

# Logistics Performance Evaluation in West Africa

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**Abstract:** With containerization and supply chains stimulating global trade each country has to apply measures and new strategies in order to maintain or develop a relevant position in this area. West Africa have now the support and financial power to reach their full potential. By betting in infrastructure reform and resource integration, West African countries might achieve the desired goal of construction, industrialization and a better layout of sea and airports that enables the interconnection of transportation infrastructures. Therefore, this thesis research focuses on the study and optimization of logistics performance evaluation through West Africa. Firstly, evaluating the current status of the logistics system in West Africa. Secondly, since the problem is complex and dynamic, to ensure the evaluation is successful, this research will mainly analyze and focus on the central logistics crossing the West African region; assess the intra-regional logistics systems and develop the logistics systems based on the importance of coastal ports, roads, railways and waterways present in the key geographical points. Lastly, by crossing the actual West African regional statistics with past data and outlooks, a reliable source of information will help establish an optimal futuristic expectation.

**Keywords:** West Africa; Logistics Performance; Analytic Hierarchy Process.

## 1. Introduction

### 1.1. Research Background

The world's economy has been in constant change and evolution. For each nation there has been growth or decline of said economy. As economy rules the world, those changes influence every aspect of the nation's development and sustainability. West African communities are no different. Especially when it comes to the economic impact in the engineering development and consequently in areas like trade, infrastructures and business.

West African countries are mostly resource rich countries, and their economic development largely depends on resource exports. However, the long-term colonial history has led to the "imbalance and fragmentation" of the logistics system in the region, and the serious shortage of the quantity and capacity of its logistics infrastructure, which has become an important constraint to the regional economic development and integration process.

Due to historical reasons later explained in this paper, most West African countries are still in development and have now reached a crucial growth stage. A major part of its development is the import and export trade. To achieve a successful trade system is necessary not only to ensure a rightful functioning of road, railway, waterway and airway infrastructures as well as being able to handle the cargo input and output, have trained personnel to deal with any situations, smooth customs and border operations and establish a sustainable communication and transportation system. Overall, it is needed to ensure good quality throughout the whole process. And that is what the Logistics Performance is all about [2,3].

### 1.2. Scope of study

West Africa has a superior geographical location, rich natural resources, a large population and broad development

space. However, due to the colonial history and the development of urbanization after independence, the West Africa region is fragmented and the gap between urban and rural development within countries is widened; At the same time, the widespread religious and ethnic differences and anti-government armed forces in various countries in the region make the danger of local unrest still an important constraint on regional economic development. The geographical scope of this study covers 16 countries in West Africa, including Senegal, Gambia, Guinea Bissau, Guinea, Sierra Leone, Liberia, C ô te d'Ivoire, Ghana, Togo, Benin, Nigeria, Cape Verde, Niger, Burkina Faso, Mali and Mauritania [4-11]. See Figure 1 for the geographical distribution of countries in West Africa (Figure 1).

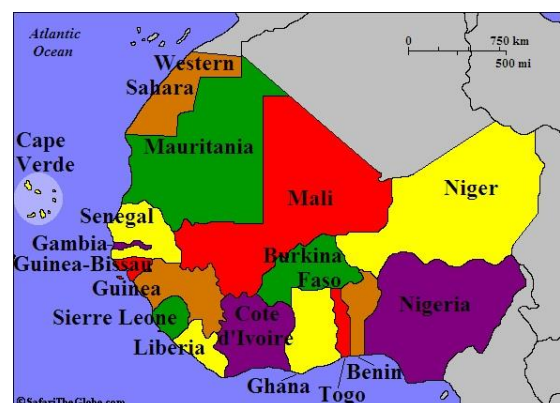


Figure 1. Geographical Map of West African Countries

## 2. AHP – Analytic Hierarchy Process

Looking at a regional logistics situation, it's an extremely complex situation. It involves a number of relevant factors: regional economic/social state, governance objectives and approaches, environmental, economic and social benefits to be achieved after the final decision, transportation structure,

infrastructures care, etc. Facing such a complex system with such complex factors makes it nearly impossible to study it exclusively with a qualitative or quantitative approach. In systematic analysis of social, economic and management issues, is usual to be faced with an interrelated system of constraints. The Analytic Hierarchy Process provides a concise and practical decision method for the analysis of such problems in this field [12-14].

