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The Cost of Transporting Cereals in West Africa

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ABSTRACT

This study examines transportation alternatives for moving cereals into position for storage under the West African Food Security Regional Reserve agreed to by the Economic Community of West African States (ECOWAS) in 2013, for which cereals were first procured in 2017. It describes the reserve’s management structure and rules for procuring commodities, both types of cereals and preferred sourcing for those purchases. The study identified countries within the 15-nation ECOWAS region where the desired types of cereals are available, and recent sources for imported rice, which is a preferred staple food in ECOWAS member countries even though the region is far from self-sufficient in this commodity. Despite the poor quality of roads and commercial trucks in much of West Africa and the official and unofficial barriers to movement of products across national borders, surface transportation of cereal shipments is determined to be the most economical mode of transportation for servicing the stockholding facilities of the regional reserve for goods originating within the continent. Significant investments are scheduled to be made in railroads that cross national borders within West Africa, as well as in infrastructure for river transport, including inland port facilities and improving navigable channels in key regional river systems, but those modes are not yet viable alternatives to road transport for most of the West Africa region.

Keywords: ECOWAS, West African Food Security Regional Reserve, West Africa, Cadre Harmonisé Bonifié, CHB, Regional Agency for Food and Agriculture, RAAF, intra-ECOWAS trade flows.
ACKNOWLEDGMENTS

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1. Introduction

Over the last decade or so, a large segment of the 335 million people living in the 15 member countries of the Economic Community of West African States (ECOWAS) have faced increased threats to their food security due to a number of factors. These factors include:

- rapid and severe increases in global commodity prices in 2007-2008 and again in 2010-2011;
- widespread natural disasters (including both flooding and droughts) across the region, resulting in production shortfalls; and
- armed conflicts in several countries, in the form of both civil wars and recurring attacks waged by Islamic insurgent groups.

In recent years, some governments within the region have taken policy actions aimed at ameliorating the impacts of these shocks on their citizens. For example, the governments of both Burkina Faso and Mali imposed export bans on cereals in 2008 in response to the price spikes, and the government of Côte d'Ivoire suspended collection of import duties on cereal imports to reduce prices for consumers (Diallo and Staatz, 2017). Such steps helped to limit the full transmission of international price volatility into these countries but also had the effect of further disrupting markets in neighboring countries.

In the wake of the 2007-2008 food price crisis, ECOWAS member countries engaged in discussions with multilateral development agencies and similar agencies in G-20 countries about ways in which the regional organization could collectively respond to such shocks. After the ECOWAS Commission received commitments of financial and technical support from the European Union, the Commission made a decision in 2013 to establish a regional cereal reserve designed to supplement reserve stocks held within individual ECOWAS member countries. This reserve has the following objectives (Traore, 2015):

- improve the effectiveness of food crisis responses;
- promote regional solidarity and integration;
- boost local food production and efficiency of regional markets; and
- reduce international aid dependency.

In this study, I will evaluate the transportation needs associated with establishing and operating a physical cereal reserve with stockpiles stored in multiple locations across the 15-country region. I will
include a discussion of the composition of the cereals that the West African Food Security Regional Reserve is expecting to procure, the locations of surplus production regions where those cereals are most likely to be procured, the likely modes of transportation to be used, and the logistics and costs associated with moving cereals and select processed products into and out of the reserve facilities.

2. **Intended Structure of the Regional Reserve**

**Policy Components**

Prior to setting up the physical parameters of the new West African Food Security Regional Reserve, the ECOWAS Heads of States determined the governing structure of this new program, particularly the rules under which commodities stored in the reserve would be released for distribution in member countries. The Regional Agency for Food and Agriculture (RAAF), located in Lomé, Togo, has been charged with the technical management of the reserve, including the establishment of a steering committee to oversee the general orientation of the reserve and a technical committee to manage the program on a day-to-day basis (Regional Agency for Food and Agriculture, 2017). The Reserve will hold two-thirds of its resources as a financial reserve, which should reduce the crowding-out pressures on private sector stock holding behavior (Le Hub Rural, 2012).

National security agency staff in countries in which storage facilities are located will conduct on-site management of the physical cereal stocks. These facilities are expected to be located primarily in northern Nigeria, Niger, or northern Benin in the Eastern sub-region of ECOWAS and in southern Mali, southern Burkina Faso, northern Togo, northern Cote d’Ivoire, or northern Ghana in the Central sub-region. The decision has been made to store up to 96 percent of the product held in the regional reserve in those two areas, with much smaller amounts to be held in Senegal, Gambia, or Guinea Bissau in the West Atlantic sub-region and either Guinea, Sierra Leone, or Liberia in the Atlantic Gulf sub-region (Gle, 2016). The regional breakdown was designed based on the staple food preferences and staple crops produced in each sub-region. The decision was made to allocate the vast majority of the physical stocks to the Eastern and Central sub-regions because of the availability of both surplus production in most years and existing storage facilities (Le Hub Rural, 2012).
Stocks of cereals or other processed foods held in the regional reserve can be acquired by ECOWAS member countries upon the request of a national government. Before such a distribution is made, a government must justify the need for the transfer based on an objective analysis of the shortfalls in that country’s national food production and other vulnerabilities. These analyses are to be conducted under the Cadre Harmonisé Bonifié (CHB) framework established by the Permanent Interstate Committee for Drought Control in the Sahel (CILSS) (Gle, 2016). Approvals of stock release are to be conditioned on confirmation of the country’s status as already facing critical food insecurity. Withdrawals are supposed to be reimbursed, either by the national government receiving the reserve stocks or by regional funds established for emergency intervention (Le Hub Rural, 2012).

In recognition of the reality that cereals degrade over time when held in storage, managers of the physical stocks held under the regional reserve are expected to keep track of the length of time that specific lots of cereals have been held and to rotate out any portion of the stocks before it has been held for three years. It is anticipated that managers will follow such a ‘first-in, first-out’ strategy when identifying stocks to be released for relief purposes; however, if normal movement of stocks for such uses does not suffice, managers are expected to sell the older stocks onto regional markets or conduct exchanges with cereal stocks maintained by ECOWAS member governments.

**Cereal Composition and Size of the Regional Reserve**

Long before the first purchases of cereals for inclusion in the Regional Reserve were actually made in 2017, extensive analyses were conducted in order to establish the appropriate size and composition (in terms of products to be held) within the reserve. The recommended composition of the stocks was established based on evaluations of both the consumption patterns and the typical production patterns of staple crops across the 15-country region in the past, as well as the on storability characteristics of those products. Recommendations based on the above information were formulated by the authors of the feasibility study with respect to minimum threshold levels for each cereal type and for select processed products by sub-region to be procured and held in the reserve in its initial stages. Those levels are shown in Table 1.
Table 1. Minimum recommended threshold levels of different products for West African Food Security Regional Reserve, by sub-region

<table>
<thead>
<tr>
<th>Cereal Type</th>
<th>Eastern</th>
<th>Central</th>
<th>West Atlantic</th>
<th>Gulf Atlantic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maize</td>
<td>15%</td>
<td>30%</td>
<td>10%</td>
<td>25%</td>
</tr>
<tr>
<td>Millet/sorghum</td>
<td>50%</td>
<td>30%</td>
<td>40%</td>
<td>0%</td>
</tr>
<tr>
<td>Rice</td>
<td>10%</td>
<td>10%</td>
<td>0%</td>
<td>0%</td>
</tr>
<tr>
<td>Gari</td>
<td>10%</td>
<td>10%</td>
<td>0%</td>
<td>0%</td>
</tr>
<tr>
<td>Enriched cereal products</td>
<td>5%</td>
<td>5%</td>
<td>0%</td>
<td>0%</td>
</tr>
</tbody>
</table>

Source: Le Hub Rural. 2012. Note: Levels do not add to 100 percent.

