

VALUE CHAIN ANALYSIS IN LIBERIA

Investment Opportunities

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Abbreviations

AfDB: African Development Bank

CBL: Central Bank of Liberia

CNG: Compressed Natural Gas

GHG: Greenhouse Gas

GoL: Government of Liberia

KOAFEC: Korea Africa Economic Cooperation

MoA: Ministry of Agriculture

PVCF: Porter's Value Chain Framework

R&D: Research and Development

SWOT: Strength, Weaknesses, Opportunities, Threats

TSR: Technically Specified Rubber

VC: Value Chain

VCA: Value Chain Analysis

INTRODUCTION

Many projects have been conducted over the years with the aim to optimize the agriculture sector in Liberia and to assess opportunities where more funding could be allocated to “high-potential” commodities. Due to some adoption of good practices and the implementation of funding from said projects, a few sectors have observed marginal changes. However, the changes have not been enough to declare the agriculture sector in Liberia self-sufficient or operationally optimal. That said, where there are challenges there are opportunities so, the aim of this report is to go beyond the conclusions established and results observed in previous projects by taking the analyses from data points to innovative applications. To this effect, investment opportunities within each of the key value chains identified by the Ministry of Agriculture of Liberia will be highlighted to demonstrate how, with the right investments, Liberia can embark on creating and expanding strategic industries of high value in fast-growing sectors, some niche and some just underdeveloped.

To begin to truly compete, Liberia’s focus on agriculture must include enhanced knowledge systems; climate-smart production and processing; access to affordable financing for all stakeholders; and innovative investments from fisheries to rubber.

AQUACULTURE & FISHERY

Aquaculture & Fishery Sector

The world demand for fish and fish products shows no signs of slowing as global fish production peaked at 179 million metric tons (MT) in 2018 with both capture fisheries and aquaculture reaching the highest levels ever recorded at 96 million tons and 82 million tons, respectively. Sustainable aquaculture development and effective fisheries management are critical to maintain these trends, as well as to support recovery of wild stock populations and coastal habitats. There is growing evidence that when fisheries are properly managed, their stock is consistently above target levels or rebuilding, but where fisheries management is not in place or is ineffective, the status of fish stock is poor and will continue to deteriorate.

Aquaculture, the commercial farming, and production of fish rather than the catching of species directly from oceans, estuaries and freshwater lakes and rivers, is one of the fastest growing segments in the agriculture industry globally; currently comprising 46% of the volume. Aquaculture is expected to continue growing, with the World Bank forecasting that up to two-thirds of fish consumed by humans will be farmed by 2030. Population growth and consumer preference has driven corresponding increases in per capita fish consumption, which reached 20.5 kg in 2016 and is expected to follow an average increase of 1.5% per year. Currently a segment worth \$263.6 billion USD, the Food and Agriculture Organization (FAO) predicts a further 25% increase in the price of aquaculture products by 2030¹.

Liberia’s extensive coastline and continental shelf comprises of 20,000 km² of fishing and 200 billion cubic meters of renewable inland water resources, a stark comparison to the availability found elsewhere in the region². However, only 25% of the fish consumed in Liberia is produced domestically despite the immense potential for marine and inland fishery and aquaculture development; the country currently imports in excess of 25,000 tons of fish and fish products annually. There is considerable local demand for fish in Liberia, with a 2020 consumption level of 11.42 kg per capita³, higher than the regional average. Fresh fish, particularly aquaculture fish such as tilapia, is a main protein source for the population; the market is also dominated by a pelagic sardinella fish, known locally as “bonnie” or “bonnie tongue”. Liberia holds a comparative advantage in fishery and aquaculture development relative to its regional trade partners due to the ample capacity for production, with low land usage and abundant water resources.

Country	Inland water resources (billion cubic meters)
Nigeria	221
Liberia	200
Cote d’Ivoire	77
Mali	60
South Africa	45
Ghana	30
Kenya	21

Fishery & Aquaculture Supply Chain

Liberia is home to a wide range of fish and crustacean species consumed in the country and the sub-region; however, the small fleet sizes and lack of fishing equipment means that most fishermen capture only a few species of fish and crustaceans with limited profitability. Marine fishing in Liberia is concentrated in three main areas in

¹ FAO, 2018

² <https://data.worldbank.org/indicator/ER.H2O.INTR.K3>

³ National Fisheries and Aquaculture Authority (NaFAA) Research and Statistics Division

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the country—Robertsport, Monrovia (West Point/Banjor), and Marshall—which together hosts up to 80% of Liberia’s entire coastal fishing population. Marine fisheries constitute the main source of fish production in Liberia.

The fishery sector can be divided into its artisanal fishing activities (both marine and inland fishing), which dominate the sector, and its industrial fishing activities (marine fishing only). The artisanal subsector is comprised of an estimated 13,000 fishermen and 18,000 post-harvest handlers and processors along the Liberian coast, and their fleet consist of roughly 3,000 canoes. Artisanal fishing is concentrated in Montserrado and Grand Bassa and takes place year-round while experiencing seasonable variations in the species of the catch. There is also an influx of Gambian, Malian, and Senegalese fisherman to both marine and inland river fishing in the artisanal sector, who take their catch out of the country for selling. Liberia’s industrial fisheries were decimated during the civil war. In recent years, trawling was done using vessels ranging in number between 20 and 45, with the majority of vessels being foreign-owned (from China, Japan, the Republic of Korea); local communities were involved only as hires for deck staff and on-vessel workers. Today, only six industrial trawlers currently operate in Liberia’s marine fisheries, producing 5,634 tons of products in 2019 and 5,113 tons in 2020. There are also 56 tuna vessels operating in the marine fisheries with a total production of 9,691 tons; however, these products did not land in the country due to a lack of fishing piers for vessel docking.

To curb illegal, unreported, and unregulated (IUU) fishing, a four-year ban was instituted on industrial fishing and a 6-nautical mile inshore conservation zone was established. These measures have altered the situation favorably for artisanal fisheries and have significantly reduced illegal fishing (by 83% in the last five years), and Liberia is the only country in the region now experiencing some level of fish stock recovery.

Aquaculture operations exist in very small numbers in Liberia. The National Fisheries and Aquaculture Authority (NaFAA) operates two hatcheries in Bomi and in Grand Gedeh. Surveys conducted by the NaFAA found that there were only 300 fish farmers in Liberia, overseeing 1,704 ponds of which only 66% or 1,125 ponds were in use. Annual production is currently around 40 MT, with farmers producing mostly tilapia and catfish; however NaFAA predicts that aquaculture has the potential to produce 15,000 MT of fish annually by 2030 if key challenges can be addressed: inadequate knowledge and human capacity; undiscerning transfer of traditional crop agriculture practices into aquaculture (e.g. seed recycling); poor species identification and broodstock management; low government budget for aquaculture development; donor-dependence with no sustainability planning.

Fish and fish products suffer significant loss in quantity and quality in Liberia during transport due to a lack of infrastructure, onboard and onshore ice supply, and poor post-harvest practices. Many fishing communities in the country do not have proper road access to markets, which results in product spoilage during the extensive transportation period. Due to poor road infrastructure, the transport of fish and fish products is very difficult and costly. Localized feed and fry production could mitigate transportation issues, particularly if farmers seek to operate in areas where there is high purchasing power, such as around mining operations. In local markets, fish is generally sold by retail by the piece, with sizes of 250 grams and higher found in the marketplace. Larger fish are preferred by do not necessarily sell for higher price per kilogram.

Aquaculture & Fishery Opportunities

1. Tilapia

A number of different culture systems are used in aquaculture. The systems of production vary by the degree of aquaculture containment and its exposure to the external environment, and thus vary in their production risks. Farmers may use ponds, tanks, nets, bags, or cages as part of either a closed system, a semi-closed system, or an open system.

	RAS	Ponds	Cages
<i>Description</i>	<p>Self-contained systems including the Recirculation Aquaculture Systems (RAS) and indoor aquaculture systems that can sterilize all intake water before use and for reuse.</p> 	<p>Semi-closed systems include ponds (i.e., holes in the ground filled with water) where the culture is largely protected from external threats.</p> 	<p>Open systems are cages or open-water mollusks farms for oysters and mussels, which are greatly influenced by events in the external environment.</p> 
<i>CAPEX</i>	Very high	Medium	High
<i>OPEX</i>	Very high	Low to medium	High
<i>Type of feed</i>	Extruded pellets	Natural, raw feed ingredients and extruded pellets	Extruded pellets
<i>Stocking densities</i>	High	Low to medium	Medium
<i>Environmental risk</i>	Low	Low	Medium
<i>Disease risk</i>	Low	Low to medium	Medium
<i>Technical risk</i>	High	Low	Low
<i>Production (\$/kg)</i>	High	Low	Medium

The most common system found in inland and brackish water is the use of ponds. Intensification in pond farming can greatly influence production by improving the amount of seed input (i.e., the stock density) and feed, and by employing technologies to properly manage these inputs; this approach can be further categorized: the use of extensive, semi-intensive, and intensive systems.

(i) Extensive systems

These ponds use basic infrastructure to operate in an earthen pond and do not require any external addition of feed and have minimal stocking density. The system depends on food that is naturally created in the aquatic environment, such as phytoplankton and zooplankton, which can be supplemented with fertilizers.

(ii) Semi-intensive systems

These ponds also depend on naturally created food but require some external addition of feed to supplement operations with higher stocking densities.

(iii) Intensive systems

These ponds are reliant on artificial feed, more sophisticated technology, and infrastructure, and operate with high stocking densities to achieve economies-of-scale. These types of ponds are often lined with plastic sheets to facilitate waste removal and require good wastewater treatment to control diseases. Most cage farming can be intensive. Newer operations now focus on low-density production to improve health of the fish and to ensure sustainability of the surrounding environment.

Over 10 million MT of fish and seafood is produced annually in sub-Saharan Africa (SSA), comprising of 35% freshwater fish and 65% marine⁴. The entirety of the freshwater fish is consumed within SSA while 1 million MT of the marine fish is exported. Almost all fish production is caught by fishermen, and fish farmers account for only a fraction of the total. A 2019 study by WorldFish estimated that growth of the aquaculture sector in Africa will lead to an increase in per capita fish consumption to 11.7 kg by 2030 and to 13.5 kg by 2050. If these projections are considered along with the United Nation’s median variant population growth projections for SSA, the demand for fish and seafood is forecasted to reach between 16 million and 29 million MT by 2050. Due to depleting wild stock, production from wild-caught fisheries is expected to plateau and begin its decline. According to Kontali industry reports, fish from aquaculture will grow much faster than other sources of animal protein, with a 2014-2024 supply CAGR of 2.8%. Aquaculture in SSA currently focuses on freshwater fish; freshwater fish farmers account for 17% of all freshwater fish output and this proportion is steadily increasing.



Compared to meat production, aquaculture produces a much lower environmental footprint in terms of freshwater use, land use, and CO₂ emissions. It is therefore recognized as one of the most efficient ways to produce animal protein. As a significant source of daily animal protein for a large portion of the global population, fish plays a key role in addressing hunger and malnutrition. It is worth noting that per capita fish consumption in developing countries is double that in developed countries.

Aquaculture development is therefore essential to meet rising consumption and preserve wild fish stock and coastal habitats and is a strategic investment area for those looking to invest in food production methods of the future. As an

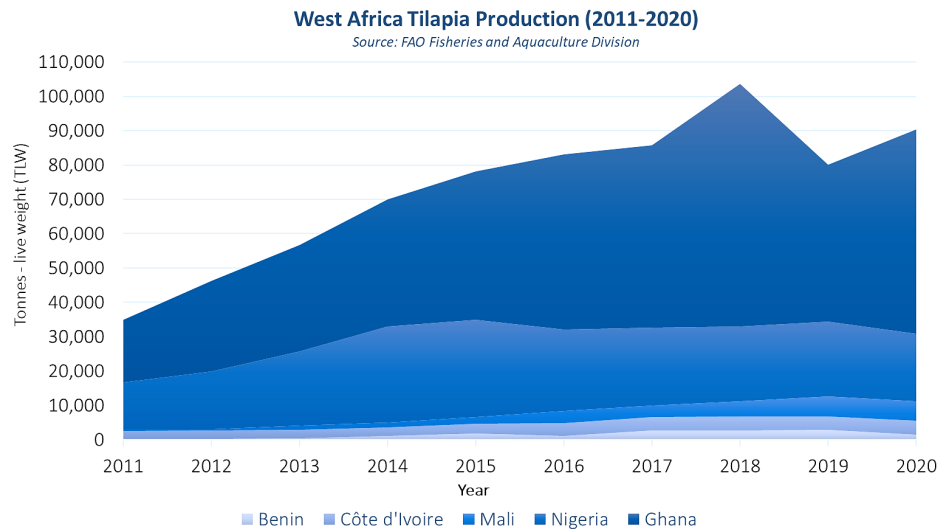
alternative to dependence on imported fish, freshwater aquaculture, specifically tilapia cultivation, can play an important role in accelerating growth in the aquaculture segment to meet rising demand.

⁴ FAO

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Many tilapia species are native to the river and lakes in SSA or are introduced into waters where wild catches are declining. Tilapia is the most consumed freshwater fish in SSA, found widely in fish markets and forming an integral part of the population’s diet. Against the backdrop of growing demands for protein in general, consumer preference for fish in particular, and to capitalize on the expected shortfalls created by declining wild stock, there exists an opportunity for fish farmers to rapidly scale up tilapia production.

Figure 1. West Africa Tilapia Production (2011-2020)



Source: FAO Fisheries Aquaculture Division

With abundant renewable water resources, Liberia enjoys highly favorable conditions for small-scale aquaculture. The NaFAA predicts that aquaculture has the potential to produce 15,000 MT of fish annually by 2030. Surveys conducted by the NaFAA found that there are only 300 fish farms in Liberia; their average in-use hectare was 73.3 and the average pond size was 464 m². Annual production is currently around 40 tons and is made up of five main species: Nile tilapia, African catfish, sampa, mango tilapia, and red belly tilapia. Nile tilapia and other tilapia varieties account for 93% of the production.



Fish is generally sold by retail by the piece, with sizes of 250 grams and higher found in the marketplace. Larger fish are preferred by do not necessarily sell for higher price per kilograms. Farmers report a preference for tilapia when fish sizes are comparable. Tilapia prices have seen a surge over the past ten years, with values in Monrovia growing from \$1.78/kg in 2011 to \$3.50/kg in 2015, a YoY price increase of 96%. Today, the price of tilapia retails above \$5/kg and given the prevailing economic headwinds and projected decline in wild caught fish, plenty of runway exists for future price growth.

In 2018 Liberia imported around 28,000 MT of fish, with an estimated market value of \$60 million USD; replacing imports with domestic aquaculture can generate significant income gains and support sustained growth of the fishery sector⁵. There is significant demand for quality fresh fish, as well as for processed products such as fillets and smoked fish in the retail and tourism and hospitality market. Per capita consumption in 2020 was 11.42 kg, a level higher than the regional average; data from the

NaFAA further suggests that consumption may be as high as 15 kg per capita and is highly influenced by the

⁵ <https://allafrica.com/stories/202110200213.html>

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amount of fish imported into the country. This highlights an unsaturated per capita consumption figure and a high corresponding domestic market ripe for growth.

Key Takeaways

With an abundance of renewable inland water resources which rival that of Nigeria and a growing domestic and regional market for fish and fish products, Liberia enjoys many fundamental conditions for a highly profitable aquaculture sector. Given the intensity of production in ponds or cages and assuming a productivity above 300 tonnes of live weight per hectare, aquaculture offers highly favorable returns relative to land resource use when compared to competing agricultural crops and activities. Although Liberia has the potential to produce aquaculture valued at over \$30 million USD per year, its natural comparative advantage relative to its regional trade partners is hampered by insufficient infrastructure and limited processing and cold storage facilities. Holistic investments across the entire aquaculture business model are needed for the subsector to achieve its income-generating potential in the domestic, regional, and global market.