This thesis evaluation shall abide by the following steps:

Step 1. Hierarchic Alize the problem - according to the nature of the problem and the goal to be achieved the problem is divided into different components and the factors are grouped in different levels according to their connections and a multi-level analytical structural model is formed;

Step 2. Reduce the system analysis according to the relative importance weight - organize from the lowest importance to highest by single sorting each problem by comparing their importance to each other;

Step 3. Quantify the comparative judgement - by using the adopted 1-9 scale method and inserting it in the judgment matrix;

Step 4. Calculate the maximum characteristic of the matrix and its corresponding eigenvector;

Input the elements of judgment matrix  $A$ , ( $A = (a_{ij})_{n \times n}$ ) in turn to determine its matrix, in which  $a_{ij} = 1/a_{ji}$ ;

Calculate the n-th root of the product of the elements in each row of the judgment matrix  $A$

$$\bar{w}_i = \sqrt[n]{\prod_{j=1}^n a_{ij}} \quad (i = 1, 2, \dots, n) \quad (1)$$

Normalize vectors  $\bar{w} = (\bar{w}_1, \bar{w}_2, \dots, \bar{w}_n)^T$

$$w_i = \frac{\bar{w}_i}{\sum_{i=1}^n \bar{w}_i} \quad (i = 1, 2, \dots, n) \quad (2)$$

The obtained  $w = (w_1, w_2, \dots, w_n)^T$  is the eigenvector.

Calculate the maximum eigenvalue of the judgment matrix  $\lambda_{max}$

$$\lambda_{max} = \sum_{i=1}^n \frac{(AW)_i}{nw_i} \quad (3)$$

Where  $(AW)_i$  represents the nth element of the vector  $AW$ ;

Step 5. Sorting the calculated results - giving relative importance from elementary to highest levels, with no less than one top level factor;

Step6. Obtain the total ranking weight value of the hierarchy - the relative weight of the lowest factor relative to the top layer (sort a sequential relative priority scheme from top to bottom).

### 3. Analysis of West Africa regional logistics system

#### 3.1. Characteristics of highway construction

Influenced by colonial history and geographical factors, West Africa has not yet formed a road transportation system that covers the whole region, has a balanced distribution and has uniform standards. Most of the road traffic lines go deep into the mainland from coastal ports, but they are not connected with each other, which is not conducive to the economic development of inland hinterland, nor to the overseas trade of inland regions and countries. Table 1 shows the conditions of highways in West African countries. The current situation of road infrastructure in West Africa is unsatisfactory. There are many low-grade roads, less than 30%

of which are asphalt pavements, and the road density is only 1/3 of that in Asia; As far as the modernization level of roads is concerned, in addition to the outstanding performance of the Abidjan Lagos corridor, road traffic in other West African countries is poor, showing the following characteristics in general:

(1) The construction standards are diverse. Due to historical reasons, the road construction standards of West African countries basically follow those of the former suzerain countries, resulting in significant differences in road construction standards in West Africa.

(2) Unbalanced development. Except Senegal, the overall road conditions in western countries are poor. With Abidjan as the boundary, the road conditions on the east side are obviously different from those on the west side. In larger cities, except that the main roads are mostly asphalt pavement, the rest are dirt roads with poor flatness.

**Table 1.** Condition of regional road network

| Network Percentage | Road condition (%) |      |      | Road type (%) |       |         |         |
|--------------------|--------------------|------|------|---------------|-------|---------|---------|
|                    | Good               | Fair | Poor | Un-known      | Paved | Unpaved | Unknown |
| Burkina Faso       | 58.2               | 33.6 | 8.2  | 0.0           | 100.0 | 0.0     | 0.0     |
| Cote D'Ivoire      | 16.1               | 47.1 | 35.4 | 1.0           | 90.3  | 9.7     | 0.0     |
| Ghana              | 70.3               | 23.6 | 6.1  | 0.0           | 100.0 | 0.0     | 0.0     |
| Mali               | 66.6               | 21.7 | 0.0  | 11.7          | 99.6  | 0.4     | 0.0     |
| Senegal            | 39.8               | 15.1 | 45.1 | 0.0           | 99.8  | 0.2     | 0.0     |

Source: AICD, various sources.

#### 3.2. Characteristics of railway construction

The railway construction in West Africa basically stayed in the former colonial period. In addition to a number of short distance railways (mainly standard tracks) newly built due to export demand in recent years, most of them are in a state of disrepair and out of service, with a large proportion of narrow tracks and poor connectivity. The overview of main railways is shown in Table 2.