Maize constitutes one of the main staple crops in every country across the entire region; as such, it is the only cereal crop recommended to be held by the regional reserve in all of the ECOWAS sub-regions. Most sub-regional reserve stocks would also heavily feature millet and sorghum, and rice is recommended to be a small component of the stocks in the Eastern and Central sub-regions.

While the majority of the stocks are designated to be raw, unprocessed cereals, which are cheaper to purchase and easier to store, there is also a desire to include a processed cassava-based product called gari in the mixture. The Commission will also conduct a pilot program to study the feasibility of including enriched cereal products to assist children in a targeted way within an affected population (Le Hub Rural, 2012).

The regional reserve will consist of three components: i) a physical stock of food held at designated regional facilities, accounting for one-third of the reserve, ii) financial reserves to be held in expectation of additional needs, with sufficient funds set aside that could purchase up to two-thirds of the reserve, and iii) five percent of the national food reserve stocks of each ECOWAS member country, to be made available to the regional reserve when events demand additional food for distribution.

Plans call for the physical stock portion of the reserve to be set at 60,000 tonnes for the first four years of operation, increasing to 100,000 tonnes in year five and to 140,000 tonnes in year eight (Gle, 2016). National governments would also commit to increasing the size of their national food security stocks by the same proportion over that period. These figures were based upon the assumption that a given food security crisis would endure for a moderate length of time and that a high share of the unmet food demand would be
met by the regional reserve (Le Hub Rural, 2012).

3. **Major Crop Production Regions**

While maize (or corn) is the dominant cereal crop across Africa south of the Sahara, its production in West Africa in terms of tonnage produced is dwarfed by cassava and rice and is nearly matched by millet production in that region, according to data reported by the United Nation's Food and Agricultural Organization (FAO). Average cassava production across the 15 ECOWAS member countries was estimated at more than 76 million tonnes annually over the 2010-2014 period (Table 2). However, cassava is more difficult to transport than other staple crops and cannot be stored over long periods in its raw, unprocessed form (FAO, 2017(a)). As a result, cassava was not selected for inclusion in the West African regional reserve. Instead, the feasibility study recommended acquiring a popular cassava-based processed food product called gari for inclusion in the reserve, at least in the East and Central sub-regions.

Between 2010 and 2014, maize production averaged more than 11 million tonnes across the region, with significant output (over 100,000 tonnes) in all but six of the ECOWAS members. Nigeria is by far the largest maize-producing country in West Africa, averaging nearly 3.9 million tonnes over the five-year period; Ghana, Burkina Faso, and Benin all produced more than 1 million tonnes. Cultivated area for maize totaled 11 million hectares in 2014.

Millet and sorghum both grow better in arid climates than maize, so they are both commonly grown in the landlocked Sahel countries in the ECOWAS region, such as Mali, Niger, and Burkina Faso, as well as in the northern tier states of Nigeria. Combined, production of these two crops averaged 18.4 million tonnes (on nearly 26 million hectares) in recent years. In fact, Nigeria is third largest sorghum-producing country in the world, trailing only the United States and India in recent years (Foreign Agricultural Service, 2014).
Table 2. Average cereal production in ECOWAS member countries, 2010-14, tonnes/year

<table>
<thead>
<tr>
<th>Country</th>
<th>Cassava</th>
<th>Maize</th>
<th>Millet</th>
<th>Rice</th>
<th>Sorghum</th>
<th>Wheat</th>
</tr>
</thead>
<tbody>
<tr>
<td>Benin</td>
<td>3,742,720</td>
<td>1,206,910</td>
<td>25,672</td>
<td>200,466</td>
<td>126,684</td>
<td>0</td>
</tr>
<tr>
<td>Burkina Faso</td>
<td>4,260</td>
<td>1,357,005</td>
<td>1,021,224</td>
<td>296,759</td>
<td>1,801,531</td>
<td>0</td>
</tr>
<tr>
<td>Cabo Verde</td>
<td>5,254</td>
<td>5,093</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Cote d'Ivoire</td>
<td>2,750,805</td>
<td>651,884</td>
<td>49,801</td>
<td>1,525,750</td>
<td>48,963</td>
<td>0</td>
</tr>
<tr>
<td>Gambia</td>
<td>10,570</td>
<td>36,613</td>
<td>106,391</td>
<td>64,324</td>
<td>26,676</td>
<td>0</td>
</tr>
<tr>
<td>Ghana</td>
<td>14,961,234</td>
<td>1,806,411</td>
<td>178,538</td>
<td>522,047</td>
<td>281,442</td>
<td>0</td>
</tr>
<tr>
<td>Guinea</td>
<td>1,164,473</td>
<td>632,145</td>
<td>209,750</td>
<td>1,869,946</td>
<td>38,860</td>
<td>0</td>
</tr>
<tr>
<td>Guinea-Bissau</td>
<td>53,082</td>
<td>8,443</td>
<td>14,797</td>
<td>185,135</td>
<td>20,202</td>
<td>0</td>
</tr>
<tr>
<td>Liberia</td>
<td>516,989</td>
<td>0</td>
<td>0</td>
<td>277,277</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Mali</td>
<td>44,578</td>
<td>1,532,456</td>
<td>1,495,026</td>
<td>2,068,140</td>
<td>1,149,150</td>
<td>34,160</td>
</tr>
<tr>
<td>Niger</td>
<td>121,464</td>
<td>19,711</td>
<td>3,375,083</td>
<td>48,722</td>
<td>1,246,853</td>
<td>5,166</td>
</tr>
<tr>
<td>Nigeria</td>
<td>48,382,418</td>
<td>3,892,695</td>
<td>2,003,392</td>
<td>5,215,079</td>
<td>6,141,918</td>
<td>106,552</td>
</tr>
<tr>
<td>Senegal</td>
<td>185,775</td>
<td>190,732</td>
<td>576,205</td>
<td>494,938</td>
<td>116,278</td>
<td>0</td>
</tr>
<tr>
<td>Sierra Leone</td>
<td>3,648,211</td>
<td>44,212</td>
<td>38,150</td>
<td>1,141,597</td>
<td>28,723</td>
<td>0</td>
</tr>
<tr>
<td>Togo</td>
<td>984,630</td>
<td>728,065</td>
<td>42,262</td>
<td>158,326</td>
<td>266,346</td>
<td>0</td>
</tr>
<tr>
<td>Total</td>
<td>76,576,463</td>
<td>11,392,365</td>
<td>7,132,899</td>
<td>14,068,506</td>
<td>11,264,903</td>
<td>145,878</td>
</tr>
</tbody>
</table>


Rice is produced in significant amounts in every ECOWAS country except Cabo Verde, Gambia, and Niger. The largest amounts of rice are produced in Nigeria, Mali, and Guinea. Total rice area across the ECOWAS region was 7.7 million hectares in 2014. According to the FAO (El Behri et al., 2013), rice forms a staple food in every ECOWAS country. The share of rice in daily caloric intake in the region ranges from 40 percent in Guinea-Bissau and Liberia down to 4 percent in Niger (Shear, 2015). In recent years, demand for rice has increased significantly—up 146 percent since 1990—especially in urban areas; as a result, rice production within the region is now wholly insufficient to meet demand (FAO, 2017(c)). About 45 percent of the rice consumed in the region is imported, primarily from Thailand and Vietnam. The region's dependence on imported rice, as well as the often mediocre quality of rice milled in West African processing facilities, contributed to the decision to hold relatively low shares of rice in the regional reserve.
Although wheat is a fairly popular staple crop in some parts of West Africa, especially as wheat-based fast food consumption has increased in urban areas, there is relatively little wheat produced in the region. For the 2010-14 period, three countries (Nigeria, Mali, and Niger) produced an annual average total of only 145,878 tonnes of wheat (on less than 100,000 hectares in 2014), which is slightly lower than the amount produced in the state of Arkansas in 2016, the 39th largest wheat-producing state in the United States in that year (National Agricultural Statistics Service/U.S.Department of Agriculture, 2017). The region’s nearly total reliance on wheat imports led the ECOWAS Commission to rule out the bulk crop's inclusion in the regional reserve, although some wheat flour may be held.

