA
270 Km
BOMBOUAKI / BOMBOUAKI
TOGO
GHANA
NOVI
6 Km
LOME
PORT OF LOME
84 Km
AKEPO
148 Km
TEMA
7 Km
ACHIMOTA
24 Km
ADENA
245 Km
TAKORADI
26 Km
PRESTEA
NETWORK / RÉSEAU
• TOTAL LENGHT / LONGUEUR TOTAL : 578Km
• LENGHT PER COUNTRY / LONGUEUR PAR PAYS : 170Km - GHANA
1Km - TOGO
• GAUGE / ECARTEMENT
EXISTING / EXISTANT
PROPOSED / PROJETE
LENGHT PER COUNTRY / LONGUEUR PAR PAYS
3'-6"
3 RAILS
346Km - GHANA
2'-6"
STANDARD
7Km - GHANA
N/A
STANDARD
148Km - GHANA
1Km - TOGO
ZONE OF INFLUENCE / ZONE D'INFLUENCE
• TOTAL LENGHT / LONGUEUR TOTAL : 863Km
• LENGHT PER COUNTRY / LONGUEUR PAR PAYS : 518Km - GHANA
345Km - TOGO
INTERCONNECTION / INTERCONNEXION
• TOTAL LENGHT / LONGUEUR TOTAL : 147Km
• LENGHT PER COUNTRY / LONGUEUR PAR PAYS : 146Km - GHANA
1Km - TOGO
• PROPOSED GAUGE / ECARTEMENT PROPOSE : STANDARD
LEGEND / LÉGENDE
INTERCONNECTION
INTERCONNEXION
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ZONE OF INFLUENCE
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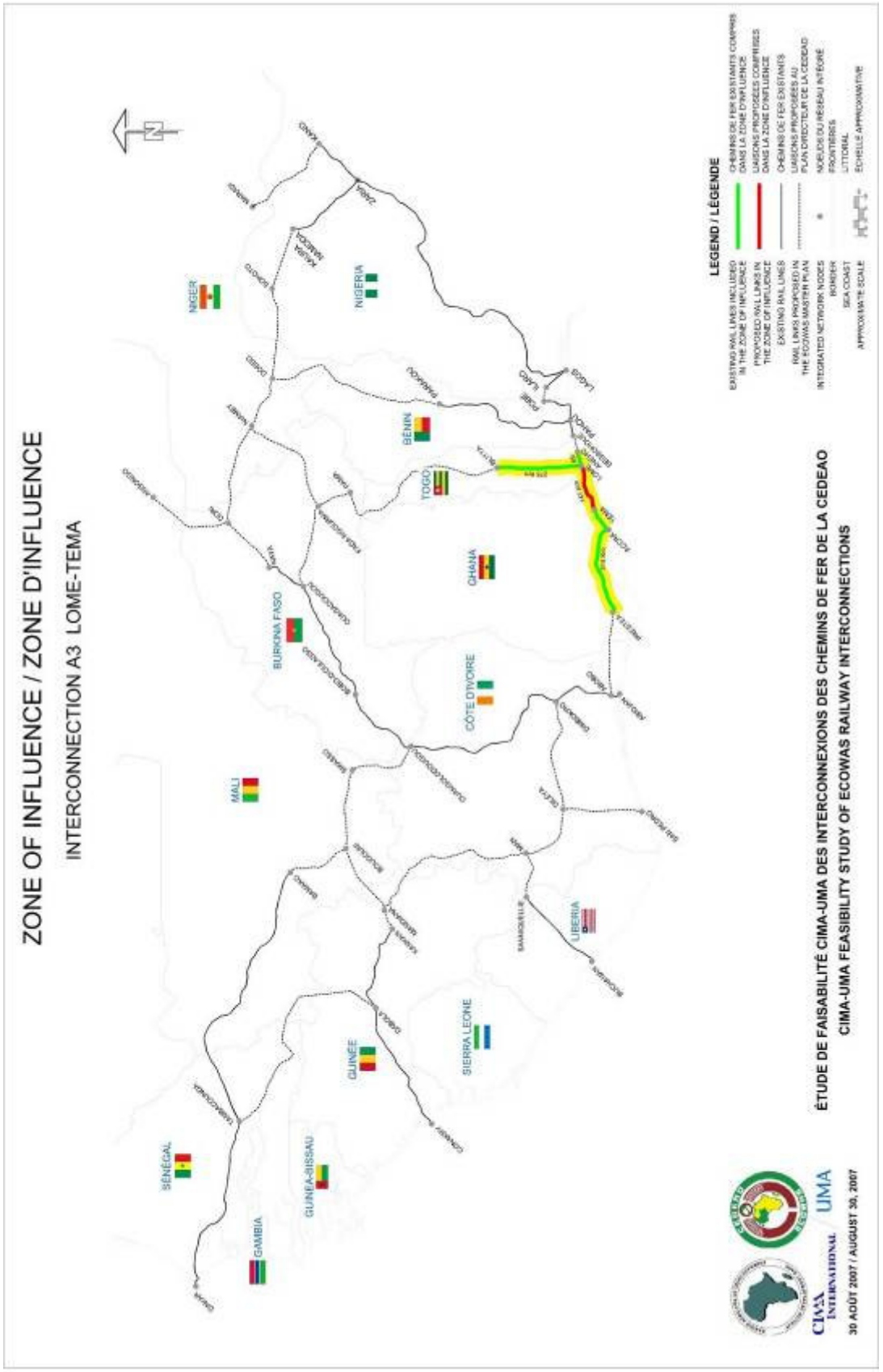
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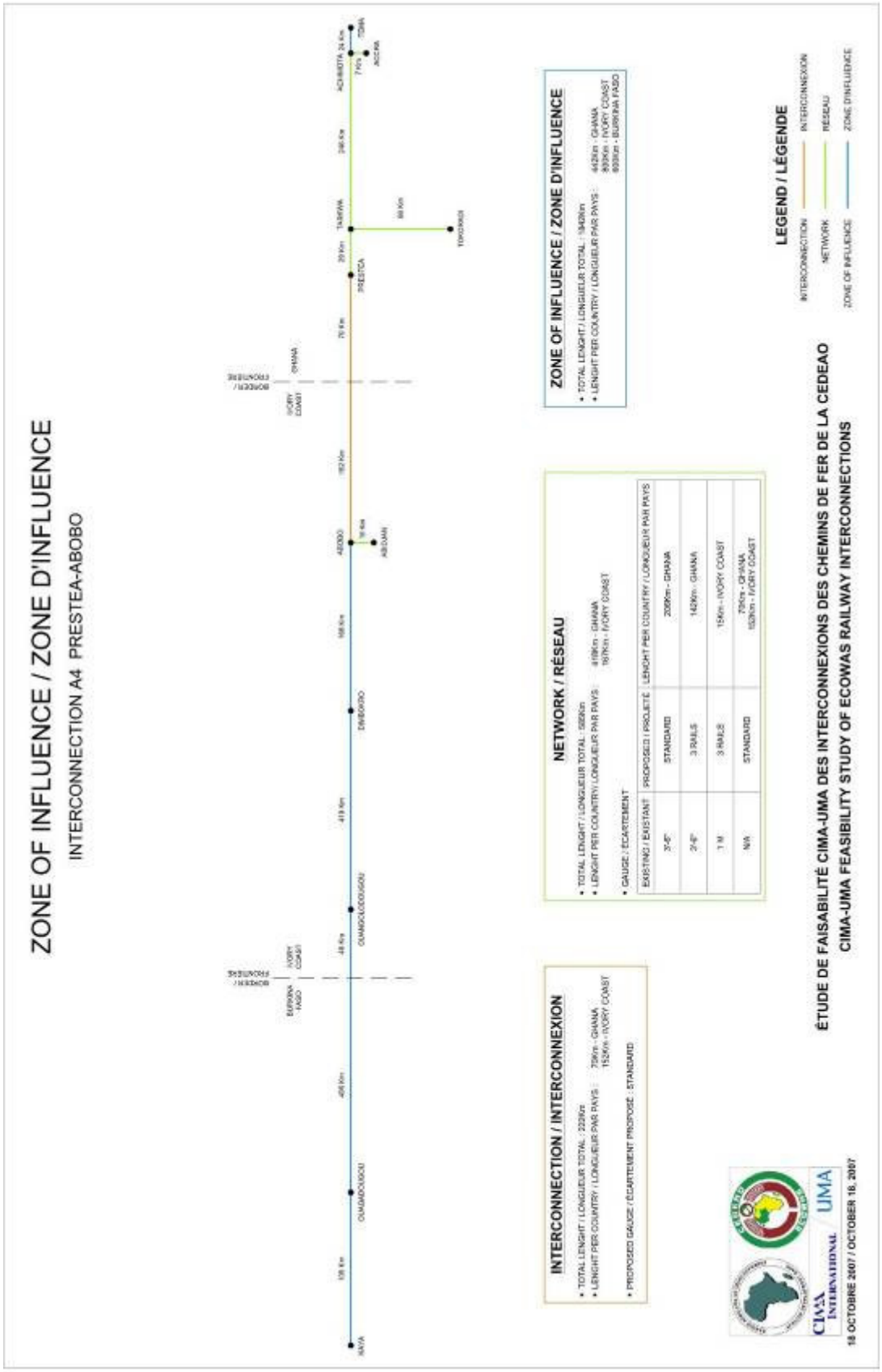
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INTERCONNECTION A4 PRESTEA-ABOBO
INTERCONNECTION / INTERCONNEXION
NETWORK / RÉSEAU
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LEGEND / LÉGENDE
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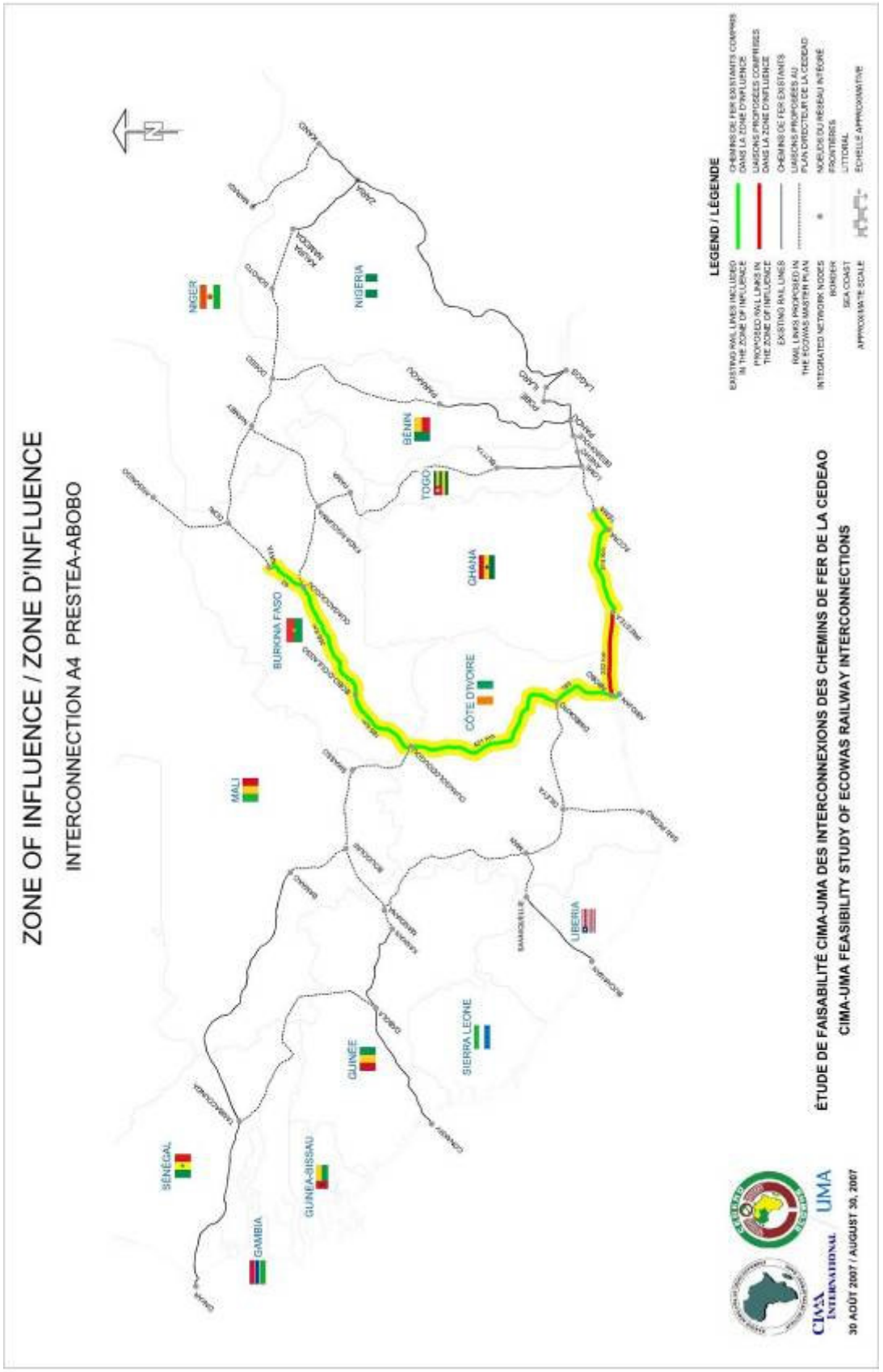
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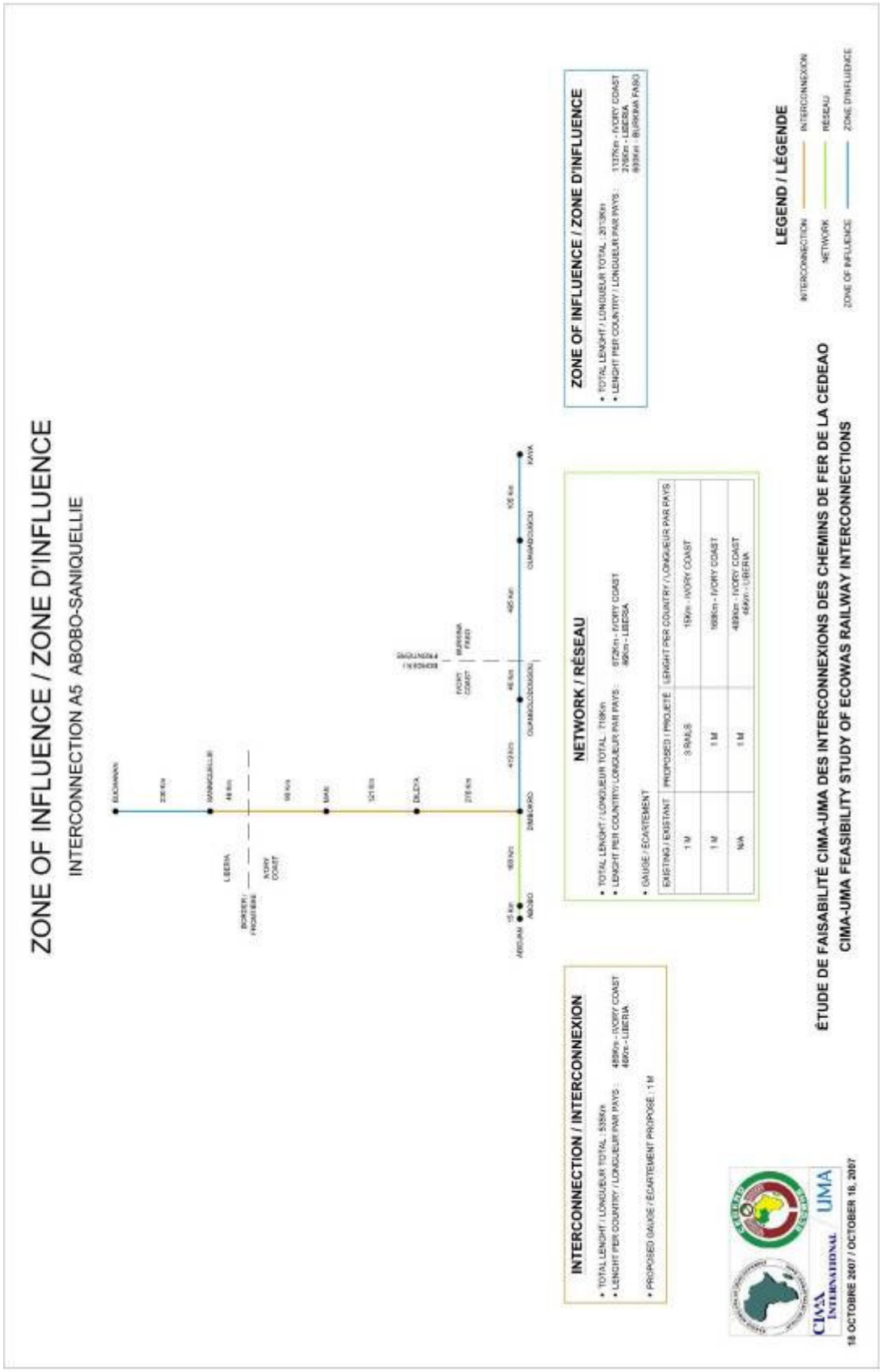
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INTERCONNECTION A5 ABOBO-SANIQUELLIE
INTERCONNECTION / INTERCONNEXION
• TOTAL LENGHT / LONGUEUR TOTAL : 538Km