Currently, the West African railways account for a total of 11,242 km, but most of the sections are short distance.

In order to improve the Benin railway system, the government has been putting effort in bringing fresh capital to the country (through private investments).

Through a competitive process, in 2010 the concession of the railway was granted to a private company. And it is being developed further. Although Liberia has 3 private mineral railways, currently none of them is completely operational. Recent deals and arrangements will allow rehabilitation of these railways. Also, the Nigerian government has been betting heavily in this transportation system, utilizing funds for several projects – railway related. Ghana has its own railway company (Ghana Railways Company) which operates on a national level, serving the country between Accra-Kumasi and Takoradi. Relatively to most railways in the West African region, GRC has acceptable traffic levels and exhibits a mediocre operational performance.

Of the 4 countries possessing a link, Cote D'Ivoire and Burkina Faso have the smoothest operation: they conjointly own Sitarail, a multinational railway. Awarded as a concession to the private sector in 1995, this line is crucial in the transport of bulk cargo to and from both countries.

**Table 2.** West African railway details

| Country   | Railways Total Length (km) | Track Gauge(mm) | Shared links  |
|---|----------------------------|-----------------|---------------|
| Benin   | 578                        | 1000            | None          |
| Burkina Faso                                      | 622                        | 1000            | Cote D'Ivoire |
| Cote D'Ivoire                                     | 660                        | 1000            | Burkina Faso  |
| Ghana   | 1300                       | 1067            | None          |
| Guinea  | 1086                       | 1435/1000       | None          |
| Liberia   | 500                        | 1000            | None          |
| Mali  | 729                        | 1000            | Senegal       |
| Mauritania  | 704                        | 1435            | None          |
| Nigeria   | 3505                       | 1067            | None          |
| Senegal   | 906                        | 1000            | Mali          |
| Sierra Leone                                      | 84                         | 1067            | None          |
| Togo  | 568                        | 1000            | None          |
| Cape Verde, G. –Bissau, Niger, Gambia No Railways |                            |                 |               |

Source: by the Author (with Wikipedia and CIA data).

### 3.3. Characteristics of aviation construction

West African countries have different numbers of large and

small airports, but most of them are no civil airports, with small traffic volume, short voyage, few routes, and no navigation with many neighboring countries. See Table3 for the information of major international airports in 2020. With the development of regional economy and the investment of international capital, the development of air transport in West Africa will be further promoted. At present, there are 42 international airports in West Africa, and the distribution of large international airports is also seriously unbalanced. The reason is the imbalance of economic development and the number of people.

In fact, merely 72 of those airports are of public use, which means that only 34% of the West African airports actually have a purpose that benefits trade, the countries expansion and have a large span of destinations. Besides that, most of the countries have 1 single hub airport, which is another disadvantage as the flow is all concentrated in one airport, and the lack of proper organization impedes its functioning at an optimal level. The other airports have a small traffic volume, short and few routes and don't have a great number of connections with neighboring countries.

**Table 3.** West Africa Airways Information

| Country       | Airlines                       | Hub Airports | Airports | Commercial Use | Paved runways* |
|---------------|--------------------------------|--------------|----------|----------------|----------------|
| Benin         | ASKY Airlines                  | Cotonou      | 6        | 2              | 1              |
| Burkina Faso  | Air Burkina                    | Ouagadougou  | 23       | 3              | 2              |
| Cape Verde    | TACV Cabo Verde Airlines       | Praia        | 3        | 5              | 5              |
| Cote D'Ivoire | Air Cote d'Ivoire              | Abidjan      | 5        | 1              | 0              |
| Gambia        | Afrinat International Airlines | Banjul       | 1        | 1              | 1              |
| Ghana         | Ghana Airways                  | Accra        | 10       | 5              | 5              |
| Guinea        | Starbow Airlines               |              |          |                |                |
| G-Bissau      | Air Guinee                     | Conakry      | 16       | 1              | 1              |
| Liberia       | NONE                           | O. Vieira    | 6        | 2              | 1              |
| Mali          | Lone Star Airways              | Monrovia     | 12       | 2              | 2              |
|               | Air Mali                       | Bamako       | 27       | 7              | 5              |
|               | STA Trans African Airlines     |              |          |                |                |
| Mauritania    | Air Mauritanie                 | Nouakchott   | 22       | 10             | 9              |
|               | Mauritania Airways             |              |          |                |                |
| Niger         | Air Niger                      | Agadez       | 19       | 1              | 1              |
| Nigeria       | Arik Air                       | Abuja        | 29       | 15             | 15             |
|               | Bellview Airlines              |              |          |                |                |
|               | Dana Air                       | Lagos        |          |                |                |
|               | Overland Airways               |              |          |                |                |
| Senegal       | Air Senegal                    | Dakar        | 17       | 11             | 8              |
|               | International Senegal Airlines |              |          |                |                |
| Sierra Leone  | Fly Six                        | Freetown     | 8        | 5              | 3              |
| Togo          | Westair Benin                  | Lomé         | 7        | 1              | 1              |