As described previously, cassava (or manioc) is actually the largest crop produced by tonnage in West Africa. Other non-cereal food crops are also commonly grown in the region, including tuber (or root) crops such as yams (7.1 million hectares in 2014) and taro (920,000 hectares in 2014), pulse crops such as cowpeas (10.7 million hectares in 2014), and plantains (1.4 million hectares in 2014), which are banana cultivars that are harvested green and cooked as a starch dish. As is the case with cassava, the other root crops and plantains are not storable in their raw form; cowpeas are more costly to prepare for storage than are comparable cereal crops. For these reasons, these crops are not included in the initial product mixture for the physical reserve, although ECOWAS did commit to studying how best to incorporate cowpeas, which provides an important source of plant protein in the daily diets of many West African citizens.

4. **International Cereal Trade Flows for ECOWAS Member Countries**

Despite the nearly 75 million hectares devoted to growing cereals and other staple food crops in the 15-country ECOWAS region in 2014, the region remained a net importer of the major cereal crops. Between 2009 and 2013, the region imported nearly 6 million tonnes of rice and more than 5.6 million tonnes of wheat on an average annual basis (FAO, 2017(d)). According to the data shown in Table 3, between 2009 and 2013, Burkina Faso was a modest net exporter of maize, millet, and sorghum, Nigeria was a small net exporter of maize and millet, Benin and Togo were small net exporters of maize, and Cote d'Ivoire and Mali were small net exporters of millet. During the 1960’s, Nigeria was a significant net exporter of food, but the country’s agricultural production has not been able to keep up with population growth. Between 1960 and
2017 the Nigerian population rose from 45 million to an estimated 191 million, a four-fold increase in 57 years (World Data Atlas, 2017).

With respect to the origin of imports of milled rice, ECOWAS countries have relied primarily on Thailand, importing 1.04 million tonnes on average in 2012-2013 (FAO, 2017(e)), and Vietnam, importing nearly 700,000 tonnes over the same period. More modest amounts of milled rice are imported from Brazil (170,000 tonnes) and the United States (110,000 tonnes). France, which was the colonial power that established the eight Francophone countries within ECOWAS, accounts for 1.05 million tonnes of wheat exports to the region, while Canada (247,000 tonnes) and Argentina (68,000 tonnes) form the two next largest sources. West African maize imports come primarily from Argentina (115,000 tonnes), with much lower amounts coming from France (10,000 tonnes) and South Africa (5,000 tonnes).

1 The trade matrix data available on the FAOSTAT website did not have entries for three ECOWAS member countries: Cabo Verde, Liberia, and Guinea-Bissau.
2 These countries, which still use the CFA Franc as their common currency, are Benin, Burkina Faso, Guinea-Bissau, Ivory Coast, Mali, Niger, Senegal, and Togo.
Table 3. Net cereal trade in ECOWAS member countries, tonnes

<table>
<thead>
<tr>
<th>Country</th>
<th>Flour</th>
<th>Maize</th>
<th>Millet</th>
<th>Rice</th>
<th>Sorghum</th>
<th>Wheat</th>
<th>Total Cereals</th>
</tr>
</thead>
<tbody>
<tr>
<td>Benin</td>
<td>-29.6</td>
<td>10,318</td>
<td>NA</td>
<td>-67,6225.2</td>
<td>-9.6</td>
<td>-19,016.4</td>
<td>-74,4071</td>
</tr>
<tr>
<td>Burkina</td>
<td>-1,985.2</td>
<td>15,766.4</td>
<td>148.2</td>
<td>-328,953.6</td>
<td>4,352.2</td>
<td>-66,358.8</td>
<td>-437,642</td>
</tr>
<tr>
<td>Faso</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cabo Verde</td>
<td>0</td>
<td>-19,968.6</td>
<td>0</td>
<td>-48,041.8</td>
<td>0</td>
<td>-21,530.6</td>
<td>-92,663</td>
</tr>
<tr>
<td>Cote d'Ivoire</td>
<td>-504.4</td>
<td>-5,789</td>
<td>455.2</td>
<td>-1,127,047</td>
<td>-180</td>
<td>-504,753</td>
<td>-1,584,507</td>
</tr>
<tr>
<td>Gambia</td>
<td>-679</td>
<td>-12.8</td>
<td>NA</td>
<td>-101,932.4</td>
<td>NA</td>
<td>-2,514.6</td>
<td>-195,093</td>
</tr>
<tr>
<td>Ghana</td>
<td>-821.4</td>
<td>-29,866</td>
<td>-846.4</td>
<td>-458,395.8</td>
<td>-12</td>
<td>-284,440.6</td>
<td>-838,913.2</td>
</tr>
<tr>
<td>Guinea</td>
<td>NA</td>
<td>-1,098.4</td>
<td>NA</td>
<td>-271,210.6</td>
<td>NA</td>
<td>-15,209.6</td>
<td>-440,772</td>
</tr>
<tr>
<td>Guinea-Bissau</td>
<td>-27.4</td>
<td>-395.6</td>
<td>0</td>
<td>-70,830.6</td>
<td>0</td>
<td>NA</td>
<td>-80,211.2</td>
</tr>
<tr>
<td>Liberia</td>
<td>-11.2</td>
<td>-9,565.2</td>
<td>NA</td>
<td>-239,856.2</td>
<td>NA</td>
<td>-16,876.4</td>
<td>-287,702.8</td>
</tr>
<tr>
<td>Mali</td>
<td>29.2</td>
<td>-1,957.6</td>
<td>173.2</td>
<td>-159,922.8</td>
<td>-3,280.4</td>
<td>-136,173.8</td>
<td>-338,577.8</td>
</tr>
<tr>
<td>Niger</td>
<td>-11,863.2</td>
<td>-43,848.4</td>
<td>-5,001.6</td>
<td>-224,042</td>
<td>-19700.4</td>
<td>-3,741</td>
<td>-340,620.4</td>
</tr>
<tr>
<td>Nigeria</td>
<td>-198.6</td>
<td>778.4</td>
<td>173.4</td>
<td>-1,974,603</td>
<td>-9,709.8</td>
<td>-4,048,129</td>
<td>-6,038,301</td>
</tr>
<tr>
<td>Senegal</td>
<td>104.4</td>
<td>-119,803.6</td>
<td>-181.4</td>
<td>-801,734.2</td>
<td>-2,855.4</td>
<td>-460,289.4</td>
<td>-1,399,694</td>
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<td>-4.6</td>
<td>-1,552.6</td>
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<td>-172,800.6</td>
<td>NA</td>
<td>-9,951.2</td>
<td>-212,830</td>
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<tr>
<td>Togo</td>
<td>-352.2</td>
<td>4,076.6</td>
<td>0</td>
<td>-97,798.2</td>
<td>-26.8</td>
<td>-69,839.6</td>
<td>-161,013.6</td>
</tr>
<tr>
<td>Total</td>
<td>-16,343</td>
<td>-200,935</td>
<td>-5,079</td>
<td>-5,951,660</td>
<td>-31,422</td>
<td>-5,658,882</td>
<td>-1,864,261</td>
</tr>
</tbody>
</table>