• LENGHT PER COUNTRY / LONGUEUR PAR PAYS : 489Km - IVORY COAST
48Km - LIBERIA
• PROPOSED GAUGE / ÉCARTEMENT PROPOSÉ : 1 M
NETWORK / RÉSEAU
• TOTAL LENGHT / LONGUEUR TOTAL : 718Km
• LENGHT PER COUNTRY/ LONGUEUR PAR PAYS : 672Km - IVORY COAST
46Km - LIBERIA
• GAUGE / ÉCARTEMENT
EXISTING / EXISTANT
PROPOSED / PROJETÉ
LENGHT PER COUNTRY / LONGUEUR PAR PAYS
1 M
3 RAILS
156m - IVORY COAST
1 M
1 M
1688m - IVORY COAST
N/A
1 M
489m - IVORY COAST
46m - LIBERIA
ZONE OF INFLUENCE / ZONE D'INFLUENCE
• TOTAL LENGHT / LONGUEUR TOTAL : 2013Km
• LENGHT PER COUNTRY / LONGUEUR PAR PAYS : 1137Km - IVORY COAST
218Km - LIBERIA
658Km - BURKINA FASO
LEGEND / LÉGENDE
INTERCONNECTION
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ZONE OF INFLUENCE
ZONE D'INFLUENCE
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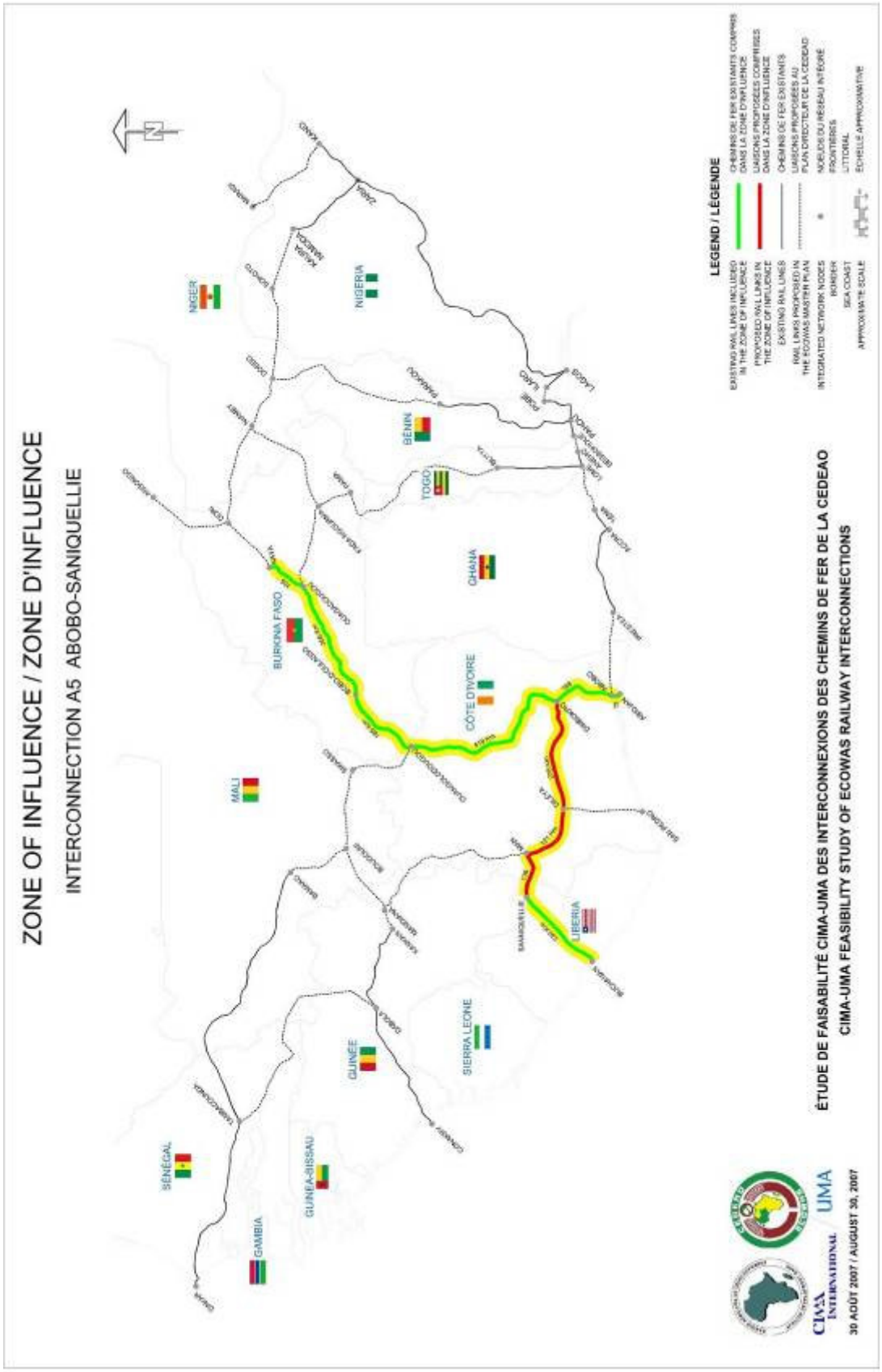
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LEGEND / LÉGENDE
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CHEMINS DE FER EXISTANTS COMPRIS DANS LA ZONE D'INFLUENCE
PROPOSED RAIL LINKS IN THE ZONE OF INFLUENCE
LIAISONS PROPOSÉES COMPRISES DANS LA ZONE D'INFLUENCE
EXISTING RAIL LINES
CHEMINS DE FER EXISTANTS
RAIL LINKS PROPOSED IN THE ECOWAS MASTER PLAN
LIAISONS PROPOSÉES AU PLAN DIRECTEUR DE LA CEDEAO
INTEGRATED NETWORK NODES
NOEUDS DU RÉSEAU INTÉGRÉ
BORDER
FRONTIÈRES
SEA COAST
LITTORAL
APPROXIMATE SCALE
ÉCHELLE APPROXIMATIVE
NIGER
NIGERIA
BÉNIN
TOGO
GHANA
BURKINA FASO
CÔTE D'IVOIRE
MALI
LIBERIA
SIERRA LEONE
GUINÉE
GUINEA-BISSAU
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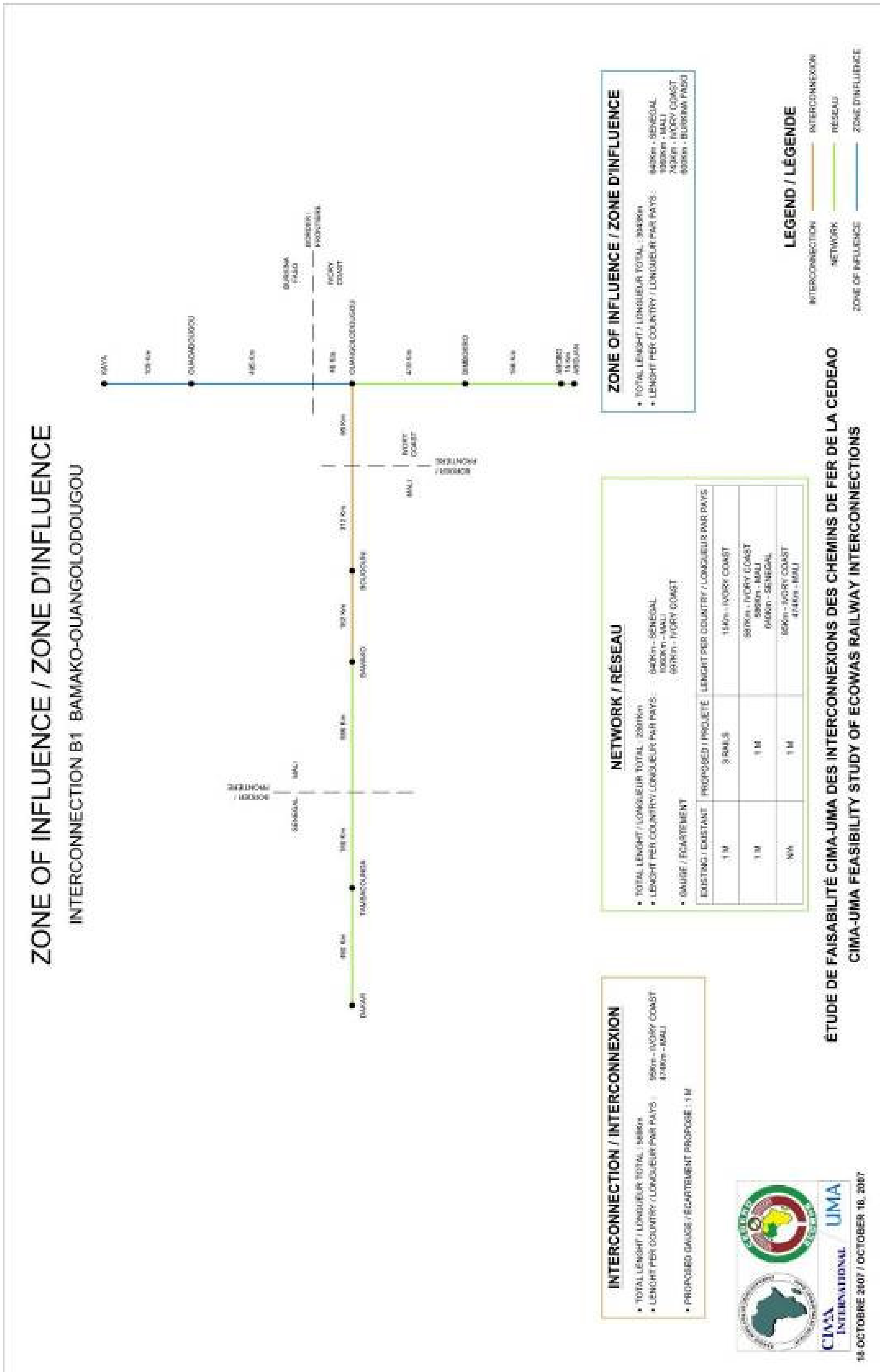
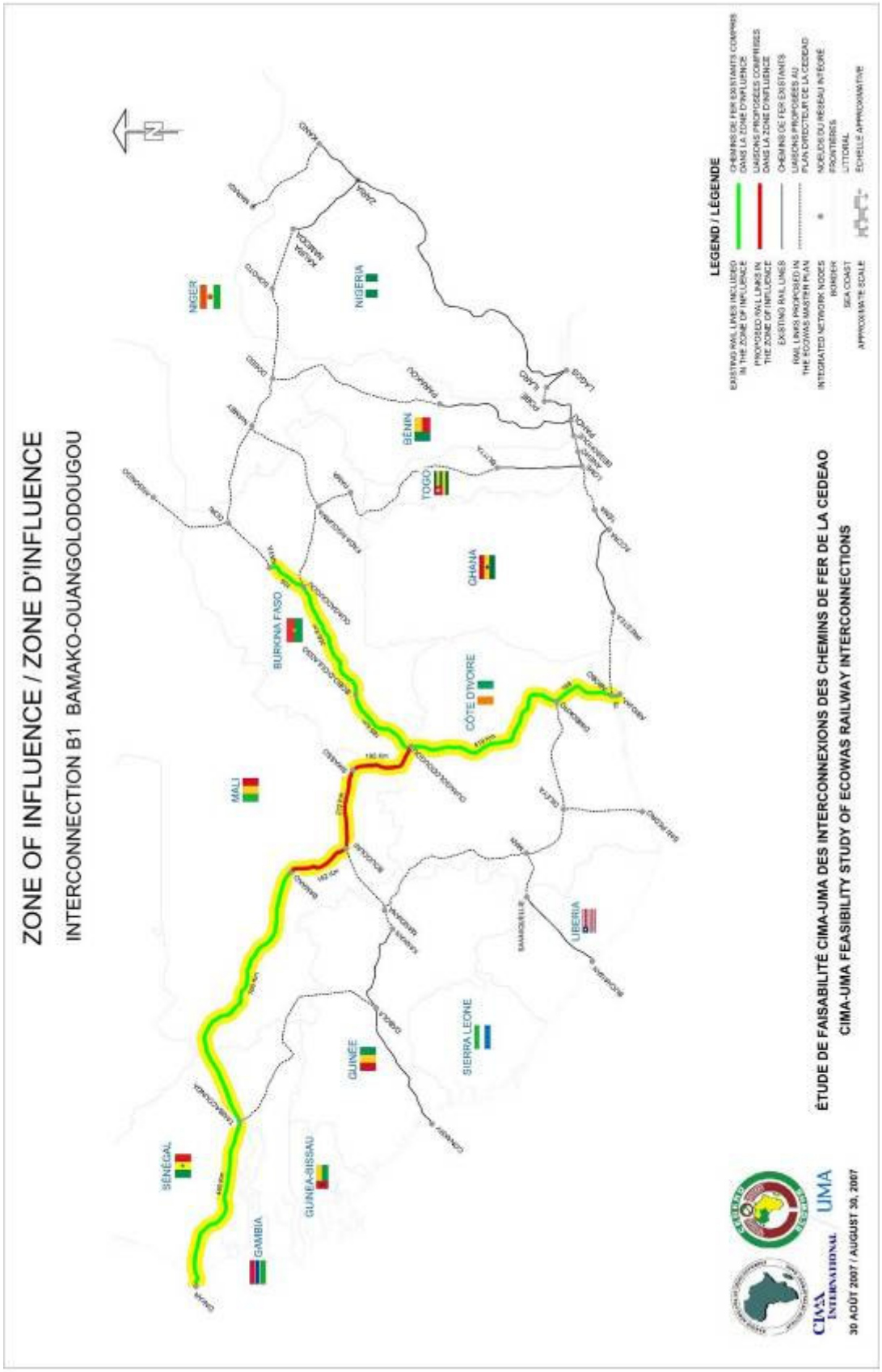
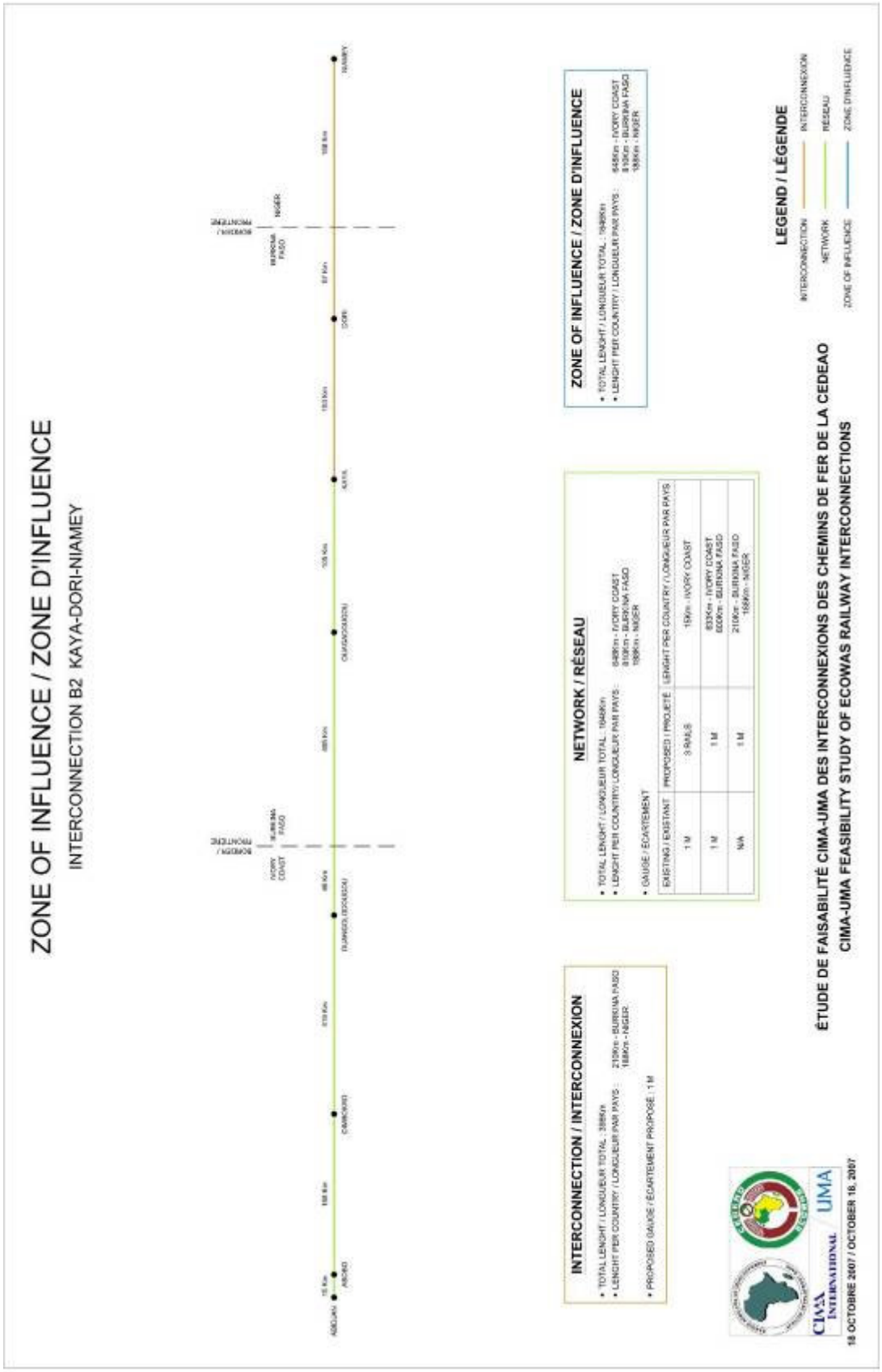