\*Commercial Use runways paved with asphalt or concrete

On the positive side, out of the 72 commercial airports, 60 (83.3%) have paved runways, which is a positive point, as it facilitates airplane traffic in the airport. An exception to the norm is Cape Verde: despite its geographical challenges and small population, it has 3 international airports and all of them satisfy international security standards. Against any odds, Cape Verde has an extensive airways network. Although the prices improved, they are still relatively high, with a fare of nearly 146 USD is the price for a round trip between islands.

### 3.4. Characteristics of shipping construction

#### 3.4.1. Port

The coastline of West Africa is 6065km long, and there are 9 large ports. As can be seen from Table 4(data Source: World Bank and respective port authorities' data). Lagos Port in Nigeria, Tema Port in Ghana, Abidjan Port in C ô te d'Ivoire and Dakar Port in Senegal are relatively large.

On the whole, the ports in West African countries are

mainly small and medium-sized, and the infrastructure is generally poor. The number of container berths is small and the level is low. The maximum berthing capacity is 4500TEU container ships. The customs clearance time is long and the port charges are high. Since the vast majority of West African countries are resource exporting countries, their oil tanker terminals are constructed and operated by major multinational oil companies, and such terminals are preferred.

**Table 4.** West Africa main ports relevant details

| Country       | Port     | Channel Depth (m) | Terminal Size (km) | Container Port Throughput (TEU) |
|---------------|----------|-------------------|--------------------|---------------------------------|
| Benin         | Cotonou  | 11                | 11                 | 353,000*                        |
| Cote D'Ivoire | Abidjan  | 10,6              | 11,5~12,5          | 674,624**                       |
|               | Tema     | 12,5              | 11,5               | 956,374*                        |
| Ghana         | Takoradi | 11,5              | 10                 | 53,381*                         |
| Guinea        | Conakry  | 10,2              | 10,5               | 171,900*                        |
| Nigeria       | Lagos    | 8                 | 10,5~13,5          | 1,050,000*                      |
| Senegal       | Dakar    | 11                | 11,6~13            | 570,500*                        |
| Togo          | Lomé     | 14,5              | 9,5                | 1,193,800*                      |
|               |          |                   |                    | *2017                           |
|               |          |                   |                    | **2018                          |

TEU: Twenty Foot Equivalent Unit

### 3.4.2. Inland navigation

Most West African countries do not have large-scale inland river transport, and there are sporadic activities such as sea river transit in Guinea Bissau, Gambia, Ghana, Mali, Nigeria and Senegal. In Gambia and Guinea Bissau, 85% of the residents live 20 kilometers away from the waterway navigation point, and can reach important ports through inland river transportation. Therefore, river transportation and offshore sea transportation are important modes of transportation. Due to the economic downturn, infrastructure and transport vessels are relatively backward.

It is worth mentioning the Volta Lake in Ghana, as shown in Figure 3-6. At present, there are two freight docks built in 1984 in the lake area of Volta Lake. The route between the north and south ends is 420km long. The current transport capacity of the lake area includes one 700-ton dry bulk carrier and ten small barges. The ship draft is about 2.8-3m. It takes 8-10 days to go back and forth between the north and south ends. At present, there are two voyages per month. At present, the shipping development in the Volta Lake area is relatively low. The function of the lake area as a logistics channel connecting the north and south of Ghana has not been fully utilized. The high-quality land along the lake area has not been reasonably developed. The whole lake area and its coastal areas have huge development potential.

## 4. Logistics Performance Evaluation in West Africa

In order to conduct the West Africa regional logistics performance evaluation, the AHP method will be used as a mean to process and quantify information. Concerning to West Africa, due to its environment and political state, it is important to also account for such social factors. Including political stability in the evaluation is extremely important as it provides an insight and highlights the distinctive nature of the regions state. Furthermore, it displays how the alleged stability (or instability) of a region can affect its levels of attractiveness and general business.