5. Food Trade and Aid Flows

Intra-ECOWAS Cereals and Food Trade

ECOWAS was established in 1975 to increase economic integration between member countries. However, at least with respect to trade in agricultural and food products, that integration has not been realized to a significant extent. Official data on intra-ECOWAS trade flows indicate that these trade flows account for only about 17 percent of all goods traded internationally by ECOWAS countries; the share is officially even lower for agricultural products, only 11 percent as of 2015 (Guedegbe, 2016). However, it is also widely acknowledged that informal trade in goods, such as bags of cereal moved on cross-border roads without undergoing customs procedures, may actually exceed recorded trade flows in most years (Diallo et
al., 2017). Although ECOWAS’s levels of intra-regional trade are lower than those seen in most other parts of the world, the current levels in West Africa do represent an improvement from 20 years ago (Soulé and Gansari, 2010).

The global commodity price spikes in 2007-2008 increased the prices of widely traded products, such as wheat and rice, in West Africa but had less of an impact on the prices of locally produced staple crops such as sorghum and millet. These differences encouraged consumers, especially those for whom food purchases form a large part of overall spending, to substitute away from the more expensive imported cereals toward other staple crops during this period. When one country had a surplus of such crops, this created an incentive for those commodities to move into deficit regions, which frequently meant movement across national borders. Those shipments occurred through both formal and informal channels.

In the aftermath of that 2007-2008 global commodity price spike (which recurred in 2010-2011), governments in West Africa and throughout Africa south of the Sahara, invested heavily in bolstering their own agricultural production. This was often done through providing subsidized inputs, such as seed and fertilizer, to farmers. Between 2009 and 2013, the annual growth rate in the production of rice, maize, and cassava averaged 7.3 percent within the ECOWAS region (Diallo et al., 2016).

In 2015, Niger and Mali shipped 53 percent and 43 percent, respectively, of their food exports to other ECOWAS countries. In that same year, six ECOWAS countries sent less than 10 percent of their food exports to fellow ECOWAS members, including Cabo Verde and Guinea-Bissau, which sent no food exports to their neighbors (Guedegbe, 2016). These shares reflect trade in all agricultural products, not just staple crops.

One reason for the continued low level of intra-regional trade within ECOWAS is that while the member countries are transitioning toward use of a Common External Tariff, there is no such agreement to strive for common internal tariffs among the fifteen member countries. Embedded within the 15-member ECOWAS group is the 8-member West African Economic and Monetary Union (the organization’s acronym is UEMOA in French, WAEMU in English), which is composed of the Francophone countries within ECOWAS. UEMOA was established in 1994, and member countries agreed to eliminate tariff and non-tariff barriers between themselves as of 2000 (Diop, 2015). While similar liberalization is being pursued
for tariff regimes across all ECOWAS member countries, far less progress has been achieved among the non-UEMOA countries. The average bilateral tariffs on agricultural products between UEMOA countries are extremely low: either zero or less than 3 percent. However, average bilateral tariffs between UEMOA and non-UEMOA countries range between 0.1 percent (exports from Niger into Ghana) and 31.5 percent (exports from Cote d’Ivoire into Nigeria) (Guedegbe, 2016).

In addition to tariffs, trade across national borders within ECOWAS faces a number of other barriers, both formal and informal; these will be discussed at greater length later in this paper. When looking at ECOWAS countries’ trade costs with neighboring countries compared to costs of shipping to overseas customers, Guedegbe (2016) found that for Senegal, the cost of trading agricultural products with Togo is six times higher than comparable transaction costs for trading with France.

**Food Aid Flows into the ECOWAS Region**

Across the ECOWAS region, the average per capita GDP was $1,985 as of 2015, ranging from a high of $6,642 per person in Cabo Verde down to $851 per person in Liberia. According to data collected by the United Nation’s World Food Program (2017), all ECOWAS member countries except Guinea-Bissau received some amount of international food aid between 2008 and 2012.

Over that same five year period, total tonnage of food aid averaged 423,000 tonnes, with the largest amounts received by Niger (109,480 tonnes), Mali (44,691 tonnes), and Liberia (42,011 tonnes) (Table 4). The United States, Japan, Brazil, and Canada were the top bilateral donors to ECOWAS countries in 2012.

**6. Available Modes of Transportation**

When the West African Food Security Regional Reserve was established, policymakers decided to acquire the cereals to be stored from within the ECOWAS region to the greatest extent possible, at least in the opening phase of the physical reserve. Consequently, the primary focus of this section of the paper will be the examination of available options for moving cereals and other products destined for storage in the reserve facilities within West Africa.
Table 4. Average food aid tonnage and top donor countries (by tonnage) for ECOWAS countries

<table>
<thead>
<tr>
<th>Country</th>
<th>Average Tonnage 2008-2012</th>
<th>Top Donor</th>
<th>2nd Highest Donor</th>
<th>3rd Highest Donor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Benin</td>
<td>16,628.04</td>
<td>United States</td>
<td>Canada</td>
<td>Australia</td>
</tr>
<tr>
<td>Burkina Faso</td>
<td>39,868.16</td>
<td>United States</td>
<td>Japan</td>
<td>Canada</td>
</tr>
<tr>
<td>Cabo Verde</td>
<td>11,401.16</td>
<td>Japan</td>
<td>Brazil</td>
<td>NA</td>
</tr>
<tr>
<td>Cote d'Ivoire</td>
<td>24,854.38</td>
<td>United States</td>
<td>Japan</td>
<td>Canada</td>
</tr>
<tr>
<td>Gambia</td>
<td>13,909.38</td>
<td>Japan</td>
<td>Brazil</td>
<td>Canada</td>
</tr>
<tr>
<td>Ghana</td>
<td>32,422.88</td>
<td>Japan</td>
<td>Canada</td>
<td>United States</td>
</tr>
<tr>
<td>Guinea</td>
<td>16,531.90</td>
<td>Japan</td>
<td>Italy</td>
<td>Russia</td>
</tr>
<tr>
<td>Liberia</td>
<td>42,011.54</td>
<td>United States</td>
<td>Japan</td>
<td>NA</td>
</tr>
<tr>
<td>Mali</td>
<td>44,691.08</td>
<td>United States</td>
<td>Japan</td>
<td>NA</td>
</tr>
<tr>
<td>Niger</td>
<td>109,480.92</td>
<td>United States</td>
<td>Brazil</td>
<td>Canada</td>
</tr>
<tr>
<td>Senegal</td>
<td>39,975.32</td>
<td>Japan</td>
<td>Brazil</td>
<td>Canada</td>
</tr>
<tr>
<td>Sierra Leone</td>
<td>21,257.92</td>
<td>United States</td>
<td>NA</td>
<td>NA</td>
</tr>
</tbody>
</table>