ZONE OF INFLUENCE / ZONE D'INFLUENCE
INTERCONNECTION B1 BAMAKO-OUANGOLODOUGOU
DAKAR
TAMBACOUNDA
BAMAKO
BOUGOUNI
OUANGOLODOUGOU
DIMBOKRO
ABIDJAN
OUAGADOUGOU
KAYA
INTERCONNECTION / INTERCONNEXION
NETWORK / RÉSEAU
ZONE OF INFLUENCE / ZONE D'INFLUENCE
LEGEND / LÉGENDE
ÉTUDE DE FAISABILITÉ CIMA-UMA DES INTERCONNEXIONS DES CHEMINS DE FER DE LA CEDEAO
CIMA-UMA FEASIBILITY STUDY OF ECOWAS RAILWAY INTERCONNECTIONS
18 OCTOBRE 2007 / OCTOBER 18, 2007


ZONE OF INFLUENCE / ZONE D'INFLUENCE
INTERCONNECTION B1 BAMAKO-OUANGOLODOUGOU
LEGEND / LÉGENDE
ÉTUDE DE FAISABILITÉ CIMA-UMA DES INTERCONNEXIONS DES CHEMINS DE FER DE LA CEDEAO
CIMA-UMA FEASIBILITY STUDY OF ECOWAS RAILWAY INTERCONNECTIONS
30 AOÛT 2007 / AUGUST 30, 2007
SÉNÉGAL
GAMBIA
GUINEA-BISSAU
GUINÉE
SIERRA LEONE
LIBERIA
MALI
BURKINA FASO
CÔTE D'IVOIRE
GHANA
TOGO
BÉNIN
NIGERIA
NIGER