Investment Impact

Investments in aquaculture can generate the following impacts:

- 1) Directly contributes to food security in Liberia
- 2) Provision of affordable fish and fish by-products into local markets for low-income consumers, helping to address protein deficits and related diseases
- 3) Population benefiting from a sustainable fishing practice, including through job creation
- 4) Increased protection of life under water from sustainable fishing practices
- 5) Addresses climate change and reduces environmental impact if fish production replaces meat and livestock activities that have higher emissions

Investment Risks

Production Risks

- Disease occurrence
Aquaculture diseases often result from traditional small-holder farming practices that utilize limited technology and infrastructure for disease prevention.
- Farm Performance
A well-functioning farming system improves performance and chances for success. In general, the farming system needs to provide a suitable aquatic environment for animal growth. Among other tasks, it must supply seed and feed for growing animals and manage water to remove waste and unwanted organisms. Good systems lower production risk.
- Feed and Quality Management
Most aquaculture production systems use external feed. Since feed often represents the largest cost item in aquaculture, it offers opportunities for cost saving that can reduce quality and performance. However, high feed quality is important to mitigate risk.
- Water Quality Management
Water quality is an extremely important element in aquaculture. Proper management of oxygen, ammonia and water salinity levels is essential for the health and production of fish.

Market Risks

- Price Volatility
- Market substitutes

Environmental Risks

- Carrying Capacity

Aquaculture carrying capacity refers to the maximum amount of biomass that can be sustainably farmed in a specific operation and ecosystem. Limits to carrying capacity usually involve limits to pollution and sufficient food sources for key species.

Fishery & Aquaculture Value Chain

There is considerable local demand for fish in Liberia; in 2020, consumption was 11.42 kg per capita, a level higher than the regional average. Fresh fish, particularly aquaculture fish such as tilapia, is a main protein source for the population; the market is also dominated by a pelagic sardinella fish, known locally as “bonnie” or “bonnie tongue”. The current low fish consumption observed is attributed not to a lack of demand but to low yields and inadequate local supply. Supply-side challenges today include low availability and high costs of inputs, low processing capacity, and difficulty with market entry linked to competition with foreign operators.

Production & Sales

Liberia is a basin country in the Gulf of Guinea, at the north-eastern part of the Atlantic Ocean. Marine fishing is concentrated in three main areas in the country—Robertsport, Monrovia (West Point/Banjor), and Marshall—together hosting up to 80% of Liberia’s entire coastal fishing population. The lack of centralized data collection means that actual production figures vary depending on the source of the information; however, it is generally accepted that marine fisheries constitute the main production source with more than 18,000 tons in 2020. Freshwater fish sourced from inland waters constitute the second largest source of catch.

The fishery and aquaculture sector can be divided into its artisanal fishing activities and its industrial fishing activities. Artisanal fishing involves both marine and inland fishing (aquaculture and river or lake fishing), while industrial actors focus exclusively on marine fishing. Artisanal vs. industrial fishing is also differentiated by the type of equipment used, the distances travelled by the operators from the coast, as well as their on-board/offboard post-harvest and processing capabilities. The fishery sector is dominated by artisanal rather than industrial fishing.

It is estimated that 13,000 fishermen and 18,000 post-harvest handlers, processors, or households participate in artisanal fishing across 139 communities along the Liberian coast, with a fleet size of roughly 3,000 canoes, most of which are not motorized. Artisanal fishing is concentrated in Montserrado and Grand Bassa and takes place year-round while experiencing seasonable variations in the species of the catch. There is wide variation in skills, equipment and methods used between fishermen, with a division seen across tribal affiliations. The Fanti prefer to use canoes fitted with outboard motors to travel between 6-12 nautical miles from shore; the Kru and Popoh stay within 6 nautical miles from shore due to restrictions in their equipment. There is also an influx of Gambian, Malian, and Senegalese fisherman to both marine and inland river fishing in the artisanal sector, though their catch is taken out of the country for selling and thus are not integrated into the local economy.

Liberia’s industrial fleet was once amongst the top performers in Africa, with the highest export by value in fish and crustacean products. However, the sector’s infrastructure was decimated, and many fishery operators emigrated during the civil war. While trawling has resumed since the end of the war, there is a shortage of a skilled

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workforce. Today, trawling is generally done using vessels ranging in number between 20 and 45, with the majority of vessels being foreign-owned (from China, Japan, the Republic of Korea); local communities are involved only as hires for deck staff and on-vessel workers. Trawling companies are engaged in landing catch, freezing, and transshipping products to other ships at sea. Since 2009, most trawling companies have ceased operations and are instead using their cold storage and landing facilities for fish imports, notably at Monrovia's Freeport. Six industrial trawlers currently operate in Liberia's marine fisheries, producing 5,634 tons of products in 2019 and 5,113 tons in 2020. There are also 56 tuna vessels operating in the marine fisheries with a total production of 9,691 tons; however, these products did not land in the country due to a lack of fishing piers for vessel docking.

Underperformance of the fishery sector has been attributed to biological and economic overfishing. Poor governance along with illegal, unreported, and unregulated (IUU) fishing has led to the loss of an estimated \$1.3 billion USD per year in legal revenue for Liberia and the West African region. Through the West Africa Regional Fisheries Project (WARFP) funded by the World Bank, a four-year ban was instituted on industrial fishing and a 6-nautical mile inshore conservation zone was established. These measures have altered the situation favorably for many artisanal fisheries, which were hit hard by near-shore trawling. These efforts have also helped to significantly reduce illegal fishing significantly (by 83% in the last five years), and Liberia is the only country in the region now experiencing some level of fish stock recovery.

Liberia is home to a wide range of fish and crustacean species consumed in the country and the sub-region. However, the small fleet sizes and lack of equipment and other inputs in Liberia means that the majority of fishery operations capture only a few species of fish and crustaceans and have limited profitability. Recovery in the country's fish stock indicate potential for the expansion of the country's fishery sector, but significant investments are needed to fully realize export competitiveness and to meet domestic demand through local production.

Aquaculture

Aquaculture was introduced in Liberia in the 1950s but has not seen significant growth despite an increasing demand for aquaculture and other favorable conditions for the subsector.

There is interest in the government and among development partners to restore government-operated hatcheries and to rehabilitate dormant ponds. A World Bank project from 2010-2013 was implemented by the Association Pisciculture et Développement Rural en Afrique (APDRA) in Bong, Lofa, and Nimba, which introduced an approach to integrate fish farming with rice production, focusing on the indigenous African arowana fish, catfish, and tilapia. The use of fertilized livestock waste as feed helped fish farmers to produce 3 MT per hectare per year. Another aquaculture project funded by FFP, HANDS, was implemented in NaFAA hatchery in Grand Gedeh, originally constructed with support from the European Union in the 1980s. The project supported the construction of a fish processing facility at the hatchery to gut, clean, sort, and package fish for transport and composting for organic fish feed. A solar dryer was also installed for fish preservation. Peace Corps projects have produced some progress in aquaculture, with the construction of fish stations funded by the European Union. Other donors and non-government organizations continue to fund some aquaculture activities in Liberia.

There are currently hatcheries operated by the NaFAA in Klay, Bomi and in Zwedru, Grand Gedeh; a previous site in Tassah, Bong has ceased operations. No private sector hatcheries exist in Liberia. Surveys conducted by the NaFAA found that there were only 300 fish farmers in Liberia, overseeing 1,704 ponds of which only 66% or 1,125 ponds were in use. The average pond size measured at 464 m². Counties with the largest average pond sizes were Lofa (786 m²), Bong (717 m²), Margibi (713 m²), Bomi (704 m²), and Nimba (527 m²). Maryland had the smallest average pond size at 200 m². A total of 114 hectares were estimated nationwide across all 1,704 existing ponds, and the average in-use land was 73.3 hectares. Nine counties which contain almost 90% of the fish farms reported

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using only fresh water: Gbarpolu, Grand Bassa, Grand Cape Mount, Grand Gedeh, Grand Kru, Margibi, Maryland, River Gee and Sinoe. Annual production is currently around 40 metric tons, with farmers producing mostly tilapia and catfish. Studies by the NaFAA has identified a number of strengths in the enabling environment that is conducive to aquaculture development:

- Abundant and perennial availability of water
- High prevalence of lateritic soils, which have a compact texture with a water retentive capacity crucial for pond construction
- Topography dominated by flat land and plateaus which provides ease for pond construction
- Steady supply of animal waste ideal for pond fertilization, from a large number of household livestock farmers
- Satisfactory habitation density
- Local consumer preference for aquaculture products over other forms of protein

While there is some local knowledge on pond construction and managements, inputs have not been able to advance beyond leaves, grass, or other on-farm supplies. There is also limited feed supply, farming technology, and facility capacity of hatcheries. As a result, aquaculture production in the country has remained low.

Transport

Globally, one-third of reported catch is wasted along the fishery value chain. In Liberia, losses in the quantity and quality of fishery products are caused by a lack of infrastructure, onboard and onshore ice supply, and poor post-harvest practices. Many fishing communities in the country do not have proper road access to markets, which results in product spoilage during the extensive transportation period. Even if the quantity of the catch is maintained, investing simply in measures to preserve catches onboard and along the value chain can reduce post-harvest spoilage and increase the value of fish products.

Market Price Information

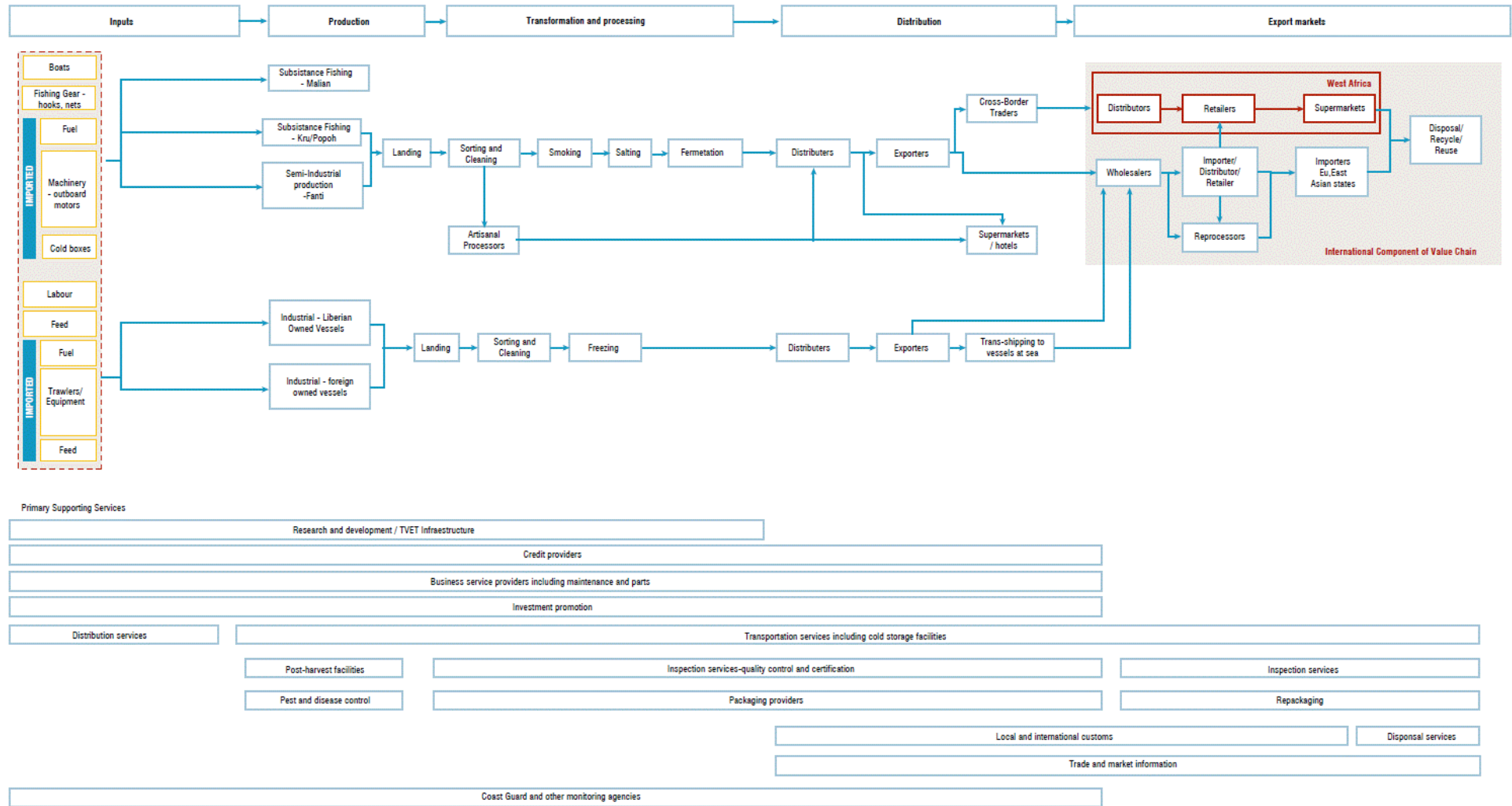
Fish is generally sold by retail by the piece, with sizes of 250 grams and higher found in the marketplace. Larger fish are preferred by do not necessarily sell for higher price per kilogram.

Regulatory Enforcement

As a part of the WARFP, Liberia strengthened the artisanal fishing sector through the establishment of the inshore exclusive zone (IEZ), registration of small-scale fishing fleets, tightened and increased transparency surrounding fishing licensing policies. Liberia also introduced the use of a satellite-based vessel monitoring system (VMS) for industrial fleets and increased sea patrols to curb illegal fishing, and officially recognized the rights to community fisheries management in the Robertsport area. A WARFP survey found that communities have since achieved better social, economic, and ecological outcomes as measured by the Fisheries Performance Indicators (FPIs).

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Figure 2. Fisheries Value Chain Chart



Source: Republic of Liberia National Export Strategy

Fishery & Aquaculture Sector SWOT Analysis

Strengths	Weaknesses	Opportunities	Threats
<ul style="list-style-type: none"> • Abundant water resources, high irrigation potential and appropriate climate and topology for tilapia and catfish breeding • Preferential access to several lucrative markets including EU (EBA) and USA (AGOA) • Existing infrastructure including over 900 ponds and 3 hatcheries • Initiatives by Government and donors to rebuild the sector including rehabilitation of ponds and hatcheries 	<ul style="list-style-type: none"> • High fish storage / processing costs due to limited availability of grid electricity • Poor transport and limited cold-chain facilities • Shortage of quality inputs for aquaculture including feed and fingerlings • Lack of comprehensive fisheries and aquaculture policy • No capacity to certify and quality approve fish • Shortage of aquaculture veterinarians / professionals 	<ul style="list-style-type: none"> • High demand for fish from both local and regional markets • Potential to invest in different aquaculture farms including freshwater ponds, integrated fish farming, brackish water and mariculture • Potential for investment in inputs and processing sectors within aquaculture supply chain • Little to no competition 	<ul style="list-style-type: none"> • Competition on the domestic market with imported fish due to incentives to import rather than catch/farm locally

CASSAVA

Cassava Thesis

Liberia produces over 600,000 tons of cassava per year. Cassava is grown in over 250,000 households across Liberia and is a food security crop since it is harvested when household rice supplies run low. However, if left unprocessed, cassava spoils in 24-72 hours after harvest due to a process known as post-harvest physiological deterioration (PPD).⁶ This short shelf life makes the crop particularly vulnerable to processing inefficiencies and other poor practices along the value chain like product handling. This is a problem for farmers but an opportunity for investors. Those with a focus on investing in PPD-resistant cassava varieties, preservation between harvest and processing, processing facilities or transportation would find a market that has a small but growing volume of annual cassava harvest capacity. Investors coming in at this stage of productivity will have access to relatively larger and more consistent sources of fresh cassava than in recent history. This is the core of the cassava sector, wrought with inefficiencies each surmountable with the right investment. Furthermore, the promotion of Liberia's cassava sector can lead to a significant boost in the food industry (cassava flour, chips), non-food industry (glue, starch, fertilizer, chemicals), poultry & livestock industries (feed) and ancillary services (transportation, warehousing, packaging).