**Moving Product Within or Between ECOWAS Member Countries: Road System**

In West Africa, trucks transport the bulk of freight goods of all types on road routes along eight major land corridors that link ports in coastal cities with major cities in the landlocked, Sahel countries of the region (Nathan Associates, 2013). While paved roads are relatively rare in the 15 ECOWAS member countries, accounting for only about 16 percent of all roads across the region on a weighted basis (World Road Statistics, 2017), a 2011 World Bank report indicated that the roads along these corridors are almost entirely paved and are mostly in either good or fair condition (Ranganathan and Foster, 2011).
ECOWAS is also in the process of building a Trans West African Coastal Highway, linking the 12 coastal ECOWAS member countries, as well as with neighboring non-ECOWAS member countries such as Mauritania, through high-quality paved roads. This project has been envisioned by multilateral and donor country development agencies since 1967, well before the formal establishment of ECOWAS itself (United Nations, Economic Commission for Africa, 1967). About 83 percent of the route had been paved with two lanes (and short stretches of four lanes along the eastern end of the route) as of 2006, but civil war and other conflicts in the region, including in Liberia and Sierra Leone, has slowed progress until recently.

In January 2016, ECOWAS signed a contract with the Chinese construction conglomerate CGC Overseas Construction Group to complete work on the highway, as well as to undertake several other major infrastructure projects (West Africa Brief, 2016). Work on the segment of road from Abidjan, Cote d’Ivoire to Dakar, Senegal was authorized to begin in March 2017. Once completed, this segment of the Trans West African Coastal Highway will span more than 2,400 kilometers of six-lane traffic, with an estimated cost of $13 billion (Sendolo, 2017). Some of this new highway will replace segments of two-lane paved roads already in place. Elsewhere in these countries, the majority of roads are built from dirt or gravel and are often impassable by vehicles, especially trucks, during bad weather (Figure 1).

In a report on economic competitiveness produced by the Global Economic Forum, 11 ECOWAS countries were included in a ranking of average road quality (Schwab, 2015). Only two ECOWAS member countries, Gambia and Cabo Verde, were in the top half of the 140 countries included (62 and 68, respectively). Senegal was ranked at 78, and the remaining ECOWAS countries fell in the bottom 40, from Ghana at 101 to Guinea at 140.3

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3 Cote d’Ivoire, Guinea-Bissau, Niger, and Togo were not included in the rankings.
Figure 1. Water-logged road in Nigeria

Source: AfricaOnline Media Corporation. https://africaonlinetv.xyz/projects

Between 2013 and 2016, the World Bank and several other partner institutions\(^4\) invested in rehabilitating roads along the Tema-Ougodougou-Bamako corridor, at a cost of several hundred million dollars. This project involved rebuilding 311 kilometers of road and building two new rest stops in each of the three countries. It was undertaken in the recognition of the growth in trade along this corridor—an increase of 650 percent in trade flows between Cote d’Ivoire and Mali and 488 percent between Cote d’Ivoire and Burkina Faso—that occurred between 2001 and 2005 (World Bank, 2015).

The managers of the West Africa Regional Reserve have the flexibility to select the locations of their physical storage facilities, as well as their sources for cereals and other products. In this way, they can minimize the need to move shipments across non-paved roads, at least during the initial movement of the product into storage. However, once ECOWAS member governments request withdrawals from the physical stocks, it is likely that much of the affected populations in need of assistance will only be reachable along the unpaved roads in the regional transportation system.

\(^4\) Partner institutions included the African Development Bank, the European Union, the Arab Bank for Economic Development, the West African Development Bank, and the U.S. Agency for International Development (USAID).
Moving Product Within or Between ECOWAS Member Countries: Rail Networks

Twelve of the ECOWAS member countries have some railroad tracks in place, ranging in total length from only 84 kilometers of track in Sierra Leone up to 3,528 kilometers in Nigeria (International Union of Railways, 2015). Nearly all of these railroad lines were established by the colonial powers in the region (France, Great Britain, and Portugal) prior to independence, primarily during a five-year span between 1957 and 1961.⁵

Many of these railroad tracks are no longer in use or are utilized only by multinational mining companies moving ore (including manganese in Burkina Faso, uranium in Niger, and gold mines in Burkina Faso, Mali, and Ghana) from interior mine sites to port facilities for export. For railroad lines still in operation, inter-operability between countries remains limited because the rail gauges used often do not match up at the borders. As of 1980, the World Bank reported that only five of the ECOWAS member countries had active rail systems carrying freight goods—Cote d’Ivoire, Ghana, Mali, Nigeria, and Senegal. In 1980 year, these countries recorded 1,682 million tonnes-kilometers⁶ of shipments being moved. This amount would have accounted for only 0.12 percent of the tonnes-kilometers of shipments moved on the U.S. railroad system in the same year (World Bank, 2017).⁷

Between 1995 and 2005, 13 countries in Africa south of the Sahara awarded concessions to private companies or consortiums of companies to operate and upgrade existing railroad lines, presumably on a profitable basis. This list includes five countries in West Africa: Cote d’Ivoire, Burkina Faso, Mali, Senegal, and Togo (Bullock, 2005). Across the continent, many of these arrangements have not worked out well; two were terminated outright after a short period and many of the others have had to be renegotiated at least once with improved financial terms for the private partners in order to stay in business (African Development Bank, 2015).

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⁵ Among the 15 ECOWAS member countries, only Liberia was an independent nation prior to 1957.
⁶ A tonne-kilometer is a unit of measure of freight transport which represents the transport of one tonne of goods for one kilometer in distance.
⁷ The World Bank did not report any data for these countries for 2015, the second year included in the database for most other countries.
Sitarail, the privatized single-track rail system linking Cote d’Ivoire and Burkina Faso, has been run by the French company the Bolloré Group since 1995. Sitarail operates a passenger train between Ougoudougou and Abidjan three times a week and also runs freight trains three times a day (SGS, 2016). Those trains have carried 300,000 passengers and 900,000 tonnes of freight per year in recent years, including goods such as cotton, fertilizer, and concrete, according to the Bolloré company website. In July 2017, Bolloré finalized a new concession deal for Sitarail with the two governments for $288 million to upgrade the rail tracks and stations (Bavier, 2017).

Over the last few years, several West African countries have contemplated or completed deals for upgrades and/or extensions of their existing rail systems. In addition to the 2017 Sitarail upgrade described above, Mali and Senegal both signed deals in December 2015 with the China Railway Construction Corporation (CRCC) to reconstruct the roughly 1,300 kilometer railway link between the two nation’s capitals of Bamako (Mali) and Dakar (Senegal), for a total of $2.7 billion (Barrow, 2016).

With the exception of Sitarail, the current array of rail lines in West Africa does not offer the ability to carry bagged cereals in a consistent, cost-effective manner to physical storage facilities. However, if these projects and others like them are completed, freight rail would be a more viable competitor for these shipments at some point in the next decade or so.