ZONE OF INFLUENCE / ZONE D'INFLUENCE
INTERCONNECTION B2 KAYA-DORI-NIAMEY
ZONE OF INFLUENCE / ZONE D'INFLUENCE
• TOTAL LENGHT / LONGUEUR TOTAL : 1948Km
• LENGHT PER COUNTRY / LONGUEUR PAR PAYS : 648Km - IVORY COAST
810Km - BURKINA FASO
488Km - NIGER
NETWORK / RÉSEAU
• TOTAL LENGHT / LONGUEUR TOTAL : 1948Km
• LENGHT PER COUNTRY/ LONGUEUR PAR PAYS : 648Km - IVORY COAST
810Km - BURKINA FASO
488Km - NIGER
• GAUGE / ECARTEMENT
EXISTING / EXISTANT
PROPOSED / PROJETÉ
LENGHT PER COUNTRY / LONGUEUR PAR PAYS
1 M
3 RAILS
156Km - IVORY COAST
1 M
1 M
633Km - IVORY COAST
600Km - BURKINA FASO
N/A
1 M
210Km - BURKINA FASO
168Km - NIGER
INTERCONNECTION / INTERCONNEXION
• TOTAL LENGHT / LONGUEUR TOTAL : 388Km
• LENGHT PER COUNTRY / LONGUEUR PAR PAYS : 210Km - BURKINA FASO
168Km - NIGER
• PROPOSED GAUGE / ECARTEMENT PROPOSE : 1 M
LEGEND / LÉGENDE
INTERCONNECTION
INTERCONNEXION
NETWORK
RÉSEAU
ZONE OF INFLUENCE
ZONE D'INFLUENCE
ÉTUDE DE FAISABILITÉ CIMA-UMA DES INTERCONNEXIONS DES CHEMINS DE FER DE LA CEDEAO
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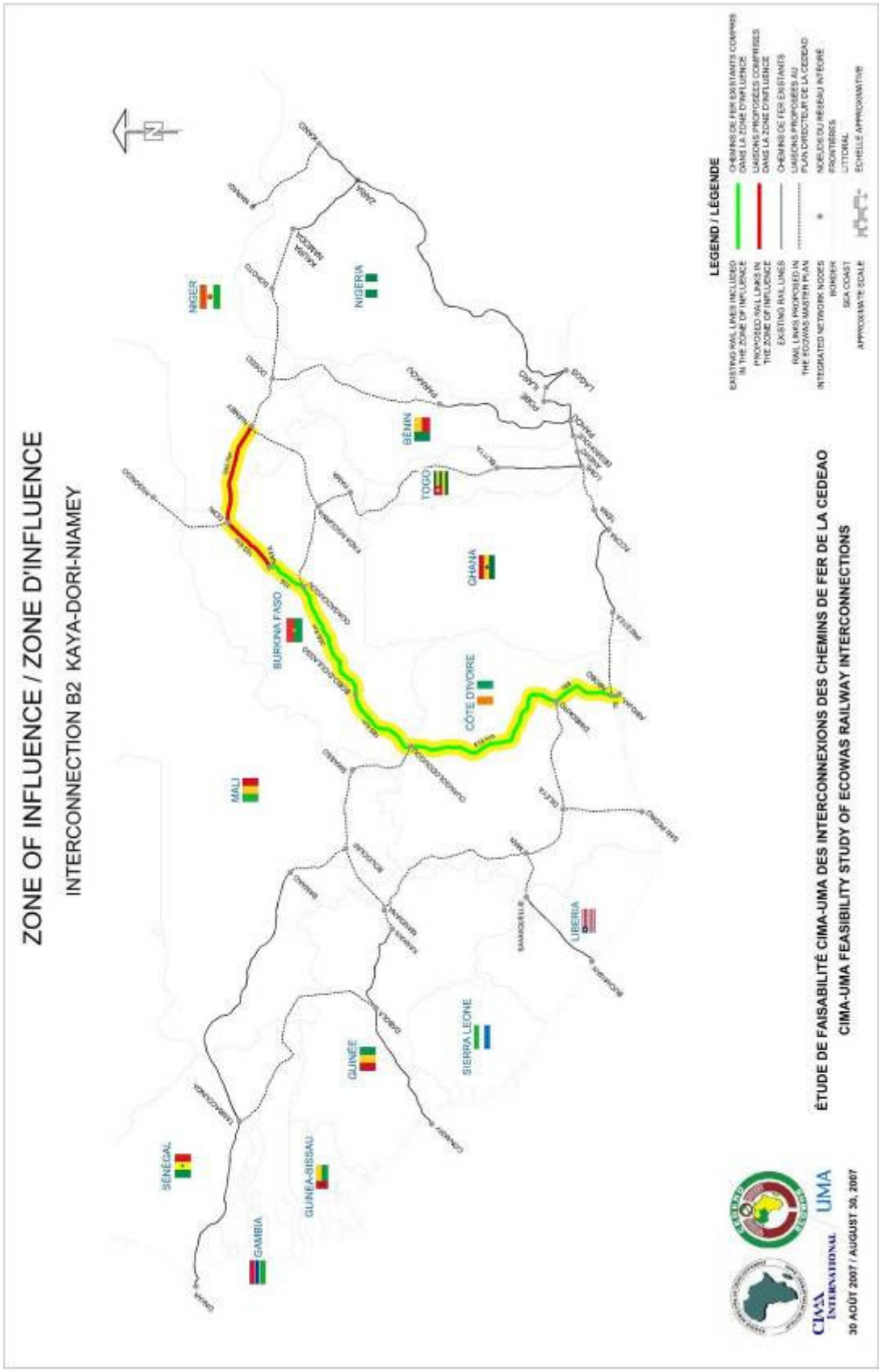
18 OCTOBRE 2007 / OCTOBER 18, 2007


ZONE OF INFLUENCE / ZONE D'INFLUENCE
INTERCONNECTION B2 KAYA-DORI-NIAMEY
LEGEND / LÉGENDE
ÉTUDE DE FAISABILITÉ CIMA-UMA DES INTERCONNEXIONS DES CHEMINS DE FER DE LA CEDEAO
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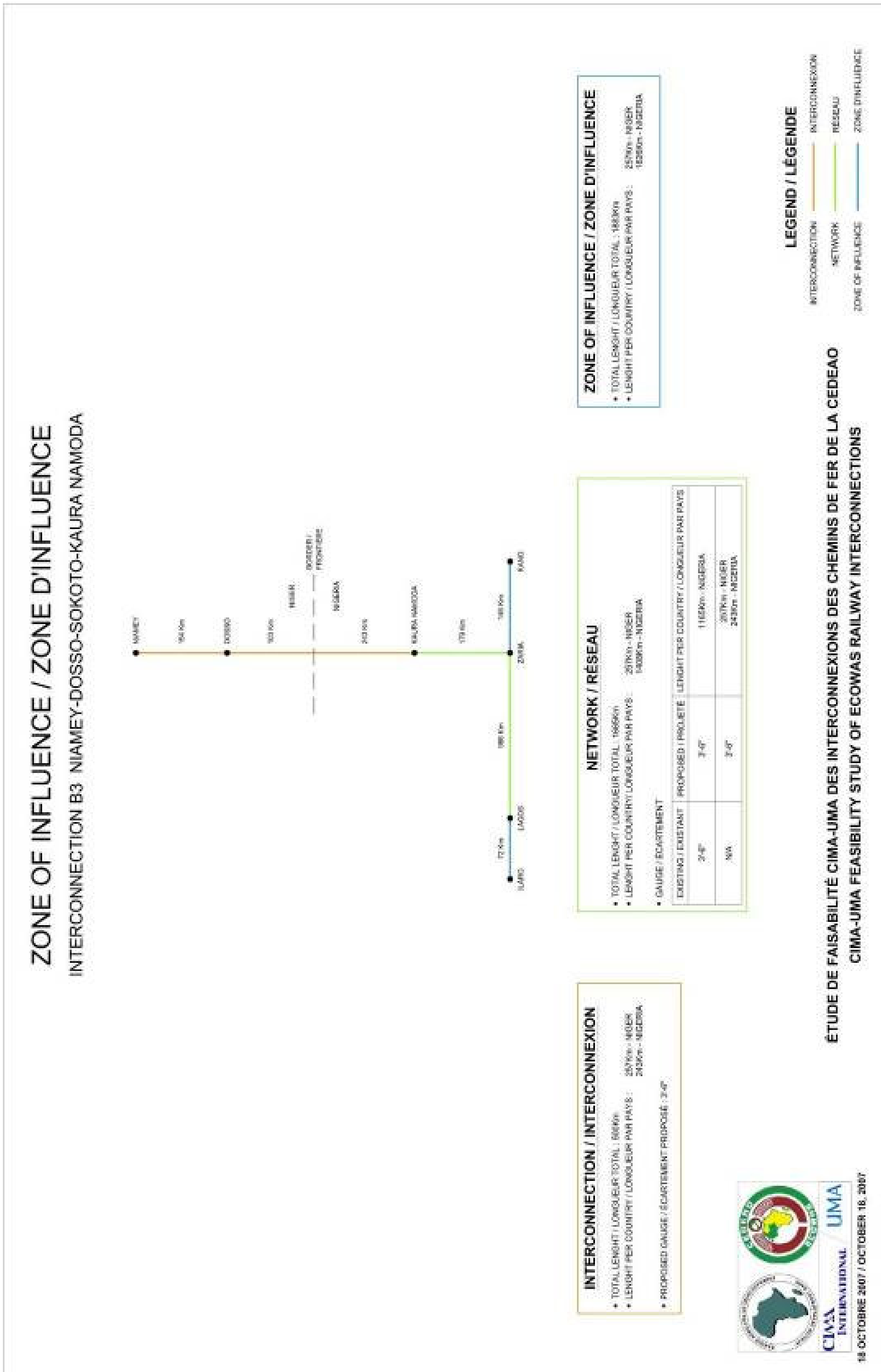
30 AOÛT 2007 / AUGUST 30, 2007
NIGER
NIGERIA
BÉNIN
TOGO
GHANA
BURKINA FASO
CÔTE D'IVOIRE
MALI
LIBERIA
SIERRA LEONE
GUINÉE
GUINEA-BISSAU
GAMBIA
SÉNÉGAL


ZONE OF INFLUENCE / ZONE D'INFLUENCE
INTERCONNECTION B3 NIAMEY-DOSSO-SOKOTO-KAURA NAMODA
NIAMEY
154 Km
DOSSO
103 Km
NIGER
BORDER / FRONTIERE
NIGERIA
243 Km
KAURA NAMODA
179 Km
72 Km
186 Km
149 Km
ILARO
LAGOS
ZARIA
KANO
INTERCONNECTION / INTERCONNEXION
• TOTAL LENGHT / LONGUEUR TOTAL : 500Km
• LENGHT PER COUNTRY / LONGUEUR PAR PAYS : 257Km - NIGER 243Km - NIGERIA
• PROPOSED GAUGE / ÉCARTEMENT PROPOSÉ : 3'-6"
NETWORK / RÉSEAU
• TOTAL LENGHT / LONGUEUR TOTAL : 1666Km
• LENGHT PER COUNTRY/ LONGUEUR PAR PAYS : 257Km - NIGER 1408Km - NIGERIA
• GAUGE / ÉCARTEMENT
EXISTING / EXISTANT | PROPOSED / PROJETÉ | LENGHT PER COUNTRY / LONGUEUR PAR PAYS
3'-6" | 3'-6" | 1165Km - NIGERIA
N/A | 3'-6" | 257Km - NIGER 243Km - NIGERIA
ZONE OF INFLUENCE / ZONE D'INFLUENCE
• TOTAL LENGHT / LONGUEUR TOTAL : 1883Km
• LENGHT PER COUNTRY / LONGUEUR PAR PAYS : 257Km - NIGER 1626Km - NIGERIA
LEGEND / LÉGENDE
INTERCONNECTION — INTERCONNEXION
NETWORK — RÉSEAU
ZONE OF INFLUENCE — ZONE D'INFLUENCE
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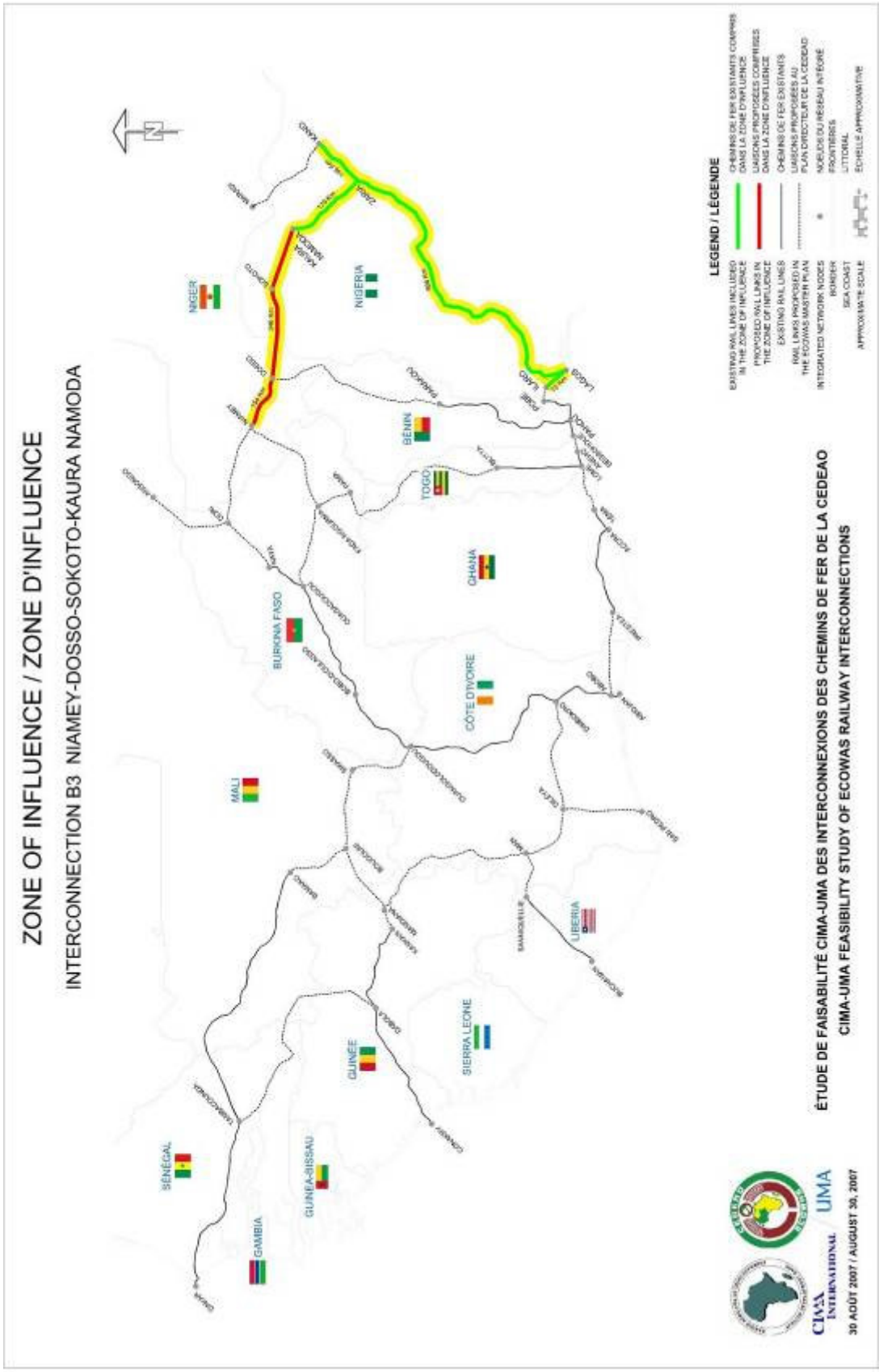
CIMA-UMA FEASIBILITY STUDY OF ECOWAS RAILWAY INTERCONNECTIONS