Unfortunately, there is a lack of information and study regarding to the West African region, its logistics and port/air/land overall performances. After careful study and

data collected from literature assessment and other works it was concluded that many factors aren't suitable for inclusion in the current analysis. So, in an attempt to make this research as complete as possible, a total of 8 main criteria and 22 sub-criteria were taken as the main evaluation points.

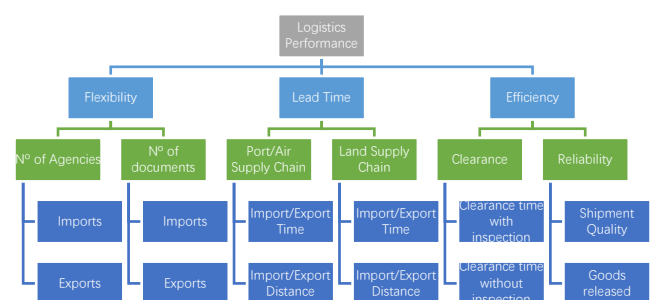
The evaluation of each criteria is obtained through the results of 2 separate surveys conducted with port and logistics managers, teachers, students, engineers and workers. The first part of the survey uses a Saty scale from 1 to 9 to judge the sub criteria, were 1 means unimportant, 5 means average importance and 9 is extremely important. Overall, the judgments made by the participants were moreover consistent and provided the necessary confidence to proceed with the study.

### 4.1. Logistics Overall Performance

There are many factors that influence the logistics performance of a company, port or even a country. In this paper, the research is focused on a more general evaluation of the West African countries. As so, the multi-criteria chosen to represent an accurate evaluation of said nations is one that fits the rest of the world's scales but at same time provides an insight on the region's situation (considering its environment). Out of the 25 indicators often used by the World Bank to conduct research, 12 will be used in this evaluation. The main focus of this performance is evaluation is as not to compare the West Africa region with the outside world but conduct an internal comparison among these neighboring countries.

Due to being countries in development and mostly with rural areas, Cape Verde, Mali, Senegal, Guinea and Guinea Bissau have insufficient data to conduct a proper study and still be compared with other regions. Unluckily, the existent data isn't from official or trust worthy sources and the speculations from various sources differ greatly. So, it was decided that they shall be removed from the AHP comparison and overall Logistics Performance comparison.

The hierarchy displayed in Figure 2 illustrates the indicators selected to conduct this research and their interconnections.



**Figure 2.** Decision Hierarchical Structure for Logistics Performance

### 4.2. Construction of Comparing Matrix

#### (2) Logistics Overall Performance

The Logistics overall performance evaluation was done by comparing the survey results. In this case, the survey was taken by employers from a freight company, teachers and managers. Figure 3 and Figure 4 showcase the pairwise comparison (with the normalized Eigenvector) and the unscaled comparison matrix respectively:

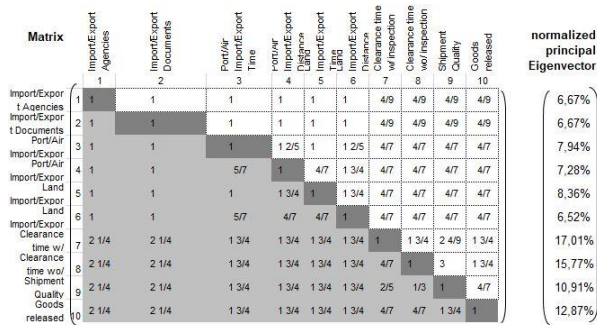


Figure 3. Logistics Performance: Pairwise Comparison Matrix

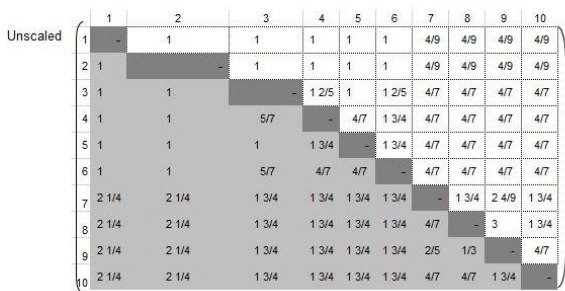


Figure 4. Performance: Unscaled Comparison Matrix

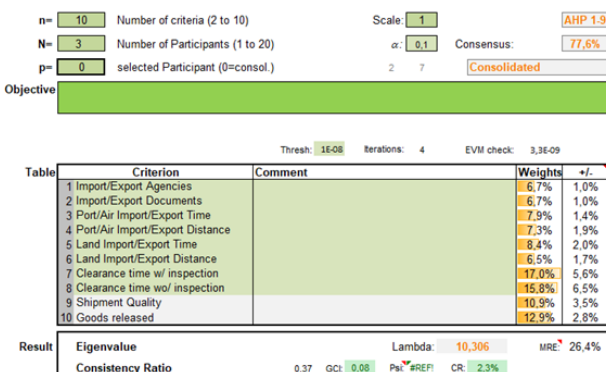


Figure 5. Logistics Performance: Criteria final weight - Source: Author AHP Excel

According to the results (Figure 5) obtained, the census (with more or less error) is that the most influential factor when accounting for any enterprise, region or company logistics performance is Efficiency, as Clearance time with inspection (17%) comes 1st, followed by Clearance time without inspection (15,8%) and Goods released after customs clearance (12,9%). The general consensus was of 77, 6% and the consistency ratio was of 2, 3%. Those rates are acceptable, especially considering that the individuals that took the survey have different job functions.

Table 5. West African region rank based on logistics performance

| Criteria           | Flexibility    |         |                 |         |
|--------------------|----------------|---------|-----------------|---------|
|                    | N° of agencies |         | N° of documents |         |
| Sub Criteria       |                |         |                 |         |
| 3rd Level Criteria | Exports        | Imports | Exports         | Imports |
| Benin              | 0,800          | 0,867   | 0,667           | 0,867   |
| B. Faso            | 0,667          | 0,667   | 0,600           | 0,600   |
| C. D'Ivoire        | 0,667          | 0,733   | 0,600           | 0,733   |
| Gambia             | 0,533          | 0,667   | 0,533           | 0,667   |
| Ghana              | 0,933          | 0,933   | 0,933           | 0,933   |
| Liberia            | 0,667          | 0,533   | 0,733           | 0,733   |
| Mauritania         | 0,933          | 0,867   | 0,867           | 0,933   |
| Niger              | 0,733          | 0,733   | 0,933           | 0,933   |
| Nigeria            | 0,600          | 0,600   | 0,600           | 0,600   |
| Senegal            | 0,800          | 0,667   | 0,733           | 0,800   |
| Togo               | 0,800          | 0,800   | 0,800           | 0,800   |
| WEIGHT             | 0,067          | 0,067   | 0,067           | 0,067   |

Ultimately, by gathering all the information, normalizing the factors, weighting and comparing the indicators a conclusion was reached. For most of the participants, efficiency is the most important characteristic when accounting for the logistics of a region. Hence, reliability and clearance are crucial. Being able to provide a complete service that is quick and fits the client's needs smoothly is indispensable and it makes a difference between choosing the hubs of a region or another.

As we can see in the Table 5~Table 7, Togo, Senegal and Gambia have the best logistic performance out of the 11 countries analyzed (through the AHP method criteria). In this case we must consider several aspects:

The evaluation isn't regarding the infrastructure or other outside components, but the transport and trade of the material when it is already in the country;

The countries geographical condition (Togo, Senegal and Gambia) are small countries, so obviously regarding lead time, their times will be smaller than other countries, which affects the weight and consequently the rank;

If we analyze the components and rank them individually, the outcome could have been different.

Is not a surprise that Togo (2nd) and Senegal (1st) exhibit a great logistic performance? As seen before in the port's evaluation, the ports of Dakar and Lomé have great conditions to receive, maintain and ship product. These two ports are amongst some of the busiest in Africa. However, their policies and handling are far better than other African countries. One can only expect that the same progress is extended to the whole trade and transport network in the countries. Gambia (3rd) besides Cape Verde, is the smallest country in West Africa. As such, even if the countries logistics isn't the best, the fact that the lead time is extremely small and that the reliability percentage is high aids the country to maintain a high rank.

On the other side, Ghana (10th) and Cote D'Ivoire (8th) are the countries with the biggest area, hence the largest lead time that paired with flawed efficiency place it low. Nevertheless, when analyzing the components individually we can assess that both of them excel in most of the criteria. Contrarily, Burkina Faso and Benin have a long way to go. Compared with the remaining countries of the region (if we discard area and what it implies), these countries performance is rather low and most of the criteria have unsatisfactory results.