River Transport

Throughout history, water transport has often been the initial means by which goods and passengers moved when a country or region was first settled and then subsequently brought into contact with the outside world. It is no accident that many of the oldest cities in the world were established along sheltered bays or alongside navigable rivers; as these cities expanded, populations were able to use boats or ships to trade their wares with other cities. The River Nile provided the main route for transporting both goods and people in ancient Egypt, including moving the massive stones from limestone quarries that were used to build the pyramids on large barges for distances up to 900 kilometers (Löhner, 2006). In the modern world, barges are still used in many countries to move heavy goods such as bulk crops, fertilizer, and cement up and down navigable rivers, such as the Rhine and Moselle Rivers in Germany and the Mississippi and Missouri Rivers in the United States.
At 4,200 kilometers, the Niger River, which passes through a total of 10 countries and through seven ECOWAS member countries, is the longest river in the region. However, only about 7 percent (or 300 kilometers; the stretch between Niamey, Niger and the Nigerien border with Benin)\(^8\) of that length is considered to be navigable (Fortune of Africa, 2017). Because of the shallowness of some points, only small craft are able to fully transit even that portion of the river.

The Senegal River flows for about 1,800 kilometers between Mali and Senegal. The entire length of the river is navigable in theory, with locks incorporated into the upstream (Manantali) and downstream (Maka-Daima) dams to allow boats and barges to move through. In 1972, the Senegal River Development Organization (OMVS in French) was established by the governments of Mali, Mauritania, and Senegal\(^9\) to develop new ways to exploit the river economically. Two of the projects sought by OMVS aimed to deepen the river channel to make it easier for boats to pass through, as well as to build a river port at Kayes, Mali (Dorsche Grupp, 2016). However, that work has not yet been completed and river freight traffic remains limited along the Senegal River.

The Gambia River empties at the modern seaport of Banjul and is navigable by boats and barges up to 300 kilometers inland (Gambia Investment and Export Promotion Agency, 2017). The river carries the bulk of passengers, freight, and mail moving within the nation of Gambia, but until recently, poor political relations with Senegal to the north have limited the river’s usefulness in moving goods across the border.

Of the other major rivers in West Africa, such as the Benue River in Nigeria and the Saloum River in Senegal, most are navigable for only part of the year. Thus they would not be reliable routes for transporting cereals for storage in any of the regional reserve facilities.

**International Transportation**

According to UNCTAD data, the 15 ECOWAS member countries exported $70.8 billion worth of goods and imported $87.6 billion worth of goods in 2016 (UNCTAD, 2017). Except for the 17 percent of goods traded within the Community, nearly all of those goods are moved on ocean-going ships through one

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\(^8\) Much of the rest of the Niger River has stretches that include both significant rapids and shallows.

\(^9\) The government of Guinea joined OMVS in 2006.
of several ports available in the region’s coastal countries. No port in West Africa appears among the top 100 ports in terms of cargo volume or TEU containers<sup>10</sup> shipped worldwide (American Association of Port Authorities, 2015), although a separate estimate from 2014 appears to suggest that the port of Lagos, Nigeria should have been ranked at about 90.<sup>11</sup> In 2014, the port of Lagos received 1.5 million TEUs, followed by the port of Tema in Ghana with 850,000 TEUs, Abidjan, Cote d’Ivoire with 602,000 TEUs, and Dakar, Senegal with 475,000 TEUs (Drewry Maritime Advisers, 2015).

Since gaining independence in the 1960s, most of these coastal countries have experienced a lack of investment by either their national governments or private entities; this shortfall has constrained these ports’ capacity to fully participate in global trade flows. Africa’s roughly 100 ports only handle about 6 percent of the world’s cargo traffic, and only half that share of global containerized cargo traffic (Business Tech, 2015).

According to a 2007 report by the Sub-Saharan Africa Transport Policy Program, while most ports in Asia had the capacity in 2007 to receive and unload ships carrying 8,800 TEUs, ports in West Africa could not accommodate ships with more than 2,500 TEUs (Palsson et al., 2007). The lower capacity of these ports has been due to a combination of factors, including:

- inadequate infrastructure, such as berths and equipment to lift containers or other cargo off of ships;
- infrequent dredging and other poor harbor management practices,
- labor management constraints; and
- inefficient multi-modal transport options for goods departing the ports for inland destinations.

These factors have generated slow turnaround times for ships visiting West African ports, which makes multinational shipping companies unwilling to send larger ships that might have to dwell in port for several days before being unloaded. These delays result in congestion charges, which raise the cost of shipping for these countries as well as for their landlocked neighbors. For example, in 2012, dwell times at

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<sup>10</sup>TEU=20 foot equivalent shipping containers.

<sup>11</sup>The AAPA list by TEU volume had the port of Haifa in Israel ranked at No. 100 in 2014, with a volume of 1.2 million TEUs.
the port of Cotonou in Benin ranged between 10 and 25 days (Nathan Associates, 2013).

New projects are underway which will improve the capacity of several of these ports over the next several years. For example, the port of Lagos will expand its annual container-handling capacity by 4.5 million TEUs, the port of Dakar in Senegal will expand by 1.6 million TEUs, the port of Abidjan in Cote d’Ivoire will expand by 1.4 million TEUs, and the port of Tema in Ghana will expand by 250,000 TEUs. All of this new capacity is expected to be in place by 2020 (Mooney, 2017).

7. Logistics of Moving Cereals into Storage Facilities of the West African Regional Reserve

Under current conditions, moving shipments of cereals and other food products from surplus areas to the storage facilities maintained by the West African Food Security Regional Reserve by truck will be expensive and inefficient. However, as the discussion in the previous section of this report makes clear, neither rail nor water transport offer viable alternatives to motor transport via the overland road corridors in ECOWAS member countries. At this time, there may be a few routes for which rail transport might be both a feasible and a cost-effective choice, but no such options appear to exist for river transport.

Once the planned expansion and rehabilitation of existing rail lines, and to a lesser extent the investments envisioned to make key stretches of the Senegal River more accessible to commercial vessels, are completed over the next decade, there should be greater competition for shipping food purchased for the reserve. However, that environment is not likely to be in place within the eight-year window envisioned for establishing the physical portion of the reserve, designated at 140,000 tonnes (Le Hub Rural, 2012). Consequently, this section of the report will focus on the factors determining the cost of transporting cereals and other food products within the Eastern sub-regions by truck, as well as the comparable costs for the Central sub-region by truck and rail. The majority of the facilities to hold reserve stocks are designated to be located in these areas, in or near the three landlocked Sahelian countries in ECOWAS. Because plans call for less than 5 percent of the cereals stock to be held in the other two sub-regions, transport costs for the Gulf Atlantic and the West Atlantic sub-regions will not be examined in this paper.

Main Corridors to Transport Cereals into Storage in the Eastern Sub-region

The initial acquisition and storage of cereals for the reserve already took place during 2017, with some of the stocks being held in facilities in northwestern Nigeria and in Niger. Indeed, there has already
been a withdrawal from those stocks—in August 2017, the government of Nigeria borrowed 1,130 tonnes of food from the reserve’s facilities to help feed hungry people in four states in the northeastern part of that country (ECOWAS Commission, 2017).

Distances: For cereal shipments being transported into storage in the Eastern sub-region, the longest overland distance traveled within West Africa would be from port facilities in Nigeria, Benin, and Ghana, for shipments with international origins to be stored in regional reserve facilities in Niger or Nigeria. Those shipments would travel distances of between 1,000 to 1,600 kilometers, with an average of about 1,400 kilometers. Shipments purchased from regional markets or vendors of cereals produced within the ECOWAS region would travel shorter distances, but still probably at least 1,000 kilometers for most shipments.

Time of Travel: A report for the World Bank found that on average in 2005, it took 11 days for freight to be moved from the port of Cotonou in Benin to the final destination of Niamey, Niger and 21 days from the port of Lagos, Nigeria to Kano, Nigeria (Foster and Briceño-Garamendia, 2010). On average, freight moves within West Africa at a rate of 1.6 kilometers per hour due to a number of constraints, both formal and informal.