ZONE OF INFLUENCE / ZONE D'INFLUENCE
INTERCONNECTION B3 NIAMEY-DOSSO-SOKOTO-KAURA NAMODA
LEGEND / LÉGENDE
ÉTUDE DE FAISABILITÉ CIMA-UMA DES INTERCONNEXIONS DES CHEMINS DE FER DE LA CEDEAO
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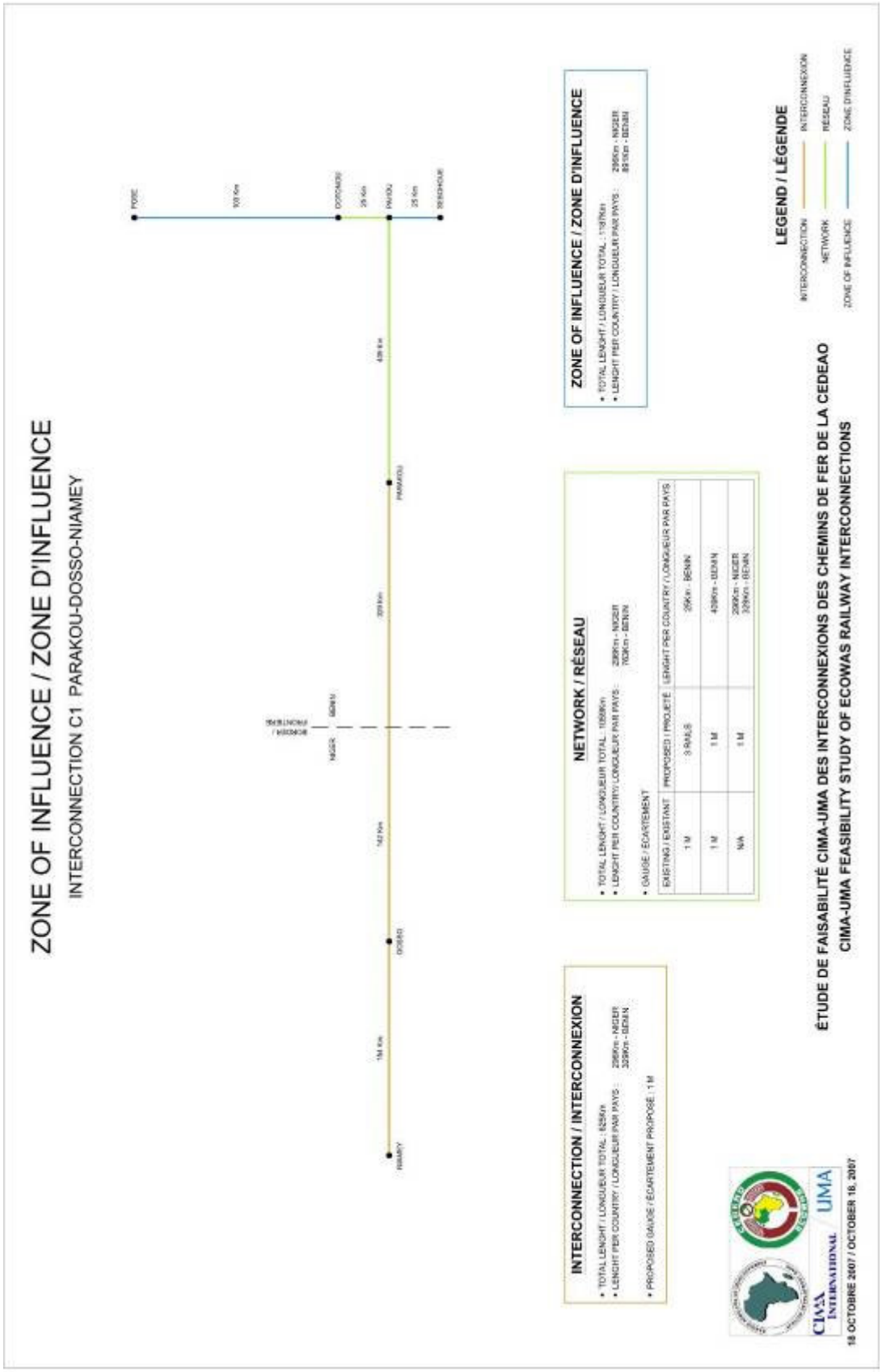
NIGER
NIGERIA
BÉNIN
TOGO
GHANA
BURKINA FASO
CÔTE D'IVOIRE
MALI
LIBERIA
SIERRA LEONE
GUINÉE
GUINEA-BISSAU
GAMBIA
SÉNÉGAL


ZONE OF INFLUENCE / ZONE D'INFLUENCE
INTERCONNECTION C1 PARAKOU-DOSSO-NIAMEY
PORE
DOSSO
PARAKOU
SEGBOHOUE
NIAMEY
NIGER
BENIN
INTERCONNECTION / INTERCONNEXION
• TOTAL LENGHT / LONGUEUR TOTAL : 626Km
• LENGHT PER COUNTRY / LONGUEUR PAR PAYS : 298Km - NIGER
328Km - BENIN
• PROPOSED GAUGE / ECARTEMENT PROPOSE : 1 M
NETWORK / RÉSEAU
• TOTAL LENGHT / LONGUEUR TOTAL : 1058Km
• LENGHT PER COUNTRY/ LONGUEUR PAR PAYS : 298Km - NIGER
760Km - BENIN
• GAUGE / ECARTEMENT
EXISTING / EXISTANT
PROPOSED / PROJETE
LENGHT PER COUNTRY / LONGUEUR PAR PAYS
1 M
3 RAILS
25Km - BENIN
1 M
1 M
439Km - BENIN
N/A
1 M
298Km - NIGER
328Km - BENIN
ZONE OF INFLUENCE / ZONE D'INFLUENCE
• TOTAL LENGHT / LONGUEUR TOTAL : 1187Km
• LENGHT PER COUNTRY / LONGUEUR PAR PAYS : 298Km - NIGER
889Km - BENIN
LEGEND / LÉGENDE
INTERCONNECTION
NETWORK
ZONE OF INFLUENCE
INTERCONNEXION
RÉSEAU
ZONE D'INFLUENCE
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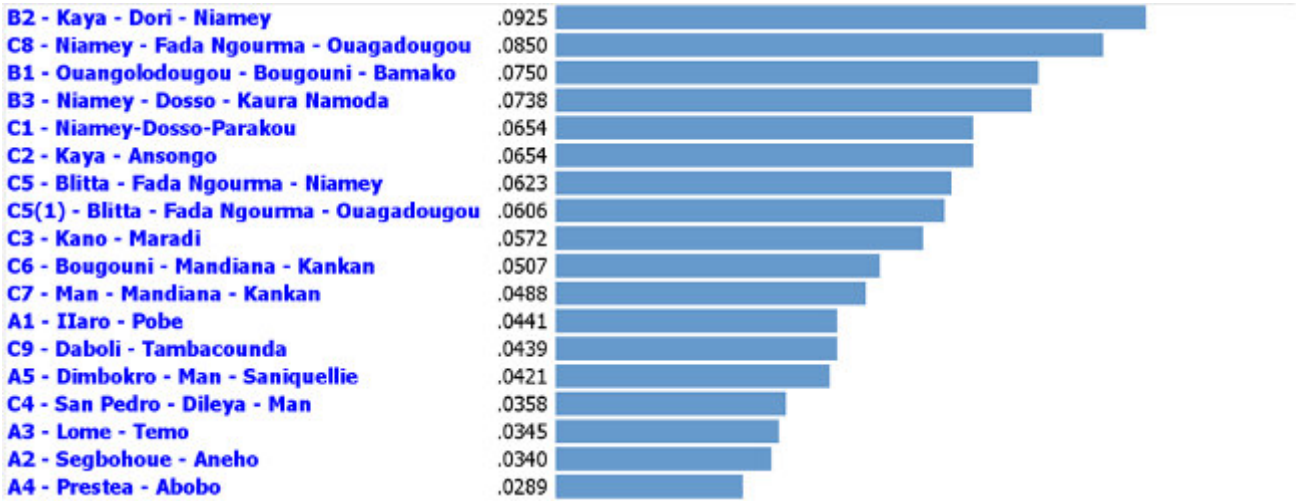
APPENDIX C. CLASSIFICATION OF NEW RAILWAY LINKS

Global Ranking

The final step is to standardize the vectors of the previous table and to calculate the score for the various projects by the vector product of the criteria and the interconnections; that is what is done by the Expert Choice software. The results displayed in the following figure, on a standardized scale of 0 to 1 (the sum of the scores is the unit):



The B2 link (Kaya-Dori-Niamey) is the first with a priority of 0.0075 point (8.8%) over the second link (C8 Ouagadougou-Fada Ngourma-Niamey). The latter distances itself from the next link (B1 Bamako- Bougini-Sikasso-Ouangolodougou) by 0.01 point, that is 13.3%. There are 0.0012 point separting B1 from the fourth link (B3 Niamey-Dosso-Sokoto-Kaura Namoda), that is 1.6%. Finally, B3 has 0.084 point over the C1 and C2 links, that is 12.8%.

These observations lead to a very important conclusion, with regards to the incremental development of the ECOWAS integrated network. The missing links of the sub-Sahelian axis are among the ones favoured by the evaluators. On the strength of these results, the Consultants recommend that the implementation of the B2 link have first priority when starting the works for the West African integrated railway network.