Cassava Sector

Cassava is a major staple food in the developing world, providing a basic diet for over half a billion people. It is the third most important calorie source in many countries where it is grown, after rice and maize, but the second most important in Liberia where maize is not a major food crop. Despite its importance in Liberia, domestic production would need to increase by at least 1/3 to satisfy local demand and an additional 60 tons per month of high quality economically produced gari would be needed to offset current imports⁷. Liberian cassava production volumes averaged just over 550,000 tons per annum in the 6 years leading to 2020. While these are the lowest volumes coming out of the Mano River region, cassava production in Liberia has nonetheless increased due, in part, to cassava increasingly becoming a rice substitute and value being added to raw cassava through the production of cassava flour, fufu, and gari. It is as a priority crop in Liberia and contributes to food security, import substitution, job creation and gender inclusion - women play a prominent role in the processing of the tuber.

Cultivated mainly in the tropical belt and in some of the world's poorest regions, cassava production has doubled in a little over two decades. Globally, output of cassava is growing at over 3% per annum, almost three times the rate of global population growth. It is key for rural development and poverty alleviation, food security, energy security, and for bringing important macroeconomic benefits. These are the factors, combined with substantial domestic demand and favorable global market conditions, that should continue to drive the commercialization of this crop and large-scale investments in upscaling processing it.

The cumulative average growth rate (CAGR) of cassava production in Liberia over the 6-year period spanning from 2014 to 2020 was 4.29%⁸. This implies that while starting from a low production volume base, Liberia is showing promise that it could be a major cassava producer. Attracting capital will mean not just highlighting land arability

⁶ Rockefeller Foundation Cassava Innovation Challenge

⁷ LADA Value Chain Analysis Assessment Report June 2016

⁸ LASIP I Liberia Agricultural Sector Investment Program May 2017

and deep natural reserves, but also emphasizing opportunities in alternate uses of cassava and how innovation can be applied to address contemporary problems including but not limited to climate change.

Cassava Supply Chain

The production of cassava in Liberia is estimated to be more than 600,000 metric tons per year; the value chain, however, is frustrated by a lack of innovation, low yields, and limited processing capacity. Furthermore, only 3-4% of arable land is currently cultivated with small acreages of tree crops maintained for generating cash income⁹.

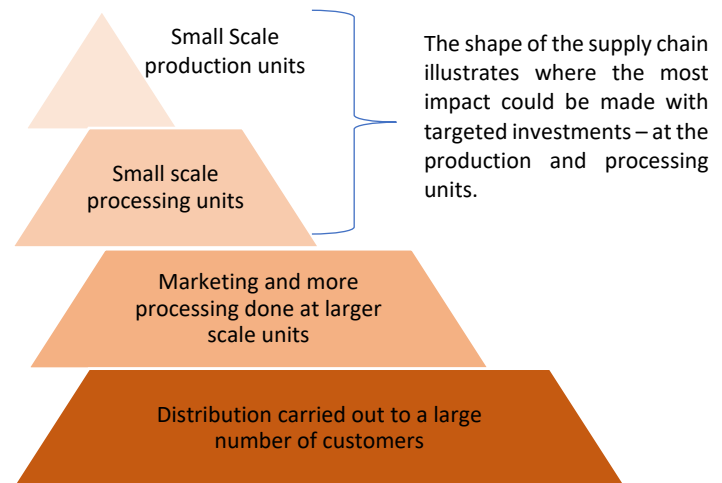
The key constraints for farmers to expand market opportunities for cassava and improve producer prices are¹⁰:

- lack of access to markets for fresh cassava
- unreliability of existing markets
- unavailability of appropriate technologies and technical knowledge to meet demands of existing potential
- high production costs and low profit margins
- over-reliance on imported materials
- high unemployment rates especially during off-peak farming seasons
- the absence of a conducive policy environment for industrializing the production of cassava

The cassava supply chain begins with small-scale production units through small holder farmers. It is then followed by small-scale processing units for the drying and milling. These steps are often carried out at the home and local level. The next step is marketing, processing, and packaging which are done by a few larger-scale units. Finally, the product is distributed to a larger number of consumers.

Figure 3. Cassava Supply Chain

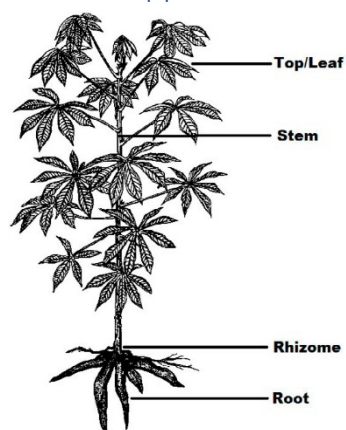
This pyramid supply chain structure suggests that the growth and development of the cassava sector markets will benefit a larger number of resource-poor farmers located on poor lands as well as the local processing units. The challenge is how to equip these farmers and processors with the knowledge and tools needed to produce the products that meet the specification demanded in global markets. There is also the challenge of how to deal with growth markets that lead to an altered supply chain - one with fewer large-scale producers. The potential structural change of the supply chain will, therefore, have to be evaluated when marketing opportunities are assessed.



9 LISGIS 2011

10 <https://teca.apps.fao.org/teca/en/technologies/4575>

Cassava Opportunities



Cassava is a high potential plant for the Liberian economy because it can be transformed into many different foods and products by using all of its parts. This versatility makes it a priority crop for the GoL as the one plant can spur various thriving industries, create jobs, and attract much needed foreign currency from exportation. This report focuses on three uses of the cassava plant that together address several UN SDGs including no poverty, zero hunger and climate action while also being commercially viable and investment ready. The three focus areas are cassava flour, edible carbon dioxide, and organic fertilizer.

1. Cassava Flour

Global demand for fruits and vegetables is continuing to trend upwards, including an increasing demand for tropical vegetables. With minimal commercial investment and basic inputs Liberia is already producing over 600,000 tons/year of cassava¹¹. Farmers have been trained to process cassava into flour, fufu, and different kinds of gari but the cassava flour should be in focus right now because of its applications in cuisine around the world and particularly in a niche, high-value, and growing sector – gluten free foods.

In recent years, cassava flour has gained momentum as a go-to gluten-free alternative. It is very close to wheat flour as it can be substituted for up to 30% of wheat flour in bread, 40% in biscuits and 100% in cake without adverse consumer responses, making cassava flour a “holy grail” for wheat flour replacement. Additionally, it has been found that cassava flour improved profits in products where use of the flour allowed the quantities of other expensive ingredients such as sugar and margarine to be reduced. Furthermore, unlike other gluten-free flours such as almond or coconut flour, cassava flour is very mild and neutral in flavor, and it has a soft and powdery texture, instead of the grainy or gritty texture often associated with almond flour. These qualities make cassava flour a preferred flour for gluten-free, grain-free baking and cooking.¹²

The global gluten-free flour market size was estimated at \$5.6 billion in 2020 and projected to increase at a CAGR of 8.1% between 2021 and 2026. The demand for gluten free flour is being driven by a growing population turning to healthier diets and the increased prevalence of those who suffer from celiac disease, represented by over 100 million people. Gluten is ever present in traditional baked goods as its principal function is to give dough elasticity, its chewy texture and make it keep its shape. However, gluten is a protein that is indigestible and intolerable for many people worldwide. Gluten intolerance has caused a significant increase in digestive and gastrointestinal disorders and resulted in manufacturers developing dedicated gluten-free product lines.¹³

The industry standard for the cassava flour yield ratio is 3.5:1, meaning that for every 3.5 tons of cassava, one ton of cassava flour is produced (depending on storage time and processing machine).¹⁴ In the case of Liberia, which produced an estimated 632,000 tons of cassava in 2020¹⁵, its current potential annual gross cassava flour volumes

¹¹ FAOSTAT; Dalberg analysis Fruits and Vegetables investor outreach materials 2012

¹² <https://downshiftology.com/5-things-you-need-to-know-about-cassava-flour/>

¹³ <https://www.industryarc.com/Research/Gluten-Free-Flour-Market-Research-507330>

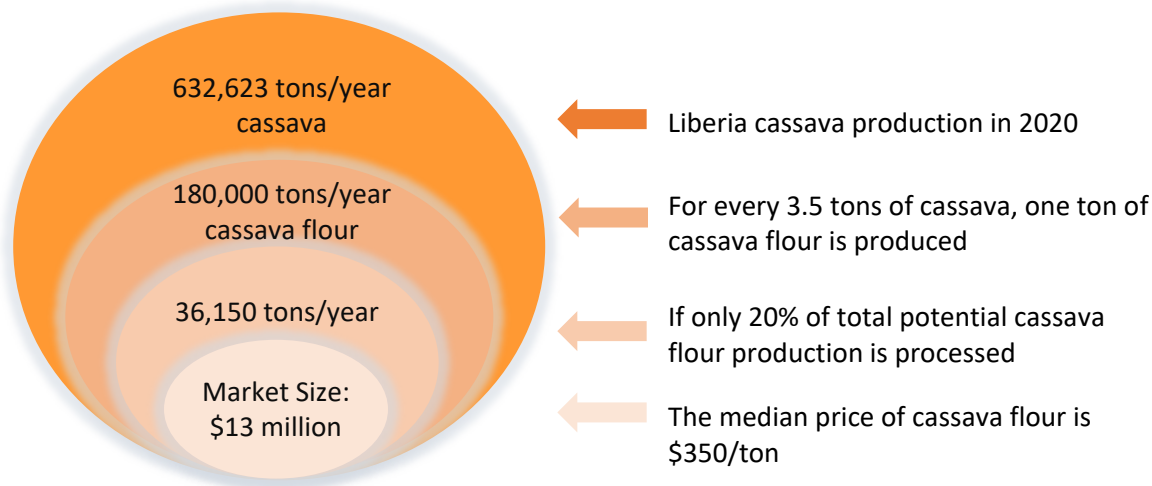
¹⁴ https://www.cassavastarchmachine.com/faq/produce_one_tonne_of_cassava_flour_281.html

¹⁵ <https://knoema.com/FAOPRDSC2020/production-statistics-crops-crops-processed?tsId=1197090#:~:text=Though%20Liberia%20cassava%20%2D%20production%20fluctuated,at%20632%2C623%20tonnes%20in%202020.>

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is over 180,000 tons of cassava flour. All cassava produced can never be consumed for one sole product so as not to affect national food reserves and existing preferences, so using a 20% cassava market penetration assumption, the potential cassava flour volumes produced in Liberia in 2020 would have been 36,000 tons. The price per metric ton of cassava flour can range from \$250 - \$450¹⁶. This suggests that at the median price of \$350/ton the Liberian cassava flour market at 2020 production levels is over \$13 million. Assuming further, cassava production in Liberia continues to grow annually as it has over the past 10 years at a CAGR of just over 4%, the base case market value of cassava flour to the Liberian economy in 10 years could surpass \$20 million, ceteris paribus. This is significant as it represents one-fifth the income expected from non-tax revenues to the Government of Liberia¹⁷.

Figure 4. Cassava Flour Market Sizing



2. Liquefied Edible Carbon Dioxide (CO₂)

Liquefied carbon dioxide has many practical uses, namely:

1. Feedstock used by carbonated beverage producers
2. Dry ice to preserve frozen goods such as fish, meat, and medical products
3. Substitute for unsafe perchloroethylene that is typically used in dry cleaning

However, consumers of liquefied CO₂ face three key challenges:

1. Erratic local production
2. High prices of imports
3. Unreliable supply chains

The lack of cheaply available local sources of CO₂ means that prices can be as high as \$3,000 per ton in markets like Ghana and Nigeria, depending on whether the gas is procured on contract or in the spot market. By contrast CO₂ prices in developed markets, like Europe and the US, range from \$50-\$100 per ton. The cause of this massive arbitrage opportunity is shipping costs, which can place a price floor as high as \$600 per ton on the overall cost to the end customer. The advent of Covid-19 and the political instability in Europe has created unprecedented supply chain issues. Coupled with the challenge of unreliable clearing processes that lead to protracted delivery times,

¹⁶ <https://www.alibaba.com/showroom/cassava-flour-price.html>

¹⁷ <https://www.mfdp.gov.lr/index.php/docs/the-national-budget>

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these constraints require higher inventory stock and working capital, which impact the bottom line of businesses. Currently, only one main company in the region, Air Liquide in Nigeria, produces the chemical in commercial quantities for export. Therefore, local production of liquefied CO₂ for both domestic and regional consumption is a highly attractive proposition.

Liquefied CO₂ is usually captured in the oil refining process, but it can be produced without the associated environmental damage in a manufacturing plant by upgrading biogas generated by the anaerobic digestion of locally sourced cassava peelings. The peelings, not the edible tuber itself, are used because the peelings have no alimentary value and therefore no impact on national food systems; in fact, cassava peelings are usually burned for disposal after stockpiling for extended periods of time, a process that releases GHG into the atmosphere. Furthermore, one of the by-products of the process is excess methane (or bio-CNG) which can be used as fuel in the generators that power the plant. Put together this means that investing in a liquefied CO₂ factory has the following positive externalities:

1. Frees rural areas of stockpiled agricultural residue
2. Creates economic value out of a current waste product
3. Reduces GHG emissions
4. Produces clean energy out of organic feedstock
5. Slashes the costs of operating an energy-intensive plant off the national grid

Processing cassava peelings opens revenue streams for Liberia that were previously unexploited and enables the country to tap into more regional and international markets all while maintaining a reduced carbon footprint.

Data and analyses from well-known biogas producing companies imply that cassava peelings are only 5% the total mass of the cassava tuber but have a 35% and 10% liquefied CO₂ and CNG yield, respectively. Therefore, holding all things constant, in 2020 when Liberia produced about 632,000 tons of cassava, there was over 31,000 tons of cassava peelings available and since cassava peelings do not compete for nutritional value, 100% of it can be used in this process. Meaning that from 31,000 tons of cassava peelings, a manufacturer can produce about 11,000 tons of CO₂ and over 3,000 tons of bio-CNG. Assuming a range of \$500 - \$1,000 per ton, a rate below typical expected landed costs of imported liquefied CO₂ and above rates in developed markets, the base case production value of liquefied CO₂ in Liberia today is between \$6 - \$12 million.

The appeal of natural gas as a viable energy source has grown rapidly across Africa over the past decade, with primary drivers including reduced costs compared to traditional fossil fuels, mounting pressure from the global energy transition, and growing demand for alternative power generation solutions. Accordingly, the emergence of CNG markets has been driven by increased investments, in a bid to address energy security, diversification and electrification challenges.¹⁸ With an estimated 3,000 tons of volume readily available today from cassava peelings and natural gas prices hovering around \$7/MMBtu, the current value of Liberian bio-CNG is about \$1 million. While small, this is an automatic tag-along additional value when producing CO₂ and the Middle East & Africa (MEA) CNG market is projected to grow with a CAGR of 12% from 2018 to 2027¹⁹. Timely investments in this space would be strategic for the savvy investor.