Institutional Constraints: In many West African countries, oligopoly arrangements known as freight-sharing agreements establish legally enforceable market shares for freight services based on the requirement that all freight deemed to be ‘strategic’ in nature shall be carried by trucks from companies operating out of the country of destination. For ‘non-strategic’ cargo, one-third of the volume must be carried by trucks from the coastal country and two-thirds by trucks from the country of destination. Since trucks from the landlocked Sahelian countries tend to be older and less road-worthy than their counterparts from coastal countries, these arrangements raise shipping costs by a significant amount (Teravaninthorn and Raballand, 2008). For those countries in which freight-sharing arrangements are not in place, trucking out of many ports operates on a ‘first-come, first-served’ basis; this does not necessarily lend itself to efficient outcomes, although shippers have the right to refuse to utilize trucks they deem to not be roadworthy (Zerelli and Cook, 2010). Cabotage rules in place also generally bar a truck from one country from carrying a backload of freight from a second country to which it just made a delivery.
In addition, trucks crossing national borders within the ECOWAS region often face lengthy delays getting through customs. For example, even though ECOWAS as a whole eliminated the requirement for traders to obtain country-of-origin certificates for food shipments moving across borders in 2003, as of November 2017, officials of eight of the countries still require such documentation. That list includes Ghana, Niger, and Nigeria, all of which fall within the Eastern sub-region of the regional reserve (West Africa Trade and Investment Hub, 2017). This requirement constitutes only one part of the procedures that must be followed. The cumulative effect of all of the paperwork and procedures that must be completed when crossing these borders often delays truckers by a full day or longer (Teravininthorn and Raballand, 2008).

Other Constraints: In addition to formal border procedures, many of the paved roads in the region feature numerous checkpoints, both official and unofficial, that truck drivers are forced to deal with as they move their cargo across the region. A reporter for All Africa counted 40 checkpoints in a drive between Seme Border and Lagos in Nigeria in 2006. He reported that those manning the checkpoints seemed primarily concerned with separating drivers from their goods and/or money (Akpor, 2006). The problem in Nigeria has clearly persisted: in July 2017, the federal Customs Service ordered its operatives to dismantle all checkpoints other than those officially operated by the Service (Oluwole, 2017). A 2011 survey by the Improved Road Transport Governance (IRTG) initiative found that illegal payments collected from truck drivers at such checkpoints ranged from $21 to $214 per 1,000-kilometer trip, depending on the West African country (Nathan Associates, 2012).

The freight-sharing arrangements described above, which allow trucking companies to essentially operate as cartels, remove incentives for truck owners in West Africa, especially in coastal countries, to purchase new vehicles to improve the efficiency of their operations. For example, a 2007 study produced for the World Bank found that the average age of semi-trucks in the fleet in Niger was 29 years (Adoléhoumé, 2007). In general, trucks in West Africa are purchased after having already been used for several years, often elsewhere in Africa, Europe, or the United States.

The lengthy delays associated with shipping goods in West Africa lead directly to truck drivers making fewer trips per month, thus restricting their opportunities to earn income. In response, many truck
drivers overload their vehicles with more weight than the vehicles are designed to hold in order to increase revenue per trip. This leads to more damage both to vehicles themselves and to the roads on which they travel. The UEMOA members among ECOWAS countries have established rules to ban such overloading; however, this list of countries includes only Niger within the Eastern sub-region (Nathan Associates, 2012). The axle damage that such overloads cause to trucks, as well as the age of the trucking fleet, are the main reasons that up to 60 percent of the trucking fleet of the ECOWAS member countries is out of service at any given time (Nathan Associates, 2012).

Transport costs: For all of the reasons described above, in general, recent studies have found that road transport costs for goods shipped to the landlocked member countries of ECOWAS account for between 15 and 20 percent of the total cost of importing those goods, which represents a share three to four times higher than is found in most developing countries (MacKellar et al., 2002). A number of studies on the transportation sector over the past decade have estimated costs per tonne-kilometer along a number of the main trading corridors in West Africa, as shown in Table 5. The cost for shipments between Cotonou, Benin, and Niamey, Niger, one of the routes in the Eastern sub-region, is among the highest shown, at between $0.09 and $0.11 per tonne-kilometer. Another route within the sub-region, from the port of Lagos to the city of Kano in the northwest corner of Nigeria, also has a cost of $0.09 per tonne-kilometer. Inland transport costs paid for U.S. food aid shipped within these corridors were somewhat mixed over the last few years; for example, food aid shipped from Cotonou, Benin to Maradi, Niger averaged between $0.14 and $0.16 per tonne-kilometer in 2014, but costs averaged only $0.072 per tonne-kilometer for shipments between Cotonou and Maradi in 2015 and $0.095 per tonne-kilometer for shipments between Lagos and Maradi in 2016.12

12 Calculated from publicly reported foreign inland transport costs from freight awards for U.S. Title II and McGovern-Dole food aid shipments, using overland road distances between port and final destination point to arrive at per ton-kilometer estimates.
Table 5. Estimated transport costs in West Africa, various sources

<table>
<thead>
<tr>
<th>Corridor</th>
<th>Rate per tonne-kilometer</th>
<th>Year</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Eastern Corridors</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cotonou to Niamey</td>
<td>$0.09 to $0.11</td>
<td>2011</td>
<td>Nathan Associates</td>
</tr>
<tr>
<td>Cotonou to Niamey</td>
<td>$0.08</td>
<td>2013</td>
<td>Nathan Associates</td>
</tr>
<tr>
<td>Lagos to Kano</td>
<td>$0.09</td>
<td>2013</td>
<td>USAID</td>
</tr>
<tr>
<td><strong>Central Corridors</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lome to Ougadougou</td>
<td>$0.07</td>
<td>2009</td>
<td>Teravininthorn and Raballand</td>
</tr>
<tr>
<td>Various Ports to Bamako</td>
<td>$0.065 to $0.072</td>
<td>2010</td>
<td>Ballereau and Douabi</td>
</tr>
<tr>
<td>Tema to Ougadougou</td>
<td>$0.07</td>
<td>2010</td>
<td>Annequin and Efshun</td>
</tr>
<tr>
<td>Abidjan to Ougadougou</td>
<td>$0.05 to $0.056</td>
<td>2010</td>
<td>Zerelli and Cook</td>
</tr>
<tr>
<td>Abidjan to Ougadougou</td>
<td>$0.06 (road and rail)</td>
<td>2013</td>
<td>Nathan Associates</td>
</tr>
<tr>
<td>Abidjan to Bamako</td>
<td>$0.06</td>
<td>2013</td>
<td>Nathan Associates</td>
</tr>
</tbody>
</table>

Another portion of the first tranche of roughly 12,000 tonnes of cereals acquired for the West African regional food reserves is being held in facilities in Ghana and Burkina Faso, the former in the city of Yendi in the northern portion of the country, for distribution within the Central sub-region (Asamoah, 2017).

Distances: The distances that cereals must be shipped within the Central sub-region to be accepted into the warehouses currently being utilized by the reserve are somewhat shorter than is the case for the Eastern sub-region. The land distance between the port of Abidjan in Cote d’Ivoire and the city of Ougadougou in Burkina Faso is 1,108 kilometers; from the port of Lome in Togo to Ougadougou, the land distance is 947 kilometers. Similarly, the land distance between the port of Tema in Ghana and Yendi is 420 kilometers, while from Abidjan to Yendi, the land distance is 805 kilometers. The average distance of those four routes is 820 kilometers, or 40 percent less than comparable routes within the Eastern sub-region. Of course, cereals sourced within these countries would travel somewhat shorter distances overland than those obtained through imports.