Classification based on the assessment criteria

Diagram 1: Strategic Criterion - Opening-up Landlocked Territories

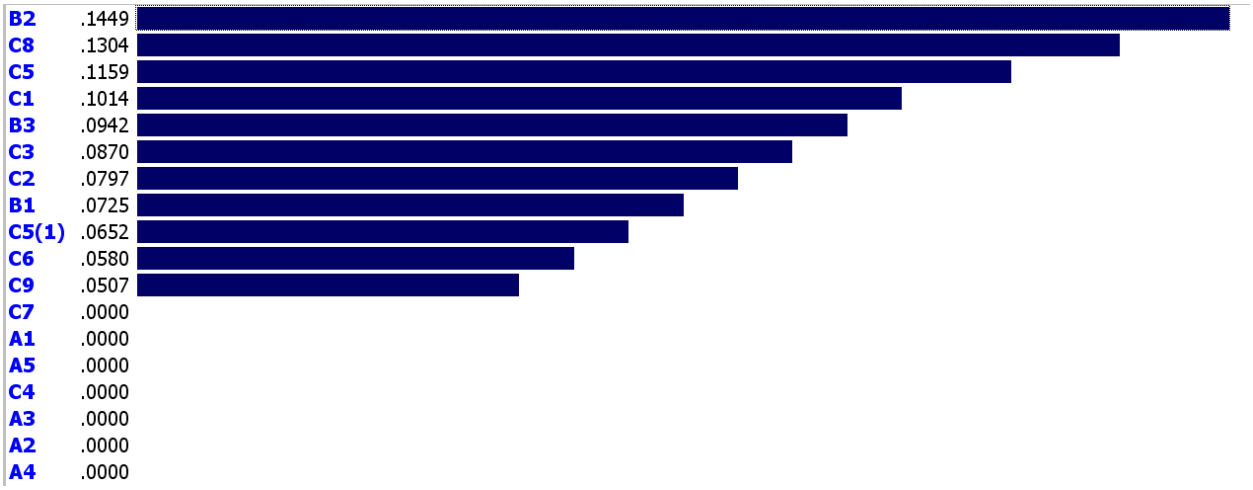


Diagram 2: Strategic Criterion - Regional Integration

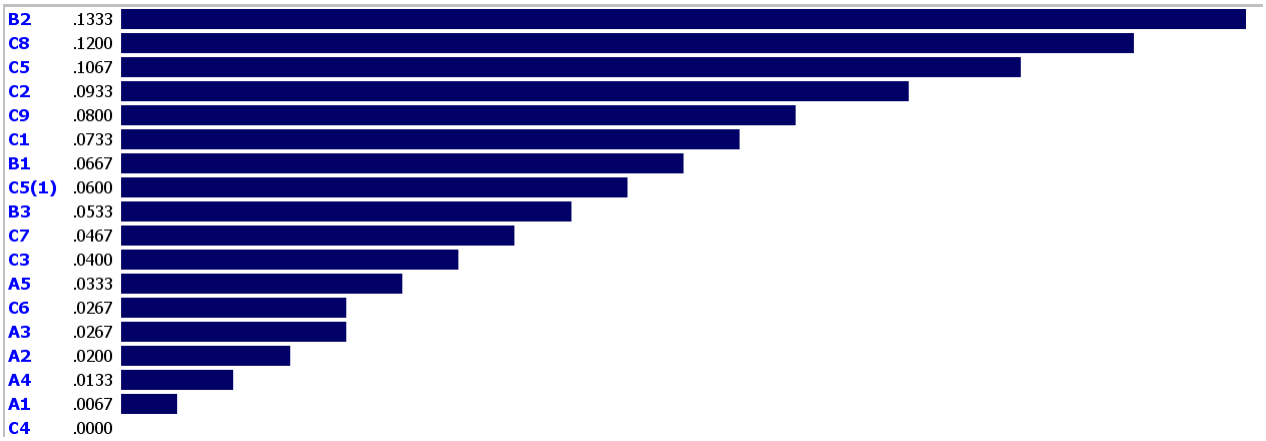


Diagram 3: Strategic Criterion - Regional Networking

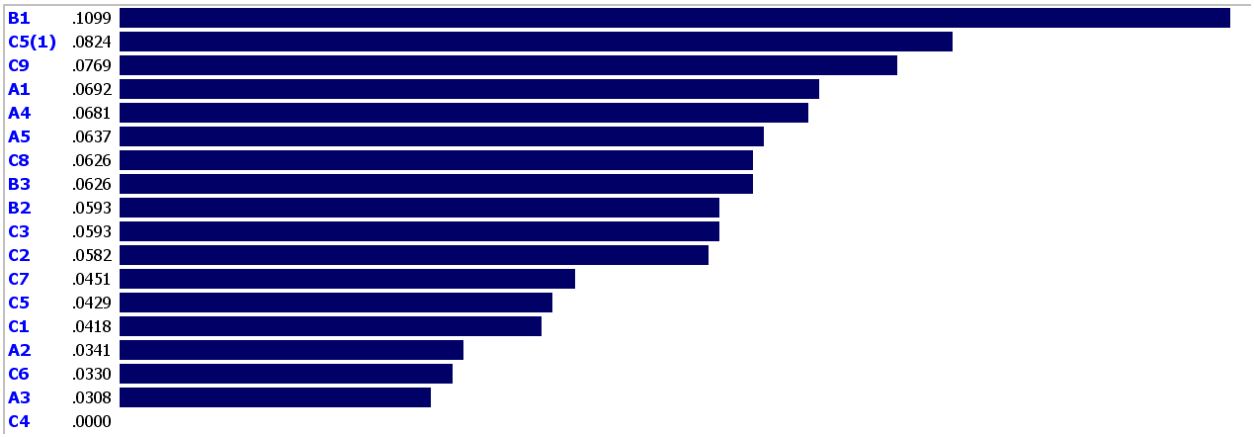


Diagram 4: Strategic Criterion - Economic Cooperation

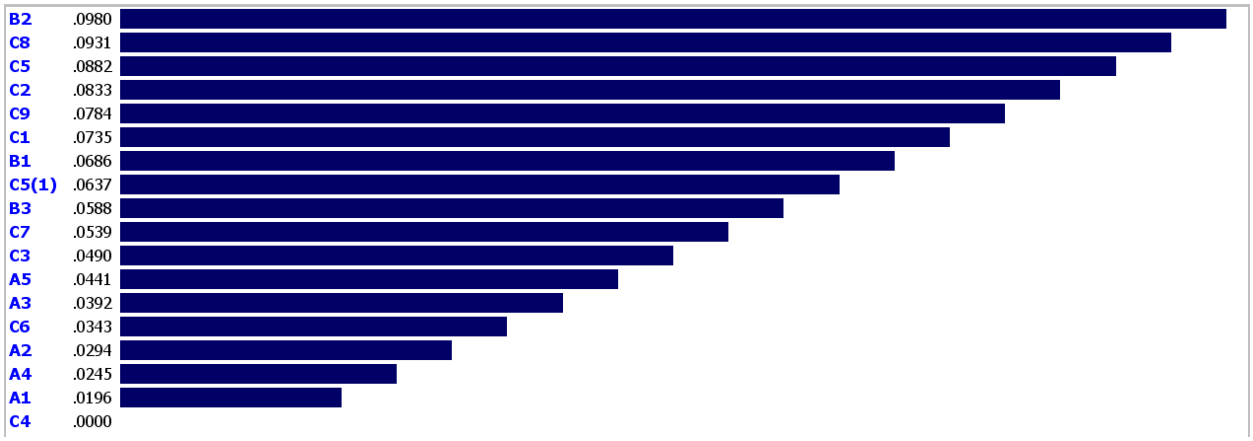


Diagram 5: Economic Criterion - Economic Viability

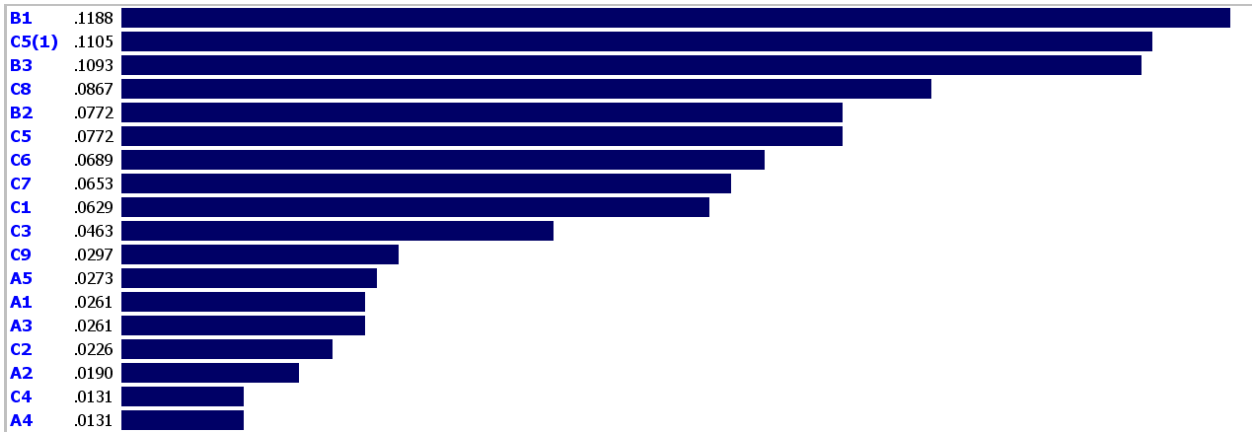


Diagram 6: Economic Criterion - Financial Profitability

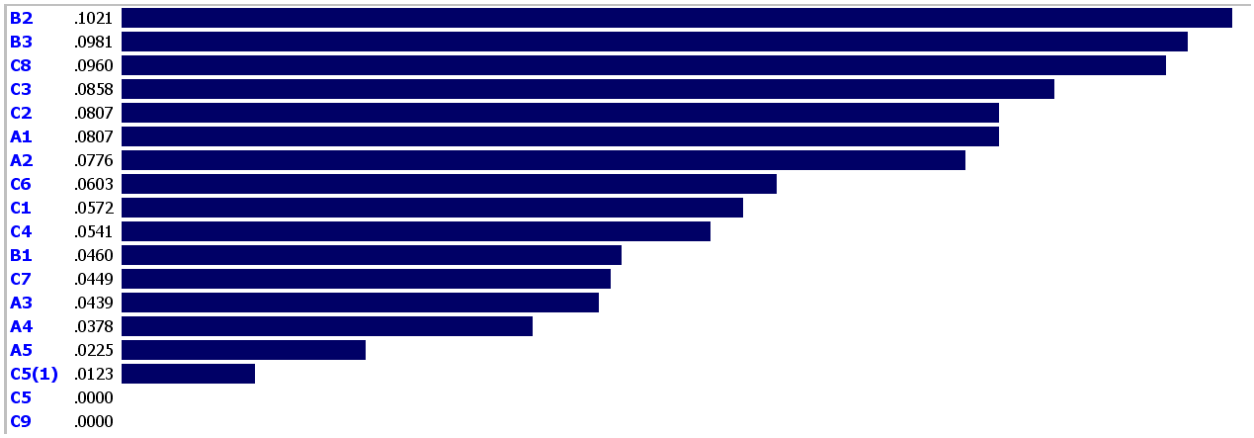


Diagram 7: Economic Criterion - Resource Potential

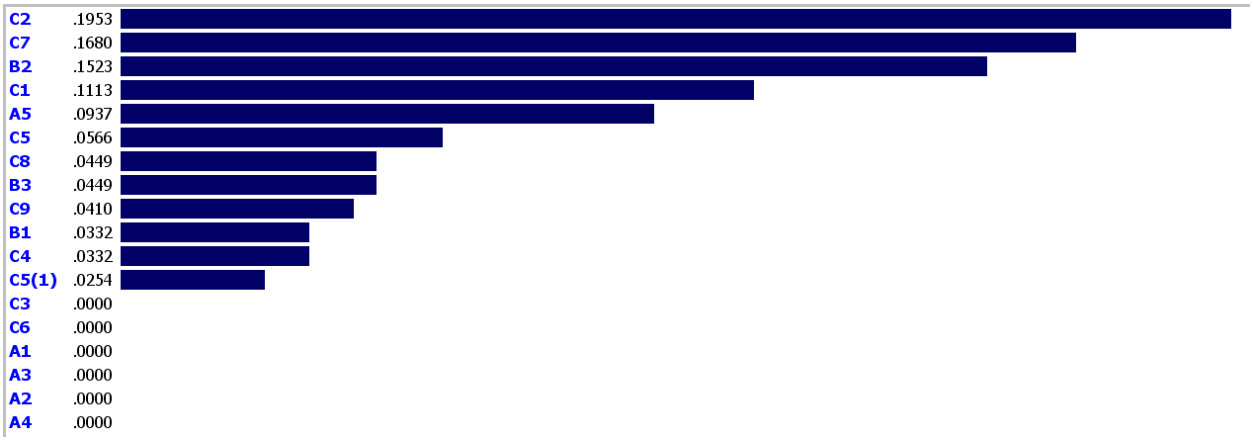