Figure 5. Advantages of CNG



¹⁸ <https://energycapitalpower.com/emerging-lng-and-cng-markets-drive-african-industrialization/>

¹⁹ <https://www.prnewswire.com/news-releases/middle-east--african-cng-markets-to-2027-focus-towards-the-diversification-of-the-regions-power-supply-301026923.html>

Figure 6. CNG Market from Cassava



3. Organic Fertilizer

Another bi-product of cassava peeling processed for liquefied CO₂ is nutrient-rich organic fertilizer which can improve the yield of Liberian farmers, a major factor as the industry is already marred by low output due to little technology, poor pest management, and the limited use of fertilizer among other things. The nitrogen-rich fertilizer would be very attractive to farmers because access to fertilizer is generally seen as a challenge, in terms of cost and availability. The lion’s share of fertilizer in Liberia is imported so consequently has the embedded risks associated with supply chain unreliability and high costs. Locally produced organic fertilizer would, therefore, disrupt not just the cassava sector, but the entire agricultural industry. Indeed, the fertilizer produced as a by-product could go back to the same farmers who produce cassava to increase their yield in exchange for the off take of the cassava peelings, but better yet, it can be sold on local and regional markets.

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Providing fertilizer to the farmers who provide the cassava would have a notable social and economic impact to them because they typically rely on credit for farming inputs and bear the risk of losses due to poor harvests. Fertilizer that does not need to be purchased frees up precious resources for vital farming inputs and extends even to the direct impact of increasing the farmers’ productivity, crop yield and earning power. In many instances farmers lose precious days in the planting season because fertilizer is simply not available for purchase, for a variety of reasons.

Research shows that the cost of retail landed fertilizer was the most adversely affected by the Covid-19 pandemic of all the variables associated with the fertilizer supply chain both in within Liberia as well as compared to other countries in the region²⁰.

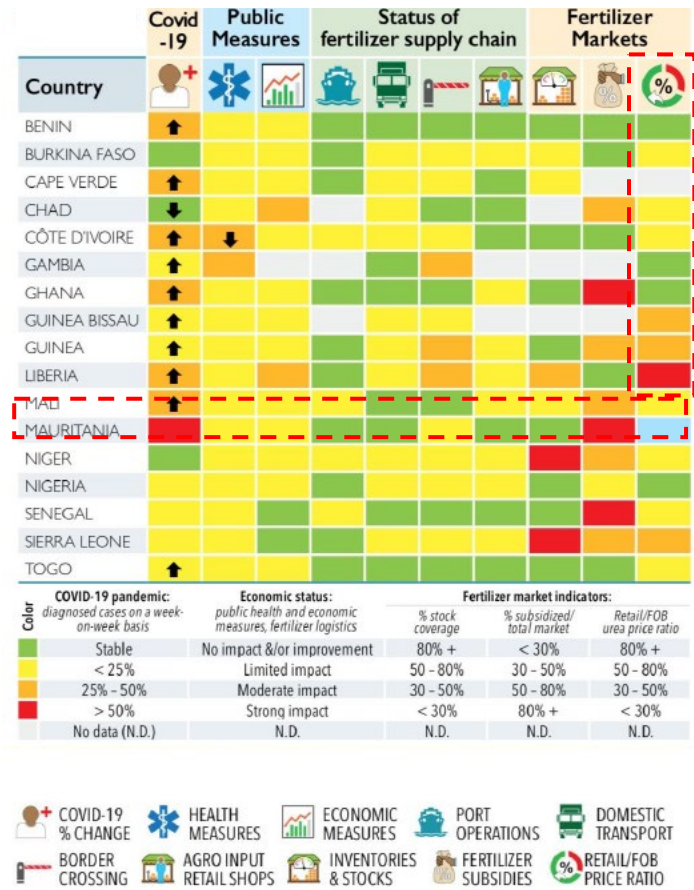
The per ton costs for urea/fertilizer in 8 west African countries ranged from \$319 in Senegal to \$475 in Niger. At \$330 to \$360 per ton delivered in most countries, domestic costs add between 50% and 85% to the FOB price. At the high end, a Liberia-based organic fertilizer producer could sell its product in the region for as much as \$600/ton. Knowing that the yield from cassava peelings for fertilizer is about 52% and based on 2020 production figures, about 31,000 tons of cassava peelings was available, the value of the Liberian organic fertilizer market is currently roughly \$10 million, ceteris paribus.

Key Takeaways

The current production of cassava in Liberia is just over 600,000 tons per year. Cassava is versatile as it can produce many variations of commonly demanded and niche food items, like cassava flour. It is also suitable for the manufacturing of less well known but high valued products in fast-growing and emerging industries such as liquefied carbon dioxide, bio-CNG and organic fertilizer.

The current combined value of the aforementioned industries is \$36 million. There are tangible opportunities that exist in unexploited areas and even at the current state of the grossly under-productive and ill-funded industry. The lesson herein is that a speculative investor could capture material returns by being innovative in the cassava sector of Liberia. It is well documented that the country is fertile and vast agricultural land remains unproductive. In fact, presently at least \$36 million of potential remains untapped from the cassava plant alone,

Figure 7. Agriculture Factor most Affected by Covid-19



²⁰ <https://ifdc.org/wp-content/uploads/2020/06/WAFW-Analysis-Edition-10-12-june-2020-costs-EN-final.pdf>

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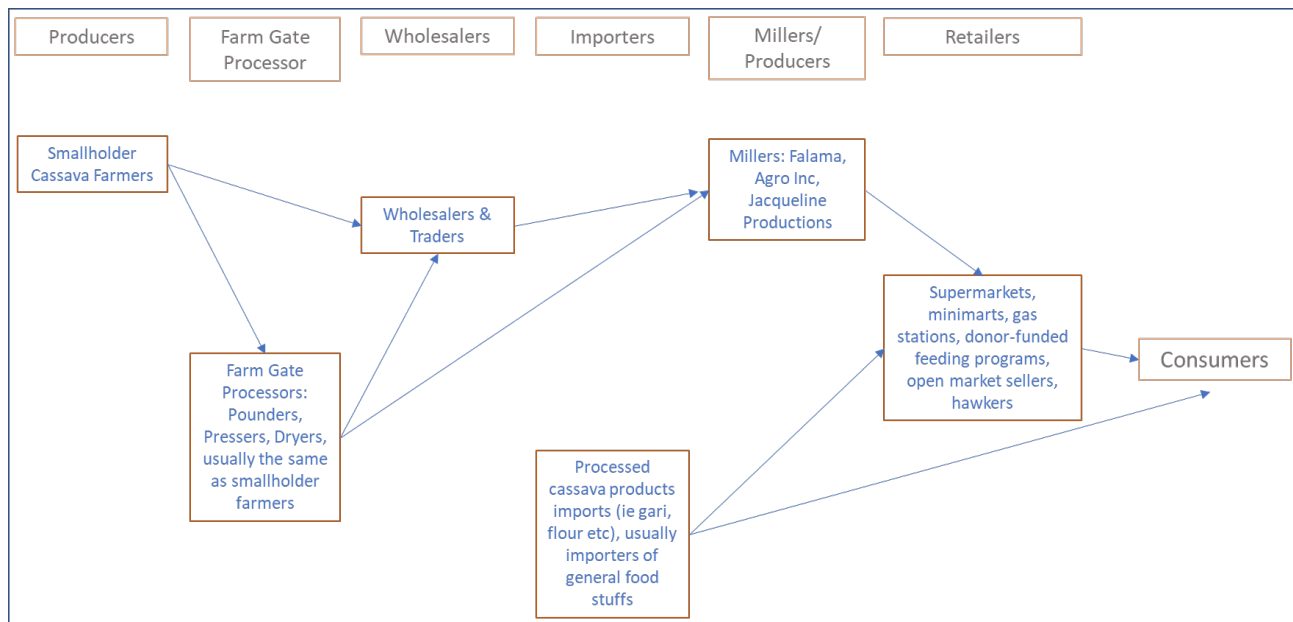
not to mention the expected cumulative average growth rates of each vertical highlighted and the added acceleration of revenue generation if adequate funding is injected.

Investment Impact:

1. Increase in jobs due to new employees being hired to meet the added production needs of the new cassava processing facilities
2. Increase in income for cassava farmers due to the increase demand of cassava products
3. Increase revenue and profits for operators due to an increase in sales
4. Liberian consumers having more access to healthy cassava products
5. Increased knock-on interest in the Liberian cassava sector from other cassava processing companies

Cassava Value Chain

Figure 8. Cassava Value Chain



Primary Activities

The specific primary activities in the cassava value chain are mapped in this figure. They include the work of small holder farmers which occurs at the local level and farm gate level processing all the way to the donor-funded feeding programs that have led to the improvement of the sector. The specific activities include planting, growing, and harvesting as well as steps to prepare the product for actual processing, which may include any or all of the following: peeling, drying, pounding, pressing, and milling. Moving prepared product efficiently through the system from the farm gate to wholesalers, import/exporters, processers and finally end consumers involves an intricate web of many players. Overall, the primary activities relate directly to the physical creation, sale, maintenance, and support of the cassava sector product or service. So, investing in the cassava sector could mean directly into the product itself or into trucking, warehousing or even the provision of feedstock and materials to

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support production such as fertilizers or tractors. Seeing as the industry is not well developed or sophisticated, the most optimal use of investment capital would be directly in the production and processing steps.

Support Activities

These activities support the primary functions above and can play a role in each primary activity. For example, procurement supports operations with certain activities, but it also supports marketing and sales with other activities. Procurement, human resources, technological and infrastructure are line items that will at the early stages be handled at the company level but over time as the industry's eco-systems develop it is reasonable to assume that sophisticated processes dedicated to supporting the primary activities will be stand-alone sectors.

Cassava SWOT Analysis

Strengths	Weaknesses	Opportunities	Threats
<ul style="list-style-type: none">• Can grow and produce high yields in areas where other crops will not grow or produce well• Can tolerate drought and can be grown on soils with a low nutrient capacity• No definite maturation point so harvesting may be delayed until market, processing, this flexibility means cassava may be field stored for several months or more so is highly acceptable in the rural areas	<ul style="list-style-type: none">• Labor intensive production• Lack of nurseries to provide cuttings to farmers• Small-scale farms• Absence of technical farming capability• High spoilage rate due to poor storage and transportation practices• Poor transport networks connecting farms to markets	<ul style="list-style-type: none">• Responds well to irrigation or higher rainfall regions• Domestic production would need to increase by at least 1/3 to satisfy local demand• Priority of GOL• High potential to improve food security• High job creation potential• Import substitution• Can be used as a famine reserve and food security crop	<ul style="list-style-type: none">• Non-competitive vs. imports due to: (1) current, (2) high costs of production (3) Relatively poor quality cassava products (4) Low or non-existent import tariffs

COCOA

Cocoa Thesis

The cocoa bean is the dried and fully fermented fatty seed of the cocoa tree (*Theobroma cacao*). It is Liberia’s second most important export crop, with nearly 50,000 households engaged in production that is mostly informally exported to international markets via neighboring countries. In addition to export through neighboring countries, local cocoa nurseries procure cocoa seeds from neighboring Ghana and Ivory Coast because there are few cocoa seed farms in Liberia. Smallholder cocoa farmers in Liberia struggle to plant much-needed new cocoa trees even though current farms are stocked with very old cocoa trees that are well beyond their productive years. A few of the major cocoa exporters in the country offer pre-financing and sell some key production inputs but the size and consistency of these services are not sufficient to make material changes in the sector. Liberian cocoa yields around 200kg/hectare, 30% of that obtained in neighboring countries, and just 20% of its potential, demonstrating the inefficiencies but large-scale potential of the sector. Lastly the price of cocoa on international markets has proven to be unpredictable for over the past decade, creating economic stress on the local markets the commodities are sourced from.



Chart 1. 13-year Cocoa Prices

For these and several other reasons, smallholder farmers need to plant new farms, procure quality inputs at reasonable prices and access affordable capital. Additionally, the MoA needs to incentivize companies that operate further up the value chain from harvesting to manufacture higher value end products for domestic, regional, and international consumption.²¹

Cocoa Sector

As of 2016, there were over 13,000 smallholder cocoa farmers working on an estimated 70,000 acres of land across Liberia with an average yield of 110kg/acre, or 7.7 million kg per year. Using the conservative assumption, considering volatility, that the average price of cocoa is around \$2/kg, the value of the existing cocoa production in Liberia, without additional investments is about \$15 million. However, the potential yield per acre is actually 650kg/acre or 45 million kg per year which has a value of over \$90 million. In short, the sector is being underutilized by nearly 500%.

The cause for the large disparity between the actual and potential productivity of cocoa farms can be explained by the following points²²:

- Excessive trade of wet cocoa
- Need for clearer price incentives
- Weak business-oriented cooperatives
- Side selling by cocoa farmers

²¹ <https://www.statista.com/statistics/237152/world-cocoa-grindings/>

²² Wienco’s smallholder Farmers Financing Model 2016

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- Poor system of grading and traceability
- Less than 2% farmers use fertilizers
- Few processing and grading facilities

Estimates show that in Cote d'Ivoire the average per-farmer-yield of cocoa per year is 500kg, meanwhile in Liberia, the estimated productivity per farmer in cooperatives (where their productivity is more readily measurable) was 40kg of cocoa per year. This disparity is material and cannot be explained away by one factor but rather a myriad of well documented factors, some in the aforementioned list.

To become economically viable, farmers' productivity must increase substantially. Some analysis indicate that the productivity of Liberian farmers could readily increase at least five times to 200kg per farmer.²³ The first step to addressing this gross underperformance is for Liberian farmers to form well organized cooperatives which will give them the bargaining power they lack to negotiate for the inputs and assistance they need and, consequently, increase production volumes and quality.

Characteristics of Efficient and Well-functioning Cooperatives

- Well-defined objectives
- Adequate governance and organizational structure
- Operating on sound business principles and business practices
- Permanent implementation of zero-loss and capitalization policies
- Transparent and frequent communication with members

Improper post-harvest processing and handling is pervasive and has led to significant origin discounts on world markets. Low quality was even institutionalized when the Liberia Produce Marketing Corporation (LPMC) created a market for "fair average quality" cocoa that is drastically below international quality standards. This situation has been perpetuated further by the operation of traders from neighboring countries who purchase said sub-grade cocoa.²⁴

Overall, the cocoa sector needs a complete overhaul that includes regulatory changes (like the Centers for Cocoa Development (CCD) set up by Solidaridad), farmers reorganization and increased investment capital in innovation. These reforms should focus on two pillars of the supply chain: (1) planting and harvesting; and (2) processing and packaging to move Liberia from merely a cocoa producing country to a cocoa-products producing country.



Source: Transparence Cacao

²³ Improving Access to Finance in the Agricultural Sector of Liberia 2015

²⁴ Reforming Cocoa and Coffee Marketing in Liberia

Cocoa Global Trends

Cocoa processing involves the conversion of cocoa beans into different forms such as cocoa liquor, cocoa butter, cocoa cakes, and cocoa powder with the chocolate industry representing the biggest end user of the bean. Aside from chocolate, the biggest consumable end products of cocoa are chocolate milk, biscuits, ice cream, and cakes. Similarly, cocoa butter is widely used during the production of soaps, cosmetics, and pharmaceutical products. The uses for cocoa beans are countless and cuts across many industries which explains how the global cocoa market reached a volume of 5 million tons in 2020.

Côte d'Ivoire and Ghana currently represent the world's two biggest producers of cocoa, together accounting for nearly 60% of total global cocoa production. Including countries like Cameroon and Nigeria, that are also top cocoa producers on the continent, Africa accounts for more than 70% of the total global cocoa production. Despite being the largest producer, the region accounts for less than 21% of the total global cocoa processing market. Fortunately, the biggest importer and processor is nearby Europe and, looking forward five years, analysts expect the global cocoa processing market to exhibit significant growth.²⁵

Cocoa is very much a smallholder business. For the Liberian cocoa sector to catch up to global trends the productivity and scale of cocoa production systems must be increased while the development of a competitive and efficient cocoa marketing chain needs to be fostered. The way that cocoa is grown, the inputs used, the methods to process, and access to moisture-controlled storage strongly determine the value and attractiveness to investors and consumers. Currently, the cocoa harvested in Liberia is known for its low quality because the trees are old, very little fertilizer is used and farmers are not well-trained to manage the exceptional moisture in the beans due to Liberia's noteworthy humidity. Once these issues are met, possibilities for commercializing Liberian cocoa expand.



Source: Bio Eco Actual

Cocoa Opportunities

1. Organic & Fairtrade Certification

Cocoa is one of the most widely used raw materials in the food and beverage industry. The rising awareness among consumers of the health benefits of organic cocoa will remain the primary driver for the growth of the global organic cocoa market, which is experiencing significant growth. The demand for organic cocoa will also continue to increase exponentially in line with population growth; fast growing countries like China, Korea, India, and Japan will augment the demand for cocoa products globally.

Organic farming aims to produce food using natural substances and processes and so tends to have limited environmental impact. It encourages the responsible use of energy and natural resources; maintenance of biodiversity; preservation of regional ecological balances; enhancement of soil fertility; and the maintenance of

²⁵ https://www.researchandmarkets.com/reports/5311826/cocoa-processing-market-global-industry-trends?gclid=CjwKCAjw46CVBhB1EiwAgy6M4urOa31wP5djJo8F5otiv3bwsM4VRPRduzEgMhW1-RnXboKcGGz6RRoCEpQQAvd_BwE

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water quality. Additionally, organic farming rules encourage a high standard for animal welfare and require farmers to meet the specific behavioral needs of animals. While cocoa production is often associated with overexploitation, environmental unsustainability, and poverty, organic and fairtrade cocoa has emerged as an alternative that improves the quality of the products and the social justice associated with them - that is, cocoa that is both socio-economically and environmentally sustainable because it is produced and processed using natural techniques such as crop rotation, biological crop protection, green manure and compost is increasingly more sought-after by consumers. Alongside social and environmental benefits are the health benefits of cocoa. Cocoa is a rich source of an antioxidant that helps lower blood pressure, prevents inflammation and is the only material used in the production of dark chocolates. The rising popularity of healthier products among millennials is projected to further thrust the organic cocoa market forward.

Quality concerns aside, Liberian cocoa already possesses many of the characteristics that appeal to specialty buyers and set it apart from other cocoa producers²⁶:

1. Small size of cocoa sector appeals to niche, specialty chocolate makers
2. Many of the old tree varieties found in Liberia pre-date the country's civil conflict, which began in 1989, and so offer unique flavors that have been lost in Ghana and Côte d'Ivoire, where older trees have been replaced with uniform hybrid varieties developed for their high productivity and resistance to disease
3. Farmers lack the means to purchase chemical fertilizer and pesticides so production is free from chemicals
4. Exceptional biodiversity in its largely intact rainforests

The size of the organic cocoa market in 2020 was \$533 million and is expected to grow to \$943 million by 2028. This means that the value of the Liberian cocoa market in 2020 was \$15 million, or 3% of the global market size, but if Liberia's production were to keep up with global growth and can be 100% organic certifiable the value of its cocoa market will reach \$27 million by 2028, or 3% of \$943 million. In recent years, there has been a strong increase in the sale of cocoa beans that are both organic and Fairtrade, which is evidenced by data showing that for just the three months from October to December 2019, farmers in Côte d'Ivoire earned over \$15 million more on their Fairtrade sales compared to conventional prices. Also, between 2014 and 2018, the volume of cocoa beans certified by both standards increased by 39% globally, amounting to almost 34,000 tons in 2018. While it is expensive, positioning Liberia as a source of organic and fairtrade cocoa would increase yields and quality making this a critical move to ensure growth this sector.^{27,28}

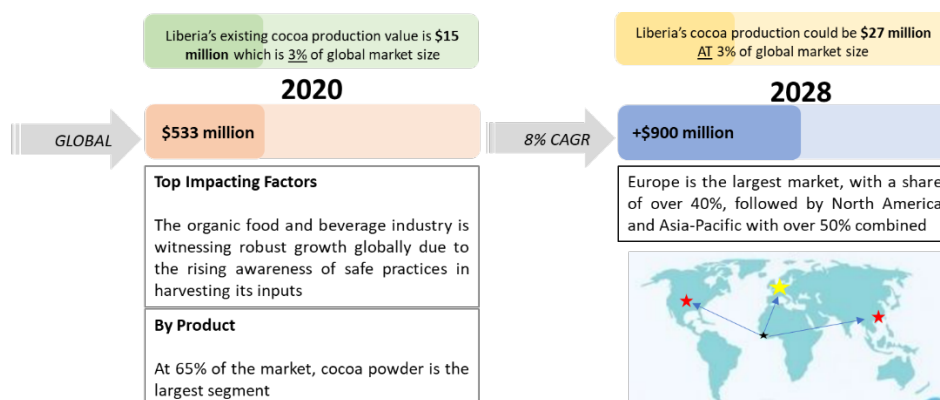
²⁶ <https://african.business/2021/08/agribusiness-manufacturing/liberia-courts-premium-markets-to-boost-cocoa-earnings/>

²⁷ <https://www.globenewswire.com/news-release/2022/03/29/2411957/0/en/Organic-Cocoa-Market-to-Hit-USD-942-57-Million-by-2028-Organic-Cocoa-Industry-Exhibiting-a-CAGR-of-7-42-2021-2028.html>

²⁸ <https://www.bioecoactual.com/en/2022/01/11/organic-fair-trade-cocoa/>

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Figure 9. Size of Global Cocoa Market



Aside from the tailwinds that could drive the growth and attractiveness of this sector to investors, the benefits to Liberia of creating an enabling environment for companies to easily obtain organic certifications are as follows:²⁹

- Price Premiums - additional \$540/ton for Organic and Fair-Trade Cocoa
- Investment in farmers by impact-driven companies
- Improvement in cocoa quality
- Environmental conservation
- Reduction and eventual prevention of child labor
- Long term investment in Liberia

2. Cocoa Seedlings and agrochemicals

For a significant boost to cocoa production, farmers need to plant affordable cocoa seedlings to grow new tree stocks and they need adequate agrochemical inputs over the course of the growing season to ensure quality harvests. As an interim strategy, Liberia can develop barter deals with neighboring producers to acquire seed technology, however, Liberia needs to develop its own agri-inputs (seedlings and fertilizer) sector to sustainably support the growth of the cocoa value chain.

Currently the private sector agrochemical supply chain in Liberia is very underdeveloped and prices are several times higher than those found in other parts of West Africa, mainly due to low volumes and the high transaction costs of importing through Monrovia. Consequently, cocoa farmers use inputs sparingly and some do not use them at all. Efforts by the MoA are therefore needed to facilitate new business linkages along the input supply chain to spur the demand and use of fertilizers among farmers. Note that given cash constraints, credit arrangements would also need to be made accessible and affordable to these same farmers.

Aside from planting new productive trees, farmers are managing plantations full of ageing trees with decreasing yields. The default plans have revolved around the planting of new, highly productive, disease-resistant trees. But research shows that the use of chemical fertilizers can also help to revive existing old plantations. A pilot study on the impact of fertilizer showed that its use on degraded farms with mature trees had a clear positive

²⁹ <https://www.growliberia.com/insights/premium-cocoa-market-opportunity/liberias-premium-cocoa-market-opportunity>

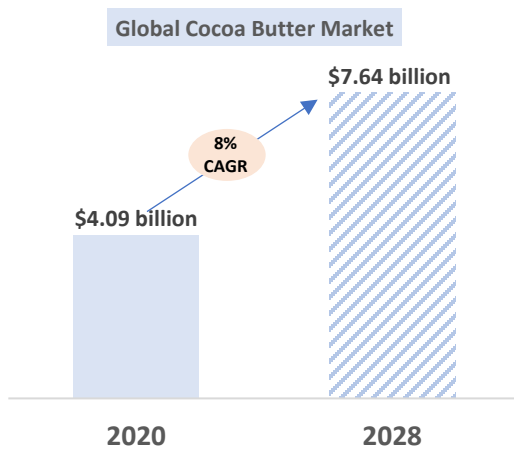
impact on the productivity of cocoa; after just one year of application the foliage on degraded farms was widely rebuilt. Fertilizer use also slows the rate of tree mortality and results in higher yields and higher-quality pods.³⁰

Agrochemical expense at West African prices is estimated at approximately \$150 per hectare or \$370 per acre.³¹ Given that 70,000 acres of land is currently under cocoa production in Liberia, the implied estimated value of the agrochemicals market specifically for the production of cocoa in Liberia is at least \$26 million.

3. Cocoa Butter

Cocoa butter is a natural, edible vegetable fat extracted from the cocoa bean. It is used to make chocolate, ointments, and suppositories, as well as skin care and cosmetic products. Due to its high melting point, it is ideal for use in products that require a solid consistency, such as lipsticks and balms. Almost all Liberian cocoa is sold on the bulk market for use in the cosmetics industry.³²

Chart 2. Global Cocoa Butter Market



The global cocoa butter market is projected to grow at a CAGR of 8.13% between 2020 and 2028 to reach roughly \$8 billion.³³

The growth in the market can be attributed to the increasing demand for cocoa butter in food, cosmetic and pharmaceutical applications. Cocoa butter is used as an ingredient in various food items due to its smooth texture and rich flavor. It is also used as a base for making skin care products owing to its emollient properties. In addition, it has various therapeutic properties such as anti-inflammatory, antioxidant, and antibacterial which makes it suitable for use in pharmaceutical products. Increasing demand for cocoa butter in the food and beverage industry as a natural preservative and flavoring agent

will also drive the market growth. Overall, rapid urbanization in developing countries and the changing tastes that come with will drive the growing demand for cocoa butter.³⁴

The two main types of cocoa that dominate are food and pharmaceutical grade. Food grade is used for classifying edible products such as meat, poultry, seafood, and processed food. It also has essential fatty acids which are considered healthy for human consumption. Pharmaceutical grade cocoa butter is the purest form of cocoa and typically used in the manufacture of ointments, creams, and lotions.

Liberia’s cocoa production represents about 3% of the global production of cocoa. Using this metric as a guide, at 1.5% (discounting the 3% by half to account for expected inefficiencies that would decrease ultimate volumes

³⁰ <https://businessfightspoverty.org/how-fertilizer-can-double-cocoa-production/>

³¹ Intensified Cocoa Sustainable Development Liberia Report

³² <https://african.business/2021/08/agribusiness-manufacturing/liberia-courts-premium-markets-to-boost-cocoa-earnings/>

³³ <https://www.verifiedmarketresearch.com/product/cocoa-butter-market/>

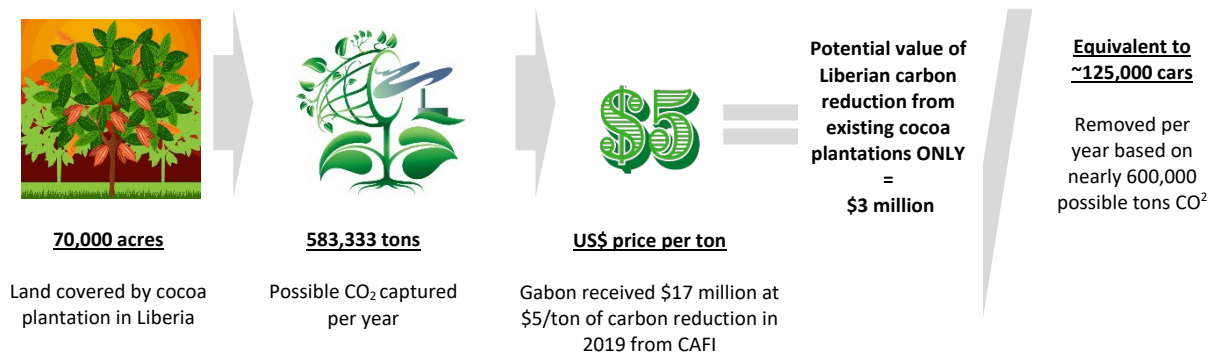
³⁴ https://dataintelo.com/report/cocoa-butter-market/?utm_campaign=copy

until economies of scale are achieved) market penetration of the 2020 cocoa butter market, Liberia could have earned nearly \$60 million.

4. Carbon Credits – Carbon Sink

Climate change and biodiversity loss caused by an increase in the earth’s temperature due to greenhouse gas emissions are some of the defining challenges the world faces today and one of the main sources to counter this change, the Amazon rainforest, is now emitting more carbon dioxide than it is absorbing.³⁵ Rainforests are critical for managing climate change as they stock and absorb carbon and are home to more than 50% of terrestrial biodiversity, while only covering 6% of the Earth’s surface.³⁶ The Guinean forests of West Africa rank fourth on the list of world hotspots in terms of intact area, rank first for animal biodiversity, and rank eighth in plant biodiversity. Therefore, the Guinean sub-region is of immense significance for biodiversity and carbon storage - Liberia sits entirely in the Upper Guinea sub-region of the West Africa Guinea Forest Zone. The country alone contains the largest carbon sink in Africa outside of the Congo Basin, and accounts for 43% of the remaining Upper Guinean Forest ecosystem.³⁷ At the same time, Liberia faces continued threats to its forestry due to both commercial and chainsaw logging, shifting cultivation, the clearing of forests for permanent agriculture, charcoal production, and rising urban and rural populations. With the continued growth in the use of carbon credits and the precedent set by Gabon as the first African country to receive results-based payments for reducing emissions caused by deforestation and forest degradation, Liberia is well positioned to benefit from its natural forest ecology.

Figure 10. Potential Value of Existing Cocoa Production



Key Takeaways

The current combined value to Liberia of the aforementioned latent opportunities in the cocoa sector is over \$110 million. Increasing volumes and quality would enable the country to attract investors all along the value chain from inputs for primary production all the way to marketing and distribution. Of all the value chains that are key for growing the Liberian agriculture industry, cocoa is the most widely used. It has application across countless industries and globally and the economic trends in each subsector of the cocoa sector are pointing to sustained

³⁵ <https://www.devex.com/news/gabon-plans-to-become-a-green-superpower-by-harnessing-its-rainforest-101636#:~:text=On%20Sept.,Gabon%20to%20offset%20their%20emissions>

³⁶ <https://www.un.org/africarenewal/magazine/july-2021/gabon-becomes-first-african-country-receive-payment-reducing-co2-emissions>

³⁷ https://www.profor.info/sites/profor.info/files/WAFS-draft-42111_0.pdf

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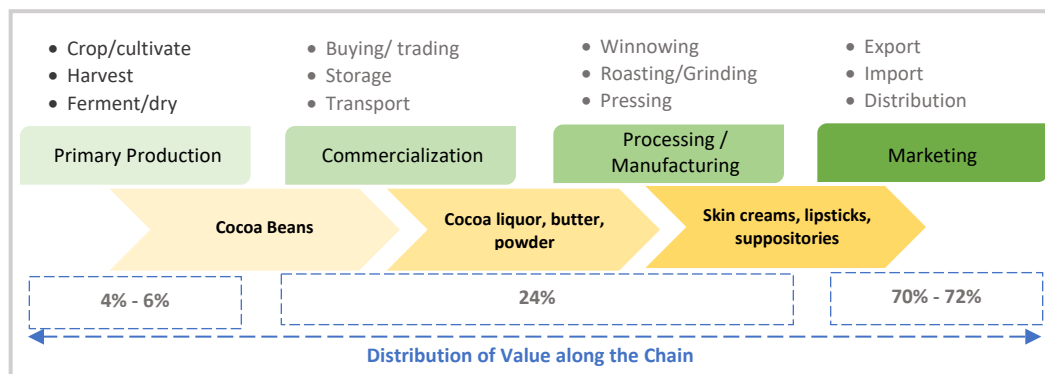
growth for the medium to long term. Therefore, building a national rehabilitation plan aimed at improving cocoa yields, quality, certification, and commercialization is needed.