Time of Travel: A World Bank study found that in 2005, it took about seven days for a container to
move from the port at Abidjan to the city of Ougadougou, the shortest time span cited among nine transport routes for Africa listed in that report (Foster and Briceño-Garamendia, 2010). As of 2010, the estimated travel time for cargo between Tema and Ougadougou was between 13.5 and 22 days (Annequin and Efshun, 2010).

Other Constraints: Freight-sharing arrangements are in place for much or all of the year in the ports of Cotonou in Benin and Lome in Togo and for part of the year in Abidjan. The ‘first-come, first-served’ truck queuing rule is utilized at least part of the time in Abidjan and Tema (Nathan Associates, 2012).

Customs delays along the road corridors in this region are still extensive and costly, and checkpoints operated by a variety of entities remain common. For example, trucks moving north from Tema to Ougadougou typically dwell for at least a day and a half at the customs facility at the Burkina Faso border. Part of the problem is that customs offices in Ghana and Burkina Faso are not necessarily open for the same hours of the day, so trucks often have to park overnight at one facility or the other to wait for clearance (Annequin and Efshun, 2010). Along the road, as of 2010, truck drivers encountered 15 checkpoints per trip within Ghana alone.

Cost estimates: According to the estimates reported in Table 5, the shipping rates per tonne-kilometer in the Central sub-region are lower than in the Eastern sub-region, falling generally in the $0.055 to $0.07 range by road over the last several years. Shipments moved by rail along the Abidjan-Ougadougou corridor, via the Sitarail line described previously, are roughly comparable to the road rates at about $0.06 per tonne-kilometer. One study of the transport costs for containerized freight along the Tema-Ougadougou corridor found that these costs had declined by about 9 percent between 2008 and 2012 (Nathan Associates, 2012).

Inland transport costs reported for U.S. food aid shipments into the Central sub-region have varied considerably over the last several years. In January 2015, a shipment of bagged yellow peas from the port of Lome to the city of Ougadougou cost $0.027 per tonne-kilometer to move, while a shipment of green peas from the port of Abidjan to the city of Sevare in Mali in January 2017 cost $0.16 per tonne-kilometer.
**Transport Costs for Initial Stages versus Later Stages in Setting up West African Regional Food Reserve**

The 2012 feasibility study on the West African Regional Reserve called for establishing the physical component of the reserve, envisioned at 60,000 tonnes of cereals and other storable food products, within the first year of operation (Le Hub Rural, 2012). However, it appears that initial plan has been modified to require a reserve of that size by the fourth year of operation (Glé, 2016).

Reports indicate that the first tranche of cereals purchased for the reserve in 2017 amounted to about 12,000 tonnes that were shipped to warehouses in the East and Central sub-regions of ECOWAS (Asamoah, 2017). If succeeding annual purchases are also 12,000 tonnes, based on the high and low rates reported in Table 5, the annual shipping costs associated with these acquisitions would likely be between $1.2 and $1.4 million. However, if the reported inland shipping rates paid to move U.S. food aid shipments are more reflective of recent costs, the annual shipping costs would be higher, likely closer to $2.2 million. It is worth noting that the 2012 feasibility study assumed a $0.12 per tonne-kilometer shipping rate for cereals purchased for stockholding under the reserve (Le Hub Rural, 2012). These estimates assume that reserve managers would buy nearly all of the initial 60,000 tonnes of cereals for stockholding from markets within West Africa, as laid out in the feasibility study (Le Hub Rural, 2012).

If reserve managers source at least a portion of their cereals and other food products for physical stockholding from outside the region, this shift will increase the transportation costs associated with operating the reserve. Since a large share of the rice, maize, and wheat products consumed in West Africa originate from the global market, incorporating those products into the physical stocks held by the reserve or purchasing these products later for relief purposes using the financial resources held by the reserve, will clearly have the same impact.

In the fourth year of operation and beyond, additional shipping costs would be incurred over and above those incurred for cereals, as managers will need to initiate the required rotation of stocks that have

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13 This calculation assumes an even 50-50 split between stocks held in the Eastern and Central sub-regions. A higher allocation to the East sub-region would likely result in higher overall annual shipping costs.
been in place for three years. About 10 percent of the first-year acquisitions have already been distributed for relief purposes in Nigeria, and more cereals are likely to be so utilized in years two and three; however, any remaining year-one vintage stocks will have to be shipped back out in year four, either to national stocks of ECOWAS member states or to regional markets. As at least some of these cereal rotation shipments could be moved as backhauls, per tonne-kilometer rates would probably be lower than the costs incurred for moving them into Reserve warehouse positions in the first place.

Additional shipping costs will be incurred when ECOWAS member countries withdraw cereals from the reserve to address domestic food security crises, although these costs would be borne by the individual governments and not by the reserve itself. The per tonne-kilometer shipping rates for these shipments would likely be much higher than the rates cited above, as many of the recipients of the food aid would be living in remote villages at the end of low-quality, unpaved rural roads.

8. **Concluding Remarks**

In order to ameliorate future food security crises within West Africa, the 15 member countries of ECOWAS have taken initial steps to establish a regional food reserve. To achieve this objective, they have identified the types of commodities preferred by consumers in their countries, where those cereal commodities can be procured, and the best locations to site the physical stocks of commodities that will be held as part of the reserve.

In addition to the cost of procuring those commodities, one of the key continuing costs associated with operating the West African Food Security Reserve will be the cost of transporting the commodities from the point of purchase to the storage facilities. If ECOWAS follows through with its intention to purchase the vast majority of the stocks from within its member states, the associated annual transport costs to move the products overland to stockholding positions should be relatively modest: between $1 and $2 million initially and then somewhat higher as stock rotation practices ensue. To the extent that ECOWAS countries eventually purchase rice, maize, or wheat products that are sourced internationally, those costs will expand to include the cost of loading and unloading at port facilities in the export country and coastal destinations, as well as the cost of ocean shipping. If only 20 percent of products held in the reserve are to be sourced internationally at some point in the future, annual transport costs associated with operating the
reserve would increase by at least several hundred thousand dollars.

Although road transport within the 15-country ECOWAS region is costly and inefficient compared to developing countries in other parts of the world, it is likely to serve as the dominant mode of transport for cereal shipments destined for warehouses utilized by the reserve, at least over the next several years, because there are few or no viable alternatives in most of the region. However, if the extensive construction and/or refurbishing of road networks and rail lines in key West African countries are completed as planned, the per tonne-kilometer costs of shipping food should decline as these modernized options come on line. In addition, reforms to the operation of the trucking industry across the ECOWAS region, such as modifying or ending freight-sharing or ‘first-come, first-served’ arrangements, streamlining customs procedures, and curtailing the incidence of informal checkpoints along the main road corridors, would also lead to reduced transport costs. Such steps would enhance economic activity throughout West Africa, as well as reduce the cost of operating the reserve.

In its first full year of operation, the West African Regional Reserve has procured, transported, and stored roughly 12,000 tonnes of cereals purchased within the region and arranged for distribution of about one-tenth of its stock for use in Nigeria to feed hungry people in four states in the northeastern part of the country. The future may yet bring sterner tests of the functioning of this new reserve, but for now, all lights are green.
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