Diagram 8: Economic Criterion - Transport Mobility

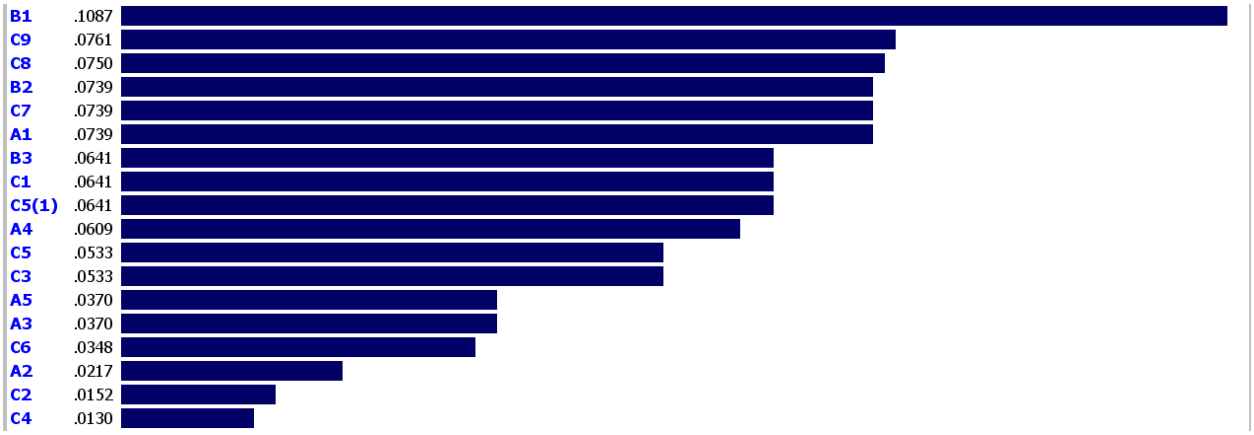


Diagram 9: Economic Criterion - Modal Integration

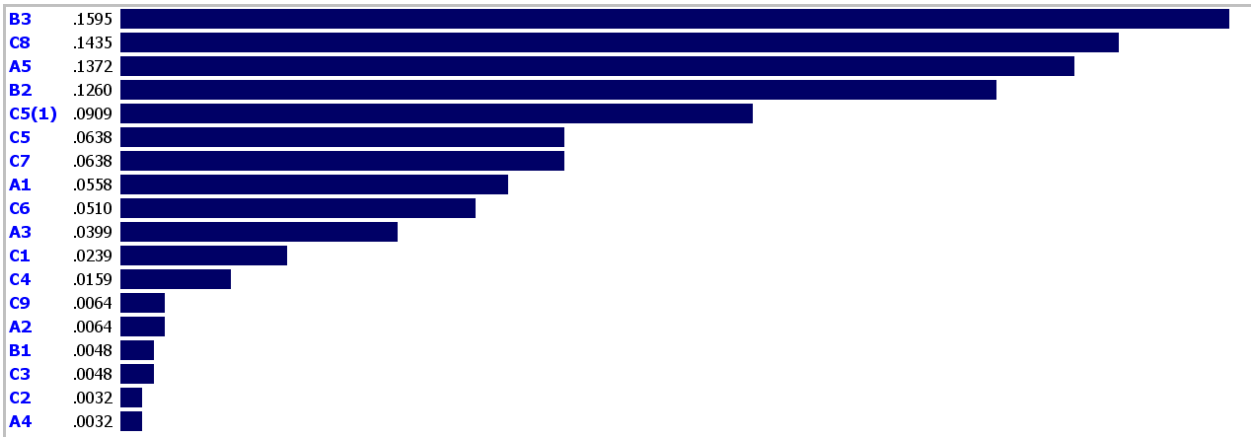


Diagram 10: Economic Criterion - Permanent Employment

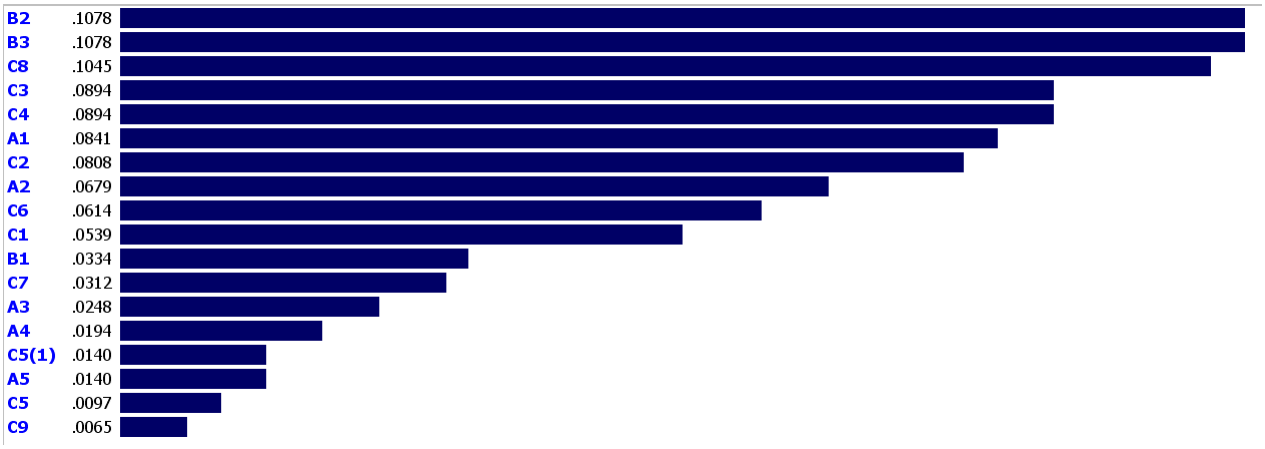


Diagram 11: Economic Criterion - Temporary Employment

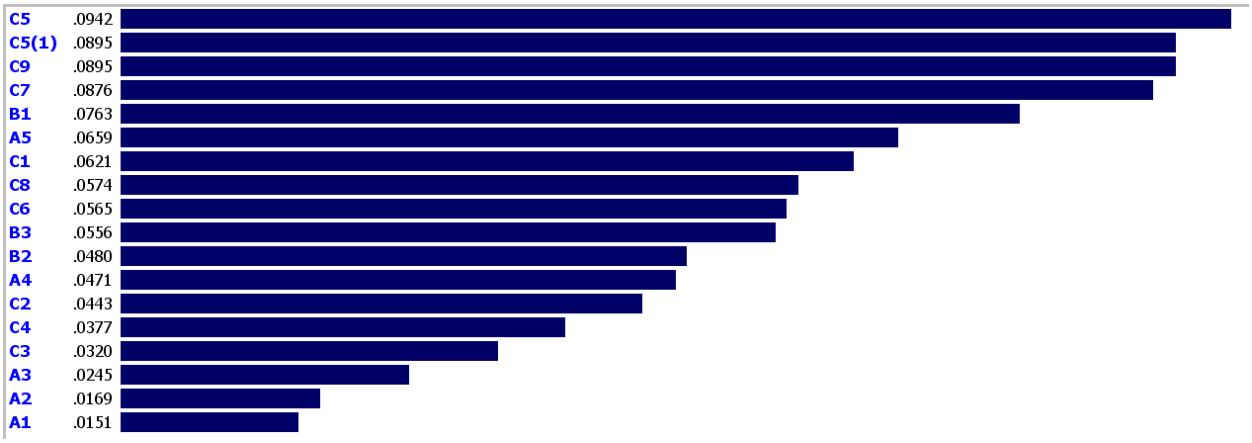


Diagram 12: Institutional Criterion - Transport Policy

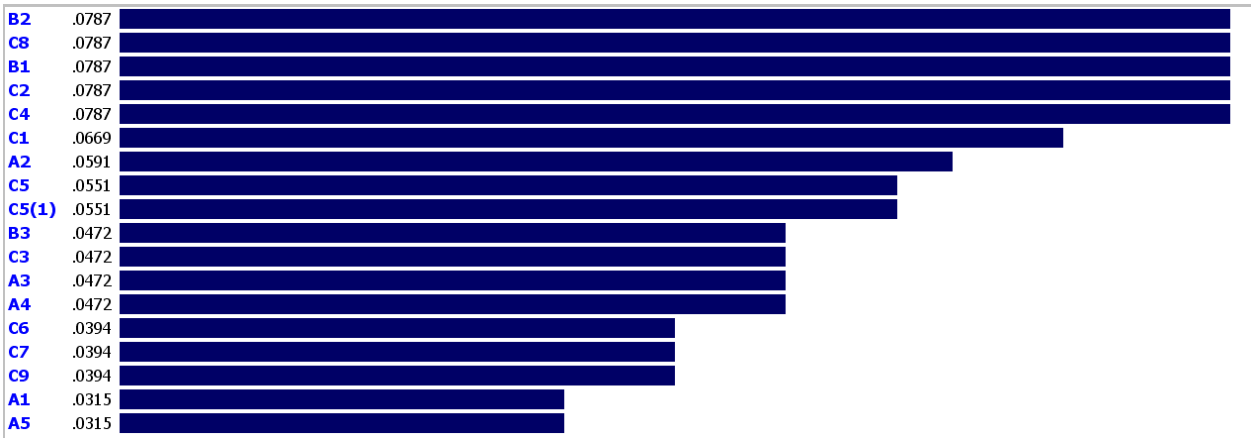


Diagram 13: Institutional Criterion - Regulatory Reforms

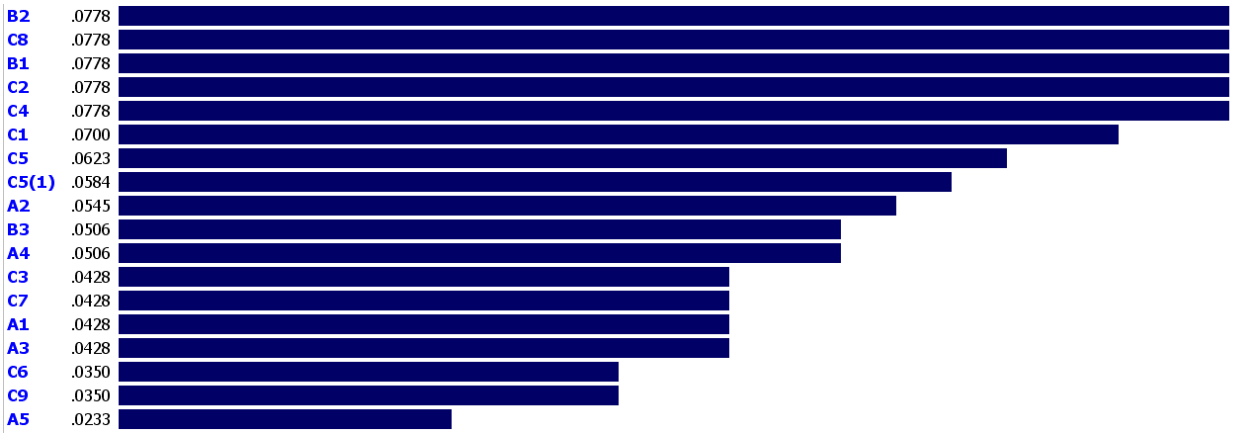


Diagram 14: Institutional Criterion - Administrative Reform

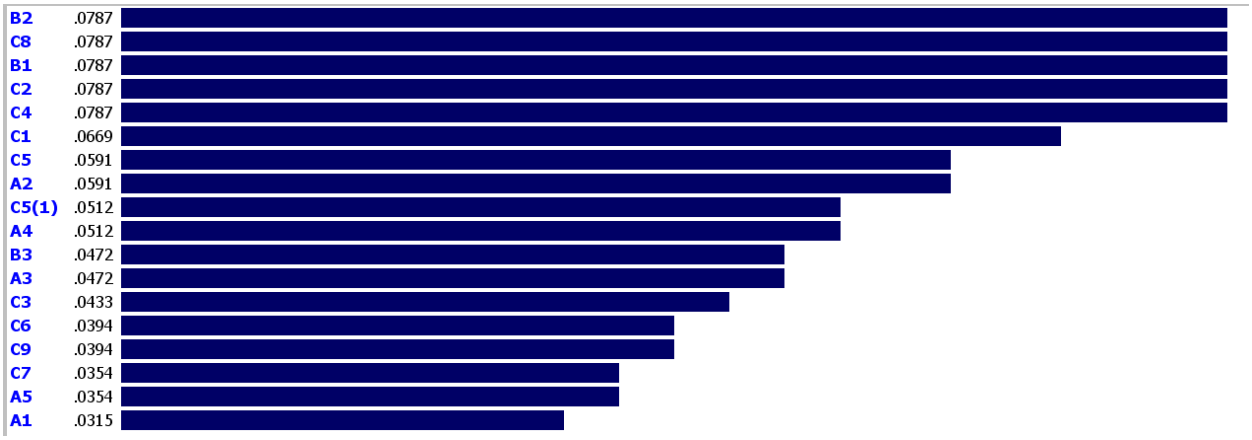


Diagram 15: Environmental & Social Criterion - Ambient Air