Investment Impact:

1. Improvements of farm-to-market roads
2. More competitive cocoa marketing driven by reform of market policies and regulatory procedures
3. Increased attention to critical processes like fermentation, drying and storage
4. The selection, production, and distribution of improved planting material
5. Producer training
6. Agricultural input marketing
7. Potential development of rural finance
8. Increase in jobs and income for cocoa farmers
9. Increase revenue and profits for operators due to access to organic products and proximity to large demand markets

Cocoa Value Chain

Figure 11. Cocoa Value Chain



Source: Research Leap; Abdulsamad et al. (2015); Díaz-Montenegro (2019)

“Cocoa accounts for 12% of the employment force in Liberia, yet the lack of access to improved planting materials and skills continues to drive farmers away from cocoa production.”

*Michael Doe - Solidaridad's Country Representative for Liberia*³⁸

A typical cocoa bean value chain involves the operation of four major segments – Primary Production, Commercialization, Processing and Manufacturing, and Marketing. During primary production cocoa farmers in Liberia, consisting of at least 50,000 households, cultivate, harvest, ferment and dry the cocoa beans. This is the first bottleneck in the cocoa value chain because farmers do not tend to use adequate agri-inputs like disease-resistant seedlings or high-yielding fertilizers. This, in turn, effects the ultimate yield from the cocoa trees and quality of the cocoa bean. The quality is measured not only by the proportionate chemical composition of the beans but how well the farmers ferment and dry the beans. If the moisture content of cocoa beans is too high, mold and bacteria will grow on the beans, effecting either the price buyers offer farmers or the ultimate sale. Liberia is known for its low-quality cocoa, and the root cause of that occurs at the very beginning of the value

³⁸ <https://www.solidaridadnetwork.org/news/cocoa-value-chain-in-liberia-receives-a-boost/>

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chain. This then goes on to influence subsequent segments like the commercialization stage, which includes transportation, quality control, as well as differentiation (e.g., fairtrade or organic certification). Some agents active in the commercialization of cocoa may also be involved in the marketing segment. The development of this segment would naturally follow the development of the precedent segment as increased volumes from harvesting would drive investments in transportation services to get the product to demanding buyers. The second major bottle neck is at the processing and manufacturing segment. At this stage, the beans are transformed from cocoa into products like chocolate bars or lipsticks. This is also where the quality assured in the first segment will enable companies to realize optimal value. During the last stage, the processed cocoa is sold for domestic consumption or exported. Sometimes, even the shells and residue from the process can be exported.³⁹

This shows that investments in the cocoa seedlings, fertilizer and fairtrade/organic designations would have the biggest impact on the sector because the increased volumes and quality would attract more investments and partnerships while commanding a higher price. In 2021, high-end organic skin care company LUSH visited Liberia and Sierra Leone looking to diversify its supply of cocoa. As an impact-driven company, it aims to help farmers reach their potential, procure organic and fair-trade feedstock cocoa while preserving the rainforests and helping farmers grow their income through access to new and better markets.⁴⁰ Ensuring quality, volume and international accreditations will unlock investments from companies like Lush looking for sustainable quality.

³⁹ <https://www.agricompas.com/how-can-value-chain-analysis-be-used-to-make-cocoa-farming-more-sustainable/>

⁴⁰ <https://www.growliberia.com/insights/premium-cocoa-market-opportunity/liberias-premium-cocoa-market-opportunity>

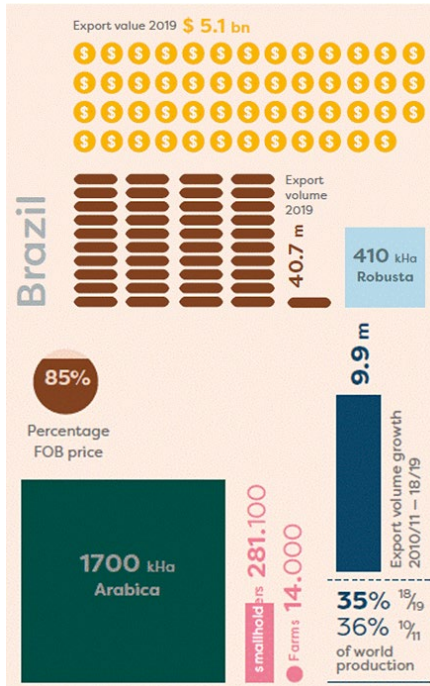
Cocoa SWOT Analysis

Strengths	Weaknesses	Opportunities	Threats
<ul style="list-style-type: none">• Copious end uses across various sectors• The topography of the land (many flood plains) is conducive to growing cocoa• Close proximity to the world's largest organic chocolate producer - Europe	<ul style="list-style-type: none">• High cost of doing business• Limited access to inputs• Unorganized cooperatives• Less than 2% of farmers use fertilizers• Poor quality of trade and transport infrastructure• Lack of drying capacity	<ul style="list-style-type: none">• Need for cocoa trees nurseries• Need for warehousing and aggregation points between farmers and markets• Financing for inputs• Replant cocoa trees and obtain carbon credits• Fast growing global organic cocoa markets• Fast growing markets where cocoa is the main feedstock	<ul style="list-style-type: none">• Ageing cocoa trees• Informal side-selling due to lack of penalties• Cocoa black pods disease and rodent infestations

COFFEE

Coffee Sector

The global coffee market, which was valued at approximately \$102.15 billion USD in 2019, and is expected to reach revenue worth \$155.64 billion USD by 2026, is set to record a compound annual growth rate (CAGR) of nearly 6.2% over the period of 2020 to 2026⁴¹. Increasing population, influence of western culture, and urbanization will further contribute to the increasing coffee demand all over the world.



Latin America is expected to dominate the global coffee market mainly due to the presence of the largest coffee producer, Brazil, and Mexico, a major player in the instant coffee market. In addition, Asia Pacific is further expected to see considerable growth owing to Vietnam—the second largest producer of coffee. In contrast to its international counterparts, Liberia produces small quantities of coffee in a sector comprised of approximately 14,000 smallholder farmers with intercropped coffee and cocoa farms⁴².

The Liberian coffee sector today suffers from the aftermath of civil wars that began in 1989 and ended in 2003. Prior to the war, Liberia’s coffee sector operated with tight regulatory controls, similar to operations in Ghana and Cote d’Ivoire. The Liberia Produce Marketing Corporation (LPMC) was the government agency that bought coffee from farmers at fixed prices, thereby infusing a measure of price stability in the market. The civil wars caused widespread destruction and abandonment of coffee farms and of the already limited processing infrastructure. Coffee production in Liberia dropped from approximately 10,000 tons annually in the 1970s to nearly zero throughout the wars. A Ministry of Agriculture (MOA) survey

from 2002 found that the number of operational coffee farms had dropped to 38% of the pre-war level.

The LPMC ceased its operations in 2010, which led to the proliferation of many formal and informal buyers who operated without standards and introduced further vulnerabilities into an already fragile sector. Other agencies intended to support the growth of the coffee sector are also unable to perform its functions. The Liberian Agricultural Commodities Regulatory Authority (LACRA), along with the National Standards Laboratory (NSL), are the national bodies to certify coffee products. LACRA has a statutory mandate to regulate and certify products, while NSL has the mandate to test and certify commercial products. However, neither agency is currently accredited by the International Standards Organization (ISO), and thus lack the official capacity to grade and certify products in Liberia. Taken together, the Liberian coffee sector today is low-performing, highly fragmented, and faces severe constraints that prevent it from meeting the requirements for entry into international markets. To rehabilitate the coffee sector, the following prerequisites must be present: transparent and available market information, coordination between processing facilities that meet market quality requirements, and improvements in market access. Improvements in productivity and infrastructure, coupled with a strong regulatory framework, are key in increasing coffee exports for Liberia.

⁴¹ Coffee Market - Growth, Trends, COVID-19 Impact, and Forecasts (2021 - 2026)

⁴² Source: LISGIS, World Bank 2017

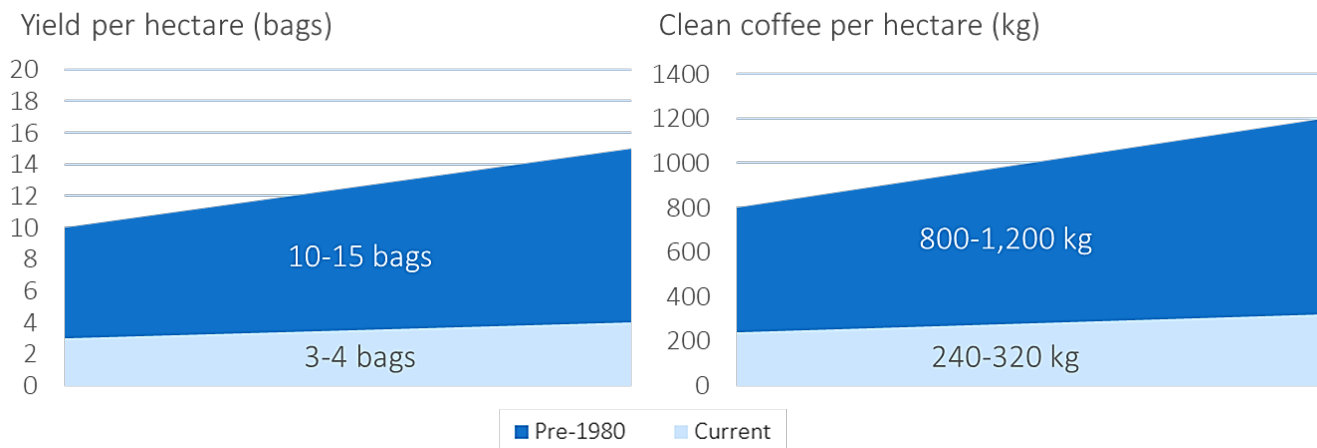
Coffee Supply Chain

There are three major coffee-producing counties in Liberia, located in the central, north, and north-eastern parts of the country—Bong, Lofa, and Nimba. The quantity of crops grown in other counties are negligible in supply chain and export considerations. Field research in Nimba, Lofa, and Bong counties found an average reported mixed farm size of 8.6 acres (3.5 hectares), which is slightly higher than some industry estimates of an average farm size of 5 acres.

The primary pre-harvest activities for coffee are under-brushing and pruning, performed from March to July each year. Both activities are labor-intensive. In some areas, farmers utilize the *kuu* system, where farmers volunteer to perform these activities on everyone’s farms, reducing the amount of time needed for these activities. In other areas, farmers hire casual laborers to assist with farm establishment and maintenance if there is insufficient help provided by family members. The value-addition process is limited only to product harvesting, pulping, and drying.

Coffee yield in Liberia has been poor since the civil war, standing at approximately 20% of the regional average⁴³. Available data from the Food and Agriculture Organization (FAO) suggest that Liberia reaches less than half of the yields observed in neighboring Guinea and Sierra Leone⁴³. Most smallholder farmers’ yields are 70% or more below levels that could be reached by those who apply good farming practices. Coffee yield per hectare today has dropped precipitously from the pre-war period (*Figure 1*). Export annually was up to 10,000 metric tons pre-war compared to only 200-400 tons today³. Earnings from exports has plummeted from a peak of an estimated \$450,000 USD in 1997 to negligible amounts in 2017.

Chart 3. Coffee yield per hectare pre-1980 vs. current



While farmers have the capacity to conduct grading of their cocoa and coffee, most do not do so since buyers are not currently buying based on grade; farmers therefore do not benefit from a higher price for higher grade coffee. This is a significant disincentive to quality improvement by coffee farmers. Most large buyers sort and grade coffee after conditioning, but this does not translate into increased value for the farmer since this evaluation takes place after the point of sale. Based on available findings from Lofa, most coffee produced in Liberia today would be of the lowest quality, some would meet grade 2 standards, and zero to negligible amounts would meet grade 1 standards.

⁴³ Source: Food and Agriculture Organization Corporate Statistical Database (FAOSTAT)

Coffee Opportunities

1. Specialty Coffee

Evolution of the global coffee market can be described by three waves. The first occurred after World War II when new technologies facilitated the commoditization and cut-price goods that allowed for large roasters to supply coffee to the masses. The second wave began in the 1970s, when coffee shop chains emerged, and market differentiation brought about higher quality and more variety. The third wave saw the establishment of independent coffee shops, where coffee buyers and coffee shop owners focused their sourcing on the origin of the coffee and stories surrounding its provenance. There is also increased attention to brewing methods and a more holistic experience in coffee consumption; consumers thus demanded information on coffee origin, blend, and sourcing practices. Consumer interest in how coffee moves through the value chain, including considerations around challenges to traditional processing, roasting and brewing, is now considered the fourth market evolution—this brings to the spotlight potentials in the specialty coffee market.

Specialty coffee is differentiated either by its superior quality or its uniqueness to command a premium price; the entire process from farmer to cup, including roasting, packing, grinding, and brewing, is considered. A high cupping score is commonly used to define specialty coffee. The Specialty Coffee Association (SCA) grades coffees with a cupping score of over 80. In the U.S. and Asia, a cupping score of over 85 is generally what qualifies as specialty coffee, while the threshold is 80 in Europe. Specialty coffee may be further classified as ‘very good’, ‘excellent’, or ‘outstanding’. However, without an official definition, individual buyers and markets often differ in their interpretation of what ‘specialty’ means. Examples of specialty coffee include single-origin coffee, flavored coffee, and Voluntary Sustainability Standards (VSS) coffee. VSS coffee makes up 18% of the global market and include those with certifications such as Organic Fair Trade, Utz, and Rainforest Alliance. While such certifications can be a way to access the coffee market, specialty buyers still prioritize quality. An ‘organic’ certification may be an exception to this due to clear trends observed in the market in preference for certified organically produced coffee.

Although quality is the main differentiator between specialty and commercial coffee, values associated with coffee origin and the culture surrounding coffee growing cannot be overlooked. Much like the concept of ‘terroir’ single origin in the wine trade, the estate, factory or washing station is often sold by name or geographical location. Specialty coffee is typically sourced through close farmer-buyer relationships characterized by transparency in and traceability of pricing. Coffee is taken to the marketplace after extensive buyer visits to the producing locales, and specialty buyers are often able to support farmers’ business models by investing in infrastructure or social projects that benefit the whole farming community, sometimes even assisting with the growing and harvesting of the coffee they buy. Ultimately, marketing and promotion of specialty coffee relies on the storytelling; in order to remain differentiated, producers must identify a niche for their high-quality and unique product.

**28 MILLION
AMERICANS
ENJOY SPECIALTY
COFFEE DAILY**



**More than a third of
coffee sales are now
specialty coffee (38%)**

Of those who had specialty
coffee AFH in the past week
25% chose their destination
based on customization





Specialty cups have recently captured **51%** of the market share, ahead of non-specialty for the first time.

Global coffee production for 2018-2019 was 168.7 million bags, an increase of 3.7% from the previous year, while global coffee consumption increased 2.1% to 164.82 million bags⁴⁴. A large proportion of coffee is mass-produced and of average quality, to be used for roasted or ground products or instant coffee. Most of this is Robusta coffee, with specialty coffee forming a smaller but increasing portion of the total market volume. The specialty coffee segment is expected to have high growth potential as consumer demand more variety and more ethically sourced products. Companies such as Nestlé and JAB Holdings, among the top ten roasters globally (controlling over 35% of all coffee sales), have been investing in well-known specialty brands and acquiring knowledge across the sector – an indication that the specialty coffee market will see steady growth over the next few years⁶.