Overall, the West African region has an ok Logistics Performance but the Leading Time and the Efficiency shall be worked on and improved in order to keep boosting the economy, the trade, industry and consequently the quality of life in the country.

**Table 6.** West African region rank based on logistics performance

| Criteria    | Lead Time                                       |                  |   |                  |   |                  |   |                  |
|-------------|---|------------------|---|------------------|---|------------------|---|------------------|
|             | Export time/distance<br>(Port/Air supply chain) |                  | Import time/distance<br>(Port/Air supply chain) |                  | Export time/distance<br>(Land supply chain) |                  | Import time and distance<br>(Land supply chain) |                  |
|             | 3rd Level<br>Criteria                           | Distance<br>(km) | Lead<br>time (days)                             | Distance<br>(km) | Lead<br>time (days)                         | Distance<br>(km) | Lead<br>time<br>(days)                          | Distance<br>(km) |
| Benin       | 0,989   | 0,767            | 0,989   | 0,833            | 0,821                                       | 0,883            | 0,989   | 0,950            |
| B. Faso     | 0,853   | 0,917            | 0,944   | 0,967            | 0,301                                       | 0,300            | 0,301   | 0,350            |
| C. D'Ivoire | 0,997   | 0,933            | 0,997   | 0,933            | 0,753                                       | 0,767            | 0,943   | 0,733            |
| Gambia      | 0,999   | 0,983            | 0,999   | 0,983            | 0,999                                       | 0,983            | 0,999   | 0,983            |
| Ghana       | 0,945   | 0,983            | 0,945   | 0,983            | 0,679                                       | 0,983            | 0,999   | 0,967            |
| Liberia     | 0,944   | 0,883            | 0,944   | 0,883            | 0,853                                       | 0,833            | 0,853   | 0,833            |
| Mauritania  | 0,301   | 0,783            | 0,602   | 0,467            | 0,301                                       | 0,900            | 0,944   | 0,983            |
| Niger       | 0,999   | 0,983            | 0,853   | 0,800            | 0,894                                       | 0,967            | 0,946   | 0,983            |
| Nigeria     | 0,991   | 0,950            | 0,987   | 0,967            | 0,992                                       | 0,900            | 0,918   | 0,933            |
| Senegal     | 0,945   | 0,983            | 0,944   | 0,883            | 0,999                                       | 0,983            | 0,977   | 0,950            |
| Togo        | 0,997   | 0,967            | 0,999   | 0,950            | 0,947                                       | 0,917            | 0,968   | 0,900            |
| WEIGHT      | 0,073   | 0,079            | 0,073   | 0,079            | 0,065                                       | 0,084            | 0,065   | 0,084            |

**Table 7.** West African region rank based on logistics performance

| Criteria    | Efficiency            |   |   |                       | Final Score | Rank |
|-------------|-----------------------|---|---|-----------------------|-------------|------|
|             | Clearance             |   | Reliability                               |                       |             |      |
|             | 3rd Level<br>Criteria | Clearance<br>time wo/<br>inspection<br>(days) | Clearance time<br>w/ inspection<br>(days) | Goods<br>released (%) |             |      |
| Benin       | 0,667                 | 0,643   | 0,992                                     | 0,991                 | 0,809       | 9    |
| B. Faso     | 0,867                 | 0,786   | 0,990                                     | 0,991                 | 0,771       | 11   |
| C. D'Ivoire | 0,867                 | 0,643   | 0,990                                     | 0,995                 | 0,827       | 8    |
| Gambia      | 0,933                 | 1,000   | 0,990                                     | 0,991                 | 0,923       | 3    |
| Ghana       | 0,533                 | 0,357   | 0,992                                     | 0,994                 | 0,780       | 10   |
| Liberia     | 0,933                 | 0,929   | 0,990                                     | 0,995                 | 0,899       | 5    |
| Mauritania  | 0,933                 | 1,000   | 0,992                                     | 0,996                 | 0,854       | 7    |
| Niger       | 0,800                 | 0,857   | 0,990                                     | 0,992                 | 0,909       | 4    |
| Nigeria     | 0,867                 | 0,857   | 0,990                                     | 0,991                 | 0,886       | 6    |
| Senegal     | 0,933                 | 0,929   | 0,993                                     | 0,994                 | 0,939       | 1    |
| Togo        | 0,867                 | 0,929   | 0,995                                     | 0,994                 | 0,926       | 2    |
| WEIGHT      | 0,158                 | 0,17  | 0,129                                     | 0,109                 |             |      |

### 4.3. Overall Judgment of Regional Logistics System in West Africa

Based on the results obtained, it is clear that the region still needs work and improvement. The region has been growing and prospering during the last years, but to have a greater development, problems and solutions must be accessed.