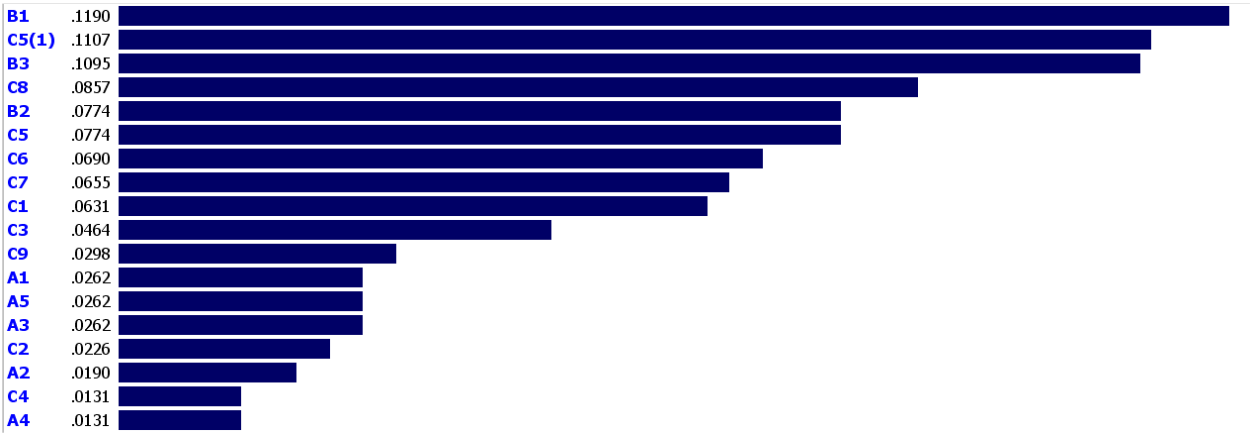


Diagram 16: Environmental & Social Criterion - Human Environment

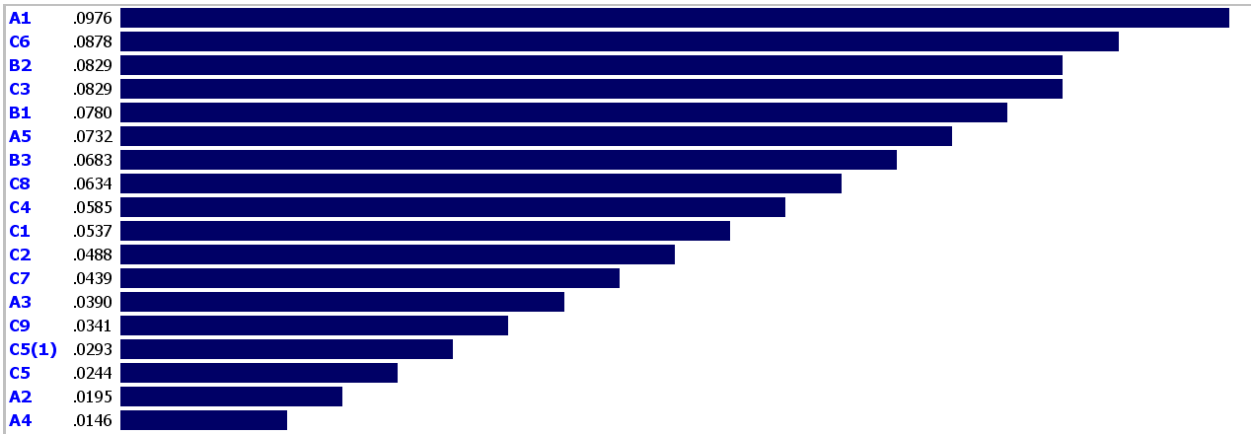


Diagram 17: Environmental & Social Criterion - Biological Environment

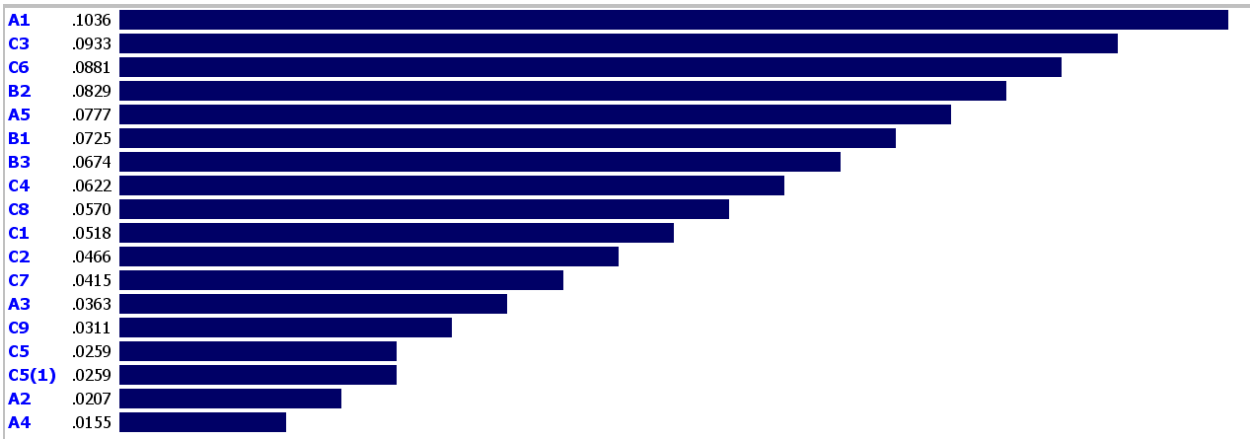


Diagram 18: Environmental & Social Criterion - Physical Environment

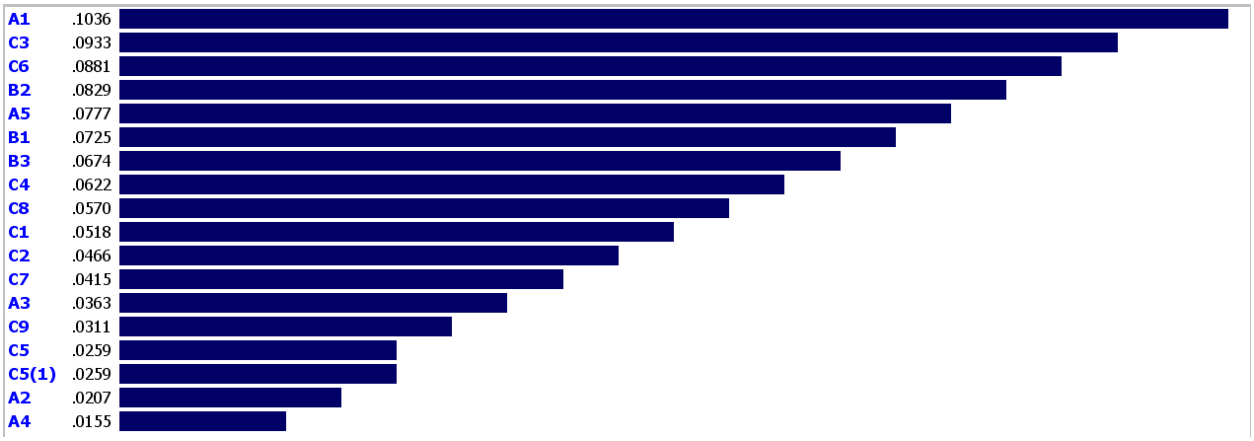


Diagram 19: Technical Criterion - Track Layout

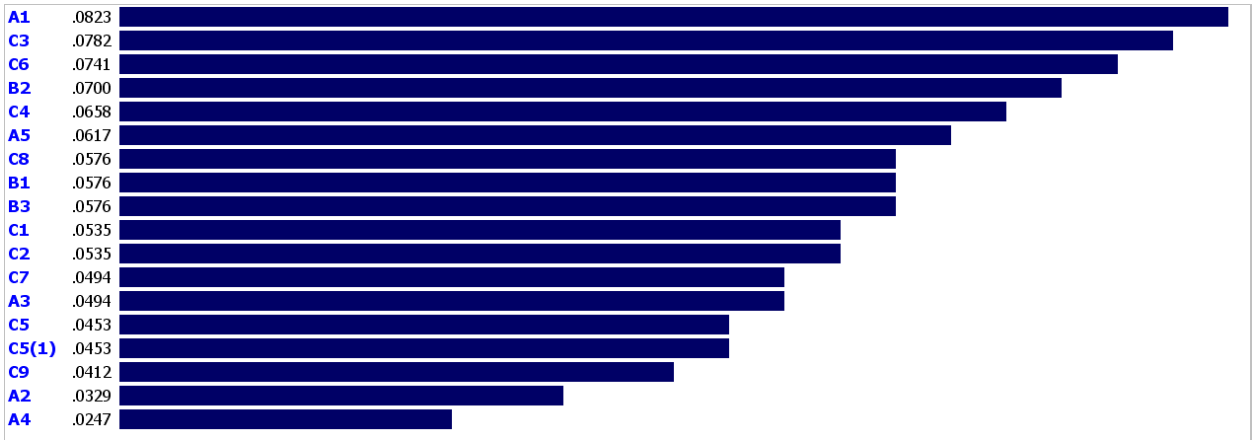


Diagram 20: Technical Criterion - Railway Infrastructures

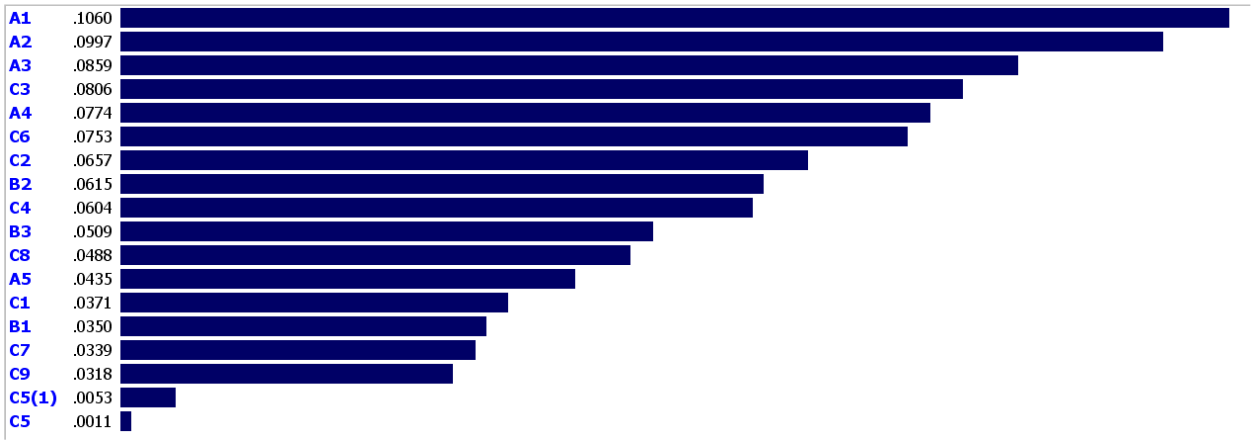


Diagram 21: Technical Criterion - Railway Rehabilitations

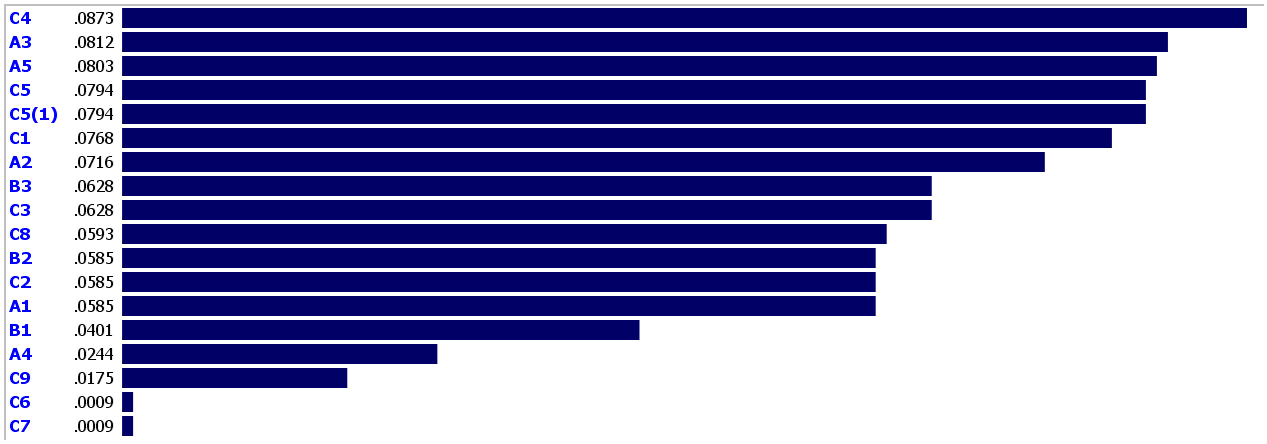


Diagram 22: Technical Criterion – Rolling Stock