Furthermore, evidence of value additions in specialty coffee can be found in available trade data. The 2019 Specialty Coffee Transaction Guide used data from 57 global specialty coffee businesses (including producers, exporters, importers, roasters) across 38,000 transactions from 2016-2019 with a total volume exceeding 4.7 million 60-kg bags and monetary value of \$1.4 billion, to provide comparative pricing information. The Guide revealed a median free-on-board (FOB) price of \$2.80 per pound. Further analyses show that higher prices correspond to higher quality and to smaller contract volumes. A clear example of this can be seen in Kenya, which recorded the highest median price at \$4.48 per pound, along with the highest median quality and one of the lowest median lot sizes. This provides further evidence that producers benefit from higher value from higher quality coffees by separating these specialty lots from average or lower quality products, since specialty buyers are willing to pay higher prices for more unique products even in smaller quantities (in microlots or multiple bags of 60 kg up to few hundred kilograms). Major international trading houses have also recognized the need to have a company exclusively focused on specialty coffee, which enables them to shift from a large-volume, small-margin model to a small microlot, highly curated business with corresponding higher margins. For example, Neumann Kaffee Gruppe (NKG) has InterAmerican Coffee (www.interamericancoffee.com), Sucafina SA has 32cup (www.32cup.com), and Volcafe has Volcafe Specialty Coffee (www.volcafespecialty.com).



Trade statistics and buyer outlook suggest promising growth potential in the specialty market segment in European and Scandinavian countries, including the United Kingdom, France, the Netherlands, Norway, Poland, and Germany. Since the volume of coffee export from Liberia will likely be small, exploration of market opportunities should concentrate in countries with small but fast-growing markets and consumers who appreciate high-value coffees; this can help to quickly increase market share and improve brand recognition.

Profitable Business Models for Specialty Coffee

Direct trade

Direct trade refers to an arrangement where buyers are in direct contact with the product source, eliminating the need for middlemen from the value chain. Coffee sectors around the world experience various degrees of direct trade, with some countries having fully liberalized sectors while others remain under tight government regulations and oversight. From an economies-of-scale perspective, there is necessary involvement of exporters and importers at both ends of the value chain when the volume of products is small.

⁴⁴ Source: National Coffee Association

Value Chain Analysis – Ministry of Agriculture Liberia - 2022



Coffee auctions

Coffee auctions or national commodity exchanges are the dominant selling models in East African countries of Ethiopia, Kenya, and Tanzania. These auctions are considered by industry experts to be best price discovery mechanism, being held daily or weekly where buyers from around the world are represented by local agents, with sales highly dependent on day-of supply and demand to attract the best prices. However, coffee farmers may not prefer auctions due

to perceptions of falling victim to cartels and price collusion; improved transparency and traceability of pricing is thus needed for these systems. Some auctions have been set up exclusively to showcase specialty coffees. Examples include the Cup of Excellence and Best of Panama auctions. While these events do attract serious buyers and coffee can sell for very high prices, these auctions are mainly meant to sell microlots of high-quality and unique coffees (e.g., single origin) for promotion and marketing.

Contract farming

Contract farming is a model that requires a direct relationship between buyer and seller, where long-term contracts are negotiated for farmers to produce fixed volumes at a pre-determined price that is periodically reviewed. The contract terms indicate volumes, quality, and frequency of delivery, and thus are often used for larger, guaranteed volumes of consistent quality that can be replicated year after year; it is therefore not commonly used for highly differentiated or small-lot coffees.

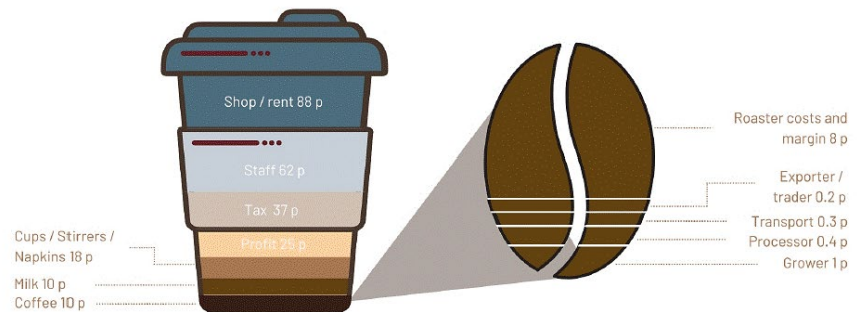
E-commerce platforms

The use of e-commerce platforms has gained mainstream popularity in the past few years. This model allows coffee farmers to extract more revenue from the value chain by connecting roasters and consumers directly. Large industry sites such as Cropster (www.cropster.com) and Algrano (www.algrano.com) used to market green coffee not only provide options for importing companies to post their sales inventory but also for farmers to offer coffee for shipment from origin. Major e-commerce platforms not designed exclusively for crops, such as Amazon and eBay, and even online grocery sites, can be an option for sales of roasted coffee. With an increasing number of business transactions being taken online, coffee producers could establish their own websites for full control over content as well as direct contact with their buyers. This direct contact can help circumvent the issue typically faced by growers who earn only a fraction of the profits (~1%) from a cup of coffee.

FARMERS' SHARE OF YOUR COFFEE CUP: THEY TYPICALLY EARN A FRACTION OF 1%!

Cost breakdown for a £2.50 cup*

Wholesale coffee cost breakdown



Liberica Coffee

The global coffee market is dominated by Robusta and Arabica as the two main coffee varieties. Liberia produces Robusta coffee as well as a third species of coffee—Liberica, which is indigenous to the country with plants much larger than those of Robusta or Arabica and offers the potential to launch Liberia onto the global specialty coffee market.

The species was introduced in the late 19th century as an alternative to the Arabica and enjoyed wide success. Liberica coffee was once an export product that constituted 1-5% of the world coffee supply, produced in Liberia then commercially cultivated in Indonesia, Malaysia, and the Philippines. However, Liberian coffee production dropped significantly due to the civil war and a collapse in the market demand for the Liberica variety. Today, Liberica coffee is produced on a very limited scale along Liberia’s coastal areas, primarily for local consumption, and is also produced in southeast Asia.

Coffea liberica in Liberia’s forests grows with good yield in fertile soils under the forest shade, without the need for chemical fertilizers, to produce organic coffee beans. With climate change rendering land unsuitable for Arabica growing (due to fastidious temperature requirements), transitioning to Liberica as a more robust crop may be the only option for some coffee farmers. The Liberica plant has deeper root systems and wider soil preferences that may render it even more resilient than the Robusta plant in some areas. Thus, if coffee farming in Liberia followed high-performing practices, farmers could dictate significantly higher prices for their products. Furthermore, the labor requirements to increase productivity and quality can make way for job opportunities for both men and women, who could be employed for conditioning, grinding, sorting, and grading, and later-stage processing.

In recent years, Liberica coffee has become visible on the specialty coffee scene as a part of new coffee mixes and floral infusions. A specialty Liberica from Sarawak was first introduced in 2018 at the Stuttgart Coffee Summit in Germany. Three years later, My Liberica debuted as part of a collaboration between ONA Coffee and Hugh Kelly, the winner of the 2020 Australia Barista Championship and third place at the 2021 World Barista Championship⁴⁵. The Malaysian government has even identified Liberica as the product to transform the country into a major regional coffee producer⁴⁶.



⁴⁵ <https://mtpak.coffee/exploring-the-growth-of-malaysias-specialty-liberica/>

⁴⁶ <https://www.malaymail.com/news/malaysia/2019/03/01/dcm-sarawak-can-be-major-coffee-producer/1728139>

Key Takeaways

The 2019 Specialty Coffee Transaction Guide highlights the ‘premiumization’ of much of African coffee, with the median FOB price at \$3.23 per pound far above the average International Coffee Organization (ICO) composite indicator benchmark price of \$1.09 per pound. The global specialty coffee market is expected to grow from \$53.67 billion USD in 2021 to \$152.69 billion USD by 2030, at a CAGR of 12.32% during the forecast period of 2022-2030⁴⁷.

Coffee production in Liberia currently faces a lack of investments in planting and processing technologies and broader issues with poor infrastructure in the country. However, the advantages in nativity, soil fertility, geography, and climate of the Liberica plant suggest that a revitalization of the sector is possible with targeted interventions. Even without rehabilitation of farms or expansion in acreage, it is estimated that Liberia could double or even triple its coffee production simply by improving productivity through replanting high-yield varieties, adopting high-performing practices, and using integrated pest management. The resultant gains in productivity could propel Liberia onto the global market as a producer of high-quality coffee. With optimistic forecasts in the growth of the specialty coffee market, Liberian products and investors may ultimately stand to benefit from this fast-growing segment of a global market currently valued at over \$53 billion USD.

Investment Impacts

Investments in the coffee sector can generate the following impacts:

- 1) Improvements in well-being and prosperity as a result of increased jobs and incomes
- 2) Preservation of high conservation value areas for enhanced coffee production
- 3) Strengthened market information systems and production mechanisms



Improve well-being & prosperity

Ensure coffee contributes to improved income and profitability that advances sustainable development opportunities for coffee growers, workers, and their facilities



Conserve nature

Conserve primary and secondary forests, high conservation value areas and other natural resources for enhanced coffee production



Resilient supply

Implement sustainable agricultural practices to sustain supply and enable the sector to meet rising consumption and the growing demand for coffee in a socially and environmentally responsible way

Strengthen market demand

Promote, support and invest in context-relevant and specific interventions that provide the necessary incentives and shared value throughout the supply chain

⁴⁷ Specialty Coffee Market Size by Grade (90-100, 85-89.99, and 80-84.99), Application (Commercial and Home), Regions, Global Industry Analysis, Share, Growth, Trends, and Forecast 2022 to 2030.

Investment Risks

The key constraints for farmers to expand market opportunities for coffee are:

- Fluctuating global coffee prices
- Lack of globally accepted grading and certification mechanism
- Lack of access to finance
- Poor infrastructure network
- High unemployment rates especially during off-peak farming seasons
- The absence of a conducive policy environment
- Climate change impacts

Coffee Value Chain Structure

Demand for coffee-based products is growing around the world, whether it be traditional coffee products in emerging economies or niche products (organic, fair-trade, artisanal) in developed economies. For any of these products, suppliers often demand grade 1 coffee and are willing to pay a premium, with organic or fair-trade certification offering additional value. Key activities and considerations along the coffee value chain structure that influence the ability of the sector to provide income gains is presented below.

Input Supply

Inputs such as fertilizers and agri-chemicals can help mitigate a number of issues face by coffee production, including high iron concentration and acidity in Liberia's soil, and high incidence of fungal disease when planting under canopies. Inputs are imported by retailers, including some in the cocoa sector (e.g., Wienco). Inputs are available in rural areas, typically sold by micro-traders who have no formal knowledge of what is being sold. Quality of inputs at points of sale is a major issue, with repackaging of bulk products into smaller quantities resulting in the introduction of moisture, foreign products, or dilution of chemicals that impacts input quality. To obtain quality products, farmers must source directly from Monrovia and incur significant costs. Most farmers also have little knowledge of and do not make use of the necessary inputs; and they are unlikely to receive proper information from the traders.

Tools, Equipment, and Extension Services

Tools and equipment such as cutlasses, wheelbarrows, and sprayers, are imported by agricultural input retailers such as Wienco. Most retail outlets for equipment are located in Monrovia with no distributors in the coffee belt, and sellers often offer no accompanying services on usage, maintenance, servicing and spare parts, or other after-sale support. Retailers also offer a very limited range of products; there is a general shortage of irrigation of equipment and water storage facilities, the use of which could greatly increase coffee production during the dry season. In many communities, NGOs have also made solar dryers available. However, without proper training or knowledge of appropriate maintenance, the equipment is either misused (leading to misunderstanding that the solar dryers burn coffee beans) or unused in the field.

It is cost-prohibitive for individual farmers to purchase equipment, and since the collapse of the LPMC there has been no companies providing equipment rental or spraying services, with the exception of Wienco. Lack of equipment or services post a significant challenge to farmers; for example, in Lofa, there is a high unmet need for fumigation and spraying services to counter problems with locusts.

Extension services are not widely available and are provided piecemeal when they are. The government provides limited services to farmers due to budgetary and capacity constraints. The private sector fills some of the capacity

gaps when formal buyers want quality assurance. Without extension services, the production potential of smallholder farmers may be impeded by problems that would otherwise be easily resolved.

Production & Sales

The primary pre-harvest activities for coffee are under-brushing and pruning, performed from March to July each year. Both activities are labor-intensive. In some areas, farmers utilize the *kuu* system, where farmers volunteer to perform these activities on everyone's farms, reducing the amount of time needed for these activities. In other areas, farmers hire casual laborers to assist with farm establishment and maintenance if there is insufficient help provided by family members. The value-addition process is limited only to product harvesting, pulping, and drying.

At the local level, formal and informal buyers' agents and cooperative purchase cocoa and coffee at the farm gate and aggregate it in small warehouses. Corporate players in the coffee sector aggregate from different product areas in the coffee belt and transport the beans to Monrovia or Buchanan for further conditioning, sorting, and grading before exporting. Some corporate agents are linked to importers from Europe, Asia, and the Middle East that require raw coffee, such as Theobroma (Dutch importer linked to its Liberian buyer LAADCO). While large formal buyers have a fixed producer base, they may also compete for products on the open market alongside informal traders. Some large formal buyers purchase from a pool of producer groups to whom they also provide pre-financing, input financing, and extension and technical advice. Small and medium-sized formal and informal buyers independently source and purchase coffee from any farmer or trader who has product. Some buyers pre-finance coffee farmers during the pre-harvest season to encourage farmers to commit their produce.

In the past, when farmers were highly disorganized or unskilled, a large portion of output was sold by farmers through producer associations and cooperatives to increase quality, reduce transaction costs through coordination, and strengthen bargaining power. Today, most of the output is sold directly to independent buyers, and the role of producer associations and cooperatives has evolved into that of a buying agent.

Buy-side challenges

Local cocoa and coffee buyers finance operations using their own resources and receive some working capital in the form of pre-financing from overseas buyers. Local financial institutions lack the sector-specific expertise to design financial products with appropriate terms and payback periods, or to assess the risk of these loans effectively. Banks also seek traditional collaterals such as physical property, which some buyers may not have or be willing to provide. Despite these challenges, most large formal buyers do have access to sufficient financing to purchase coffee. However, there is a lack of information on the details of the amount or source of the financing. Buyers face ongoing issues with uncertainty surrounding receipt of their coffee, with side-selling occurring due to higher prices paid on the spot by informal buyers, who can offer higher prices due to their low overheads and lack of long-term commitment to the sector. Many informal buyers work for foreign principles operating out of Guinea or Sierra Leone who have no permanent presence in the Liberian coffee sector, but profit on the price differential between Liberian and Sierra Leonean coffee. Experts estimate that as much as 90% of Liberian coffee may be bought through informal channels⁴⁸

Climate change

The lengthening of the dry season and corresponding shortening of rainy season reduces the production period in the coffee belt, where smallholder coffee farmers do not irrigate their farms and rely entirely on rain-fed agriculture. This, combined with other low-performing practices, makes it difficult to achieve high yields. Climate uncertainties increase perceived risks by would-be lenders, but also highlight the need for crop insurance which is not currently offered by banks.

⁴⁸ Coomes et al. 2015

Grading and Quality Control

While there are independent quality control firms such as SGS, Bivac, Veritas, and AIM Global, that offer international-standard quality control services including certification and grading, these actors do not operate in the coffee sector. Some large buyers have started to use these services on a trial basis for certification, driven by expectations of their international buyers; however, this is not common practice. Unlike other coffee-producing countries that have established systems in line with international standards of the ICO to promote and regulate quality, Liberia only recently became an ICO member and has not received any assistance to develop market incentives to promote routine grading of coffee products. The Ministry of Commerce and Industry (MOCI), LACRA, and the MOA has discussed the establishment of a regulatory mechanism to prevent the export of ungraded cocoa and coffee; however, the progress on legislative change has been slow.

Transport

Informal buyers typically purchase the coffee at the farm gate and transport to their own warehouses, and formal buyers may also send their agents, including cooperative representatives, to pick up products at the farm gate. Although large formal buyers are not legally permitted to buy directly at the farm gate, this regulation is often circumvented by buyers who work through a third-party agent. Cocoa crop and coffee from smallholder farmers are generally transported from farms to small villages and regional warehouses either by bike or motorcycles. From there, it is transported to larger warehouses in Monrovia by private for-hire trucks. The cost of transporting the product is usually deducted from or reflected indirectly in the buying price by both formal and informal buyers. In some areas, a farmer is responsible for bringing the coffee to the collection point themselves if they are selling to a buyer not linked through a cooperative. Poor road infrastructure and conditions in the interior of the country pose significant challenges to the transportation of coffee products.

Aggregation, Warehousing and Storage

Many cocoa warehouses exist throughout the coffee belt, from small ones at village or regional levels to large warehouses in Monrovia. Private warehouses are operated by formal buyers (essentially limited to LAADCO, Wienco, AVL, and the Aya Group) and their agents, agents who buy on behalf of cooperatives, or informal buyers. The majority of warehouses are small and poorly maintained, with pest infestations and poor storage conditions. A number of them are private homes with storage, serving more the function of a holding center before shipment rather than proper warehousing facilities. High-quality warehousing is only found in large cities near the seaports. The lack of high-quality storage and aggregation facilities impacts the quality of the coffee; for example, high humidity increases the moisture content in coffee, which reduces its value. Many farmers prefer to store coffee at home, which is also subject to problems with moisture levels; data from a GROW study found that 79% of coffee farmers store their beans at home.

Export Infrastructure & Enabling Environment

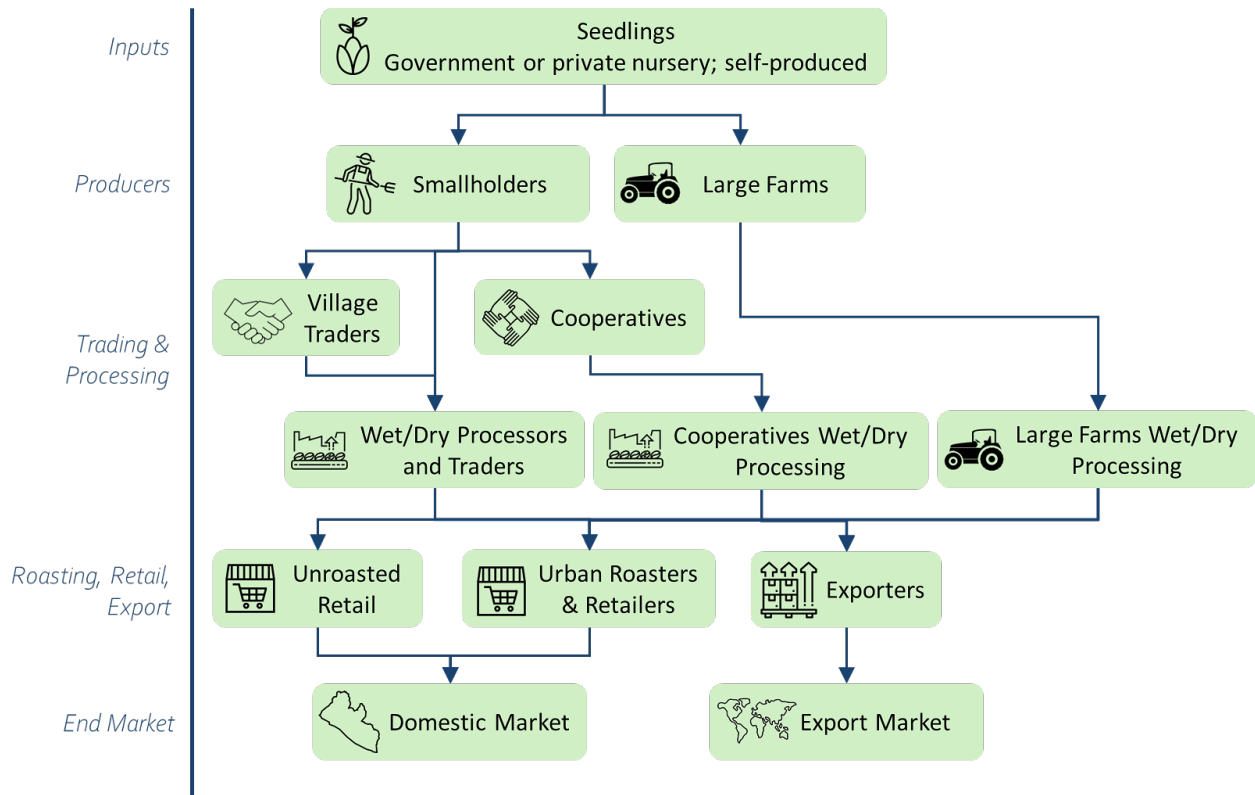
There are two functional seaports that can provide basic infrastructure to serve the cocoa and coffee market—the Monrovia Freeport and the Port of Buchanan. Seaports in Harper, Maryland, and Greenville, Sinoe are not functional. While the seaports have sufficient warehousing space for the volumes being shipped, warehousing quality is often low. Other infrastructure includes the Robertsfield International Airport in Margibi, the national road network, large official border-crossings in Ganta, Loguatu, Foya, and smaller border-crossings peppered through the counties. While there are numerous inter-county roads, many are unpaved and inaccessible during the extensive rainy season. One exception is the Abraham Bambagida Highway, a paved road connecting to Sierra Leone. There are anecdotal reports of informal exporting of coffee from Liberia to Guinea, which may provide some explanation for low levels of formal export activity. However, market access to neighboring countries is dwarfed by the potential market outside the region if formal export via air or sea could be established.

Market Price Information

Liberia maintains a national reference pricing system. The farm gate reference price is the daily reference price adjusted for market access and quality/quantity factors. Market access costs are all the costs associated with bringing product from the farm gate to the border or port for export, such as storage, transport and margins applied by buying agents. Farm gate refers to the price of product available at the farm via direct purchase from the producer. Producers, however, do not receive timely or reliable information. While ACDI/VOCA has launched a program for farmers to receive price information via their mobile phones, less than 3% of farmers reported using this channel; information is also outdated from actual market trends, being transmitted weekly rather than daily. Buyers typically access reference pricing information then verbally communicate this to farmers or agents at the point of sale.

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Figure 12. Indicative Coffee Value Chain Structure



Coffee Sector SWOT Analysis

Strengths	Weaknesses	Opportunities	Threats
<ul style="list-style-type: none"> •Vast area of land with suitable agro-ecology •Organic coffee production is viable •Strong origin story for Liberica coffee 	<ul style="list-style-type: none"> •Labor-intensive production •Lack of extension services •Absence of technical farming capability •Inadequate infrastructure & processing facilities •Lack of established marketing system •Poor transport networks connecting farms to markets 	<ul style="list-style-type: none"> •Improved regulatory framework can drive exports •Emerging opportunities for Liberica in new coffee mixes and floral infusions •Environmental sustainability •High job creation potential 	<ul style="list-style-type: none"> •Fluctuating coffee prices •Climate change •Non-competitiveness with other higher value cash crops such as cocoa and oil palm

FORESTRY

Forestry Sector

Liberia is home to the most extensive standing rainforest in West Africa, with a complex ecosystem hosting a wide range of products, including 225 species of timber, charcoal, non-timber forest products (NTFPs), and bushmeat⁴⁹. High-value timber species are felled for sale on the domestic market and for international commercial export. Sawn timber is purchased for the construction of furniture, private homes, and business infrastructure. It is estimated that between 800,000 and 1.3 million cubic meters of timber is harvested from Liberia’s industrial forest sector⁵⁰. While the industrial timber sector exports approximately 175,000-200,000 cubic meters of round logs annually, an ample domestic market for primary processed wood exists in Liberia⁵¹. The domestic timber market, active in all 15 counties, bustles with chainsaw milling, transportation, urban market purchases and sales, and businesses for woodworking and construction. There is an abundance of potential in downstream value addition as the country’s demand for construction and woodworking outpaces timber production.

Forestry Supply Chain

Chainsaw milling is the key element of the forestry supply chain—felling trees, operating the entire primary transformation, and sectioning timber into planks using chainsaws. Wooden planks are produced in all 15 counties in Liberia, and most of the purchases made by plank depots come directly from the forest; there is often no processing beyond chainsaw milling. Rudimentary processing equipment such as ripping machines continues to be used in Liberia for production since no sawmills for timber are operational in the country.

Four species of timber make up the majority of all timber sales in Monrovia: wawa, tetra, framire, and abura, with purchase prices varying by the species and quality of the planks. Planks are sold in fixed dimension (commonly found as 2x10x14, 2x12x14, 1x12x14, and 1x10x14) and depots may offer a wider range of dimensions by making modifications to these standard sizes before selling. As it stands, informal chainsaw milling supplies construction, carpentry and woodworking businesses with planks that are undried, relatively unprocessed, and ultimately



low-quality, since there are no kiln facilities or sawmills in the country. Likewise, concessions export raw logs due to the absence of primary processing facilities in Liberia. The majority of downstream businesses do not have access to power tools and produce furniture with only hand tools. The workforce is also largely unskilled, with no access to woodworking techniques or methods to improve operations. The combination of low labor productivity, absence of sawmills, and use of outdated techniques and technology has led to limited downstream value addition. Thus, outputs from domestic woodworking and construction firms remain uncompetitive in the regional and global market. A shift towards higher value-added wood processing and production could maximize the

⁴⁹ Flora & Fauna International, High conservation values: Draft national interpretation for Liberia, 2012.

⁵⁰ Blackett et al. Chainsaw Logging in Liberia: An Analysis of Chainsaw Logging (Pit-sawing) in the Natural Forests of Liberia Towards a More Sustainable Production, 2009.

⁵¹ Export volume projected from SGS dataset 2020

productive capacity of Liberia’s forest cover, while supporting preservation, to meet current and future market demands.

Timber Investment Attributes⁵

Given its short history and unique investment characteristics, basic research material for investors on timberland as an asset class is scant. The key attractions of timberland to investors can be summarized into four broad categories:

1) Portfolio fit

Competitive risk-adjusted returns

Timberland has historically offered attractive average returns relative to its volatility, and its performance compares favorably with that of equities, fixed income, and other leading asset classes.

Inflation hedging

Timberland, like agricultural commodities, precious metals, and oil and gas investments, is considered a real asset—one that derives its intrinsic value from its utility. To varying degrees, different real assets are recognized as potential inflation hedges. In the case of timberland, wood-based products permeate and are used in a multitude of sectors within the global economy.

Diversification

Because timberland investment returns have been observed to move in a manner quite different from those of other asset classes, timberland can help provide portfolio-level diversification. This potentially lowers the portfolio’s total risk profile and expands its efficient frontier of risk and return.

2) Intrinsic attributes

Beyond timberland’s basic financial performance, there are also features that compellingly differentiate it from other asset classes. One of these is the ability of a commercial forest to add value through biological growth regardless of what is happening in financial markets and the world economy.

3) Positive market fundamentals

Investors who view commodities in a positive light also tend to view timberland favorably. The resumption of global economic growth is expected to place upward price pressure on many commodities and real assets, including timber. The world population is projected to grow from 7.8 billion in 2020 to 9.7 billion by 2050, which will lead to an increase in the global consumption of paper and wood products. Rising incomes in fast-growing emerging economies such as Asia, Central Europe, and Latin America, will further augment per capita consumption for timber.

The supply of timber is expected to be constrained even as long-term demand is expected to grow, as government restrictions and public conservation efforts begin to limit harvest from natural forests, and international pressure has curbed illegal logging. Consumer preference is also shifting towards sustainably grown timber. This means the world’s timber demand will increasingly be met by managed forest plantations. However, the total land available for the establishment of these plantations is also limited by competitive land uses from agriculture, conservation, and development. It is now an opportune time to make new and expanded commitments to the asset class within the context of these global trends.

4) Soft values

Timberland investments managed responsibly are an environmentally-friendly investment option—it is “green”. Investors keen to be a part of socially responsible investments (SRI) see this as a unique feature of the asset class. Another soft value attribute of timberland investments is related to carbon credits. A forest sequesters carbon, and the sequestered carbon can be monitored and registered when the appropriate systems and processes are in place. A landowner’s capacity to certify the amount of carbon sequestered in a forest ecosystem can then be monetized in the carbon offset credits market. The carbon credits are purchased, either voluntarily or by government mandate, by entities that emit greenhouse gases (GHGs) into the atmosphere. Carbon credits can also be sold based on active preservation of a natural forest, where

Investment Opportunities

Timberland is a relatively new asset class, having emerged as an attractive option for institutional investors in the early 1980s. From 1989 to present, the total amount of institutional capital invested in timberland grew from less than \$1 billion USD to approximately \$100 billion USD. While the asset class was initially anchored in North America, it has since expanded to other forested regions around the world. The first institutional timberland investment outside of North America was made in New Zealand in 1992; a decade later, the global footprint has expanded to Australia and the Latin American countries of Brazil, Chile, and Uruguay. In recent years, timberland investors have further broadened their geographic scope to consider opportunities in select countries in Africa, some emerging Latin America countries, China, and Central and Eastern Europe.

1. Sawmills

A key aspect of the forest supply chain often overlooked by investors in timberland is the primary manufacturing of timber. The sawmilling sector is a relatively untapped area of investment. Investing in sawmill assets can be an attractive option for investors who wish to complement the lower-risk profiles of their timberland assets by investing in higher-returning infrastructure and private equity-oriented opportunities higher in the value chain.

Investments in sawmill projects also offer a number of environmental, social and governance (ESG) benefits.



Facilities that manufacture lumber and wood panels create employment opportunities and support other forms of economic development, particularly in disadvantaged rural communities. Lumber and plywood products used for building and construction also work to store carbon, which means building with wood rather than other materials helps to reduce the emission of GHGs and helps to combat global climate change.

The global lumber market is currently at its strongest in history; global lumber prices broke past \$1,000 USD per thousand board feet (MBF) during the first quarter of 2021, more than double the \$400 average MBF observed during the previous decade. This record-setting performance is drawing investors to explore the expansion of opportunities in the sawmilling sector.

In Liberia, the domestic market for construction and woodworking continues to grow compared to estimated production and domestic lumber prices have skyrocketed in the past 5 years. According to a survey conducted in 2017, between 207,583 m³ and 276,777 m³ of sawn timber is sold annually on the Liberian domestic market⁵². On average, one cubic meter of sawn wood sold in Monrovia costs \$255 USD in 2022, a 68% increase from market prices recorded in 2017. As the supply of sawn timber increases to meet demand, the estimated minimum domestic market size for sawn timber is in excess of \$50 million USD. Investors in lumber manufacturing facilities can exploit the localized nature of wood markets because half to three-quarters of the cost of manufacturing lumber comes from the cost of purchasing logs, and the commercial tree species favored by chainsaw millers are oftentimes the same ones in demand on the international market.⁵³ The international market prices for sawn wood are also significantly higher than Liberia's domestic prices, revealing the country's cost advantage and a

⁵² Liberia: Domestic Timber Value Chain Analysis

⁵³ Source: Forest Economic Advisors

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potentially lucrative arbitrage opportunity for discerning investors. This means that investors are well positioned to influence the long-term performance of a sawmill investment by choosing to operate in areas where logs are plentiful and where log pricing is low due to slack competition.

Beyond wood costs, another factor that can determine the success of a sawmill investment is productivity, i.e., how much lumber can be produced from a log. According to some estimates, the sawn timber supply chain in Liberia is hampered by a 30% efficiency rate in the production of planks from logs due to obsolete production methods and rudimentary processing capabilities⁵⁴. Industry research has determined that a sawmill that is equipped with the latest proven technology and that is located in a reasonably priced wood market can be profitable when lumber prices are above \$100 per cubic meter, a favorable metric when compared to Liberia's current prices above \$250 per cubic meter⁵⁵. Several inefficiencies still exist in the market, including weak communication between actors, limited value-addition, volatile swings in supply, and all of which are ripe for disruption, providing ample opportunities for investors to profit from efficient and reliable production and improved product offerings.

2. Carbon Credit

The United Nations estimates the cost to decarbonize the world at \$35 trillion. Capital markets will necessarily have to