The data obtained and the data produced shows that indeed some countries are logistically advanced but yet have flaws. Most of the logistic performance related issues are related to the countries current economic and social status. For example, the necessity of better infrastructure is undoubtedly evident. Even though the requirements differ from country to country, along the region there is a lack in the main infrastructure ranges such as Power, Transport, Water and Healthcare. Infrastructure development is the main cause of logistics problems. Regrettably, there are still some issues concerning transportation and flow, the average lead time in the region for imports is 5 days. Besides that, the cost is high: it is more expensive to import cargo from neighboring countries the West African region than to import them from the United Kingdom.

On the positive side, reliability wise West African performance is excellent and above the average in the continent. And most of the other factors are still improving, with new regulations and reforms nearly every month.

### 4.4. Development Strategies

Considering the Overall judgement, it's inevitable to suggest some solutions to the problems and to the setbacks that don't allow the West African Region to exhibit a better performance.

Firstly, improving the infrastructures of the region is crucial! Having better infrastructures and reliable power source can improve the performance extremely, as it contributes to a smooth flow between channels and nodes, promotes better solutions for problems that might occur and boosts security as well. Creating better options for railway/port/airway infrastructure precaution and refining operational safety in the West African Region will only encourage the expansion of West Africa's hinterland transport network.

Secondly, betting on the population's quality life is also extremely important, as it boosts population's mood and consequently the work performance will be higher, which means the logistics in the work place will be enhanced as well. Improving the political imbalances of the region, fighting corruption and ensure normal levels of safety and security can make the difference. Also, the transformation of natural resources dependent economies by doing the transition to a more industrialized region is also a good option. As it will allow more trade partners to join and empower the region.

Investing in the youth and insuring the rise of young educated population, creation of new asset classes, modification of the government revenues are some of the benefits of developing infrastructure in the West Africa region.

Also, having educated staff and personnel improves the quality of the work, decreases the time of work consequently increasing effectiveness.

Thirdly, concerning the main ports and logistics, in order to increase their performance, the region needs adjustments regarding flexibility, lead time and pricing. It's amazing that most West African countries scored above 90% regarding good released, and that's a great step. But in order to effectively increase the Logistics Performance, the clearance time needs a serious reform. The laws and procedures in place clearly are not effective and are time consuming. Most countries of the region had a score of 70% or below, which is extremely disappointing, as this criterion was the one considered the most important. Flexibility wise, the region has many agencies to process the customs but it has demanded an unusual number of documents that need to be cleared.

Although most of West African ports have a high container throughput volume and are frequently used in trade routes, the logistics performance of the ports is still a major step back that blocks most ports of bigger growth and expansion.

## 5. Conclusion

The goal of this paper was to evaluate the logistics performance on the West African region, while analyzing the state of its ports, politics, economy and overall social state. The extensive process of this evaluation went from review countless reports, papers and studies, to collecting and analyzing data, distribution of a survey and finally to a comparison amongst the data collected.

Regarding the main focus of this research, Logistics Regional Performance, the evaluation revealed that the main criteria that indicates a good performance is the Regions Efficiency: clearance time with and without inspection had the most consensus, followed by reliability (goods released after customs and shipment meeting the quality criteria) and lead time. West Africa, is a "young" region, where there are still many problems such as corruption that have a heavy impact in the development and consequently in the expansion and progress of railways, airways, hubs, ports, etc.... Consequently, the logistics of these structures often is flawed. Despite that, the growth is noticeable and the rank results show that Togo and Senegal are actually complying with the Western average. Burkina Faso and Benin rank low, and that can be explained simply by understanding the countries current condition.

Comparatively with others papers analyzed, the main difference in the results is the "Political Stability" aspect. On the few papers available about this subject, most of them ranked political stability as one of the top factors regarding attractiveness and logistics. On this paper, political stability is

below the top line.

Overall, the results produced in this research have been enlightening, showed how to select the best factors, connect them discarding conflicts and aid in the decision-making process. The results accomplished were interesting and better than the initial expectation as they show that the regions' general performance is constantly improving and provided an empirical analysis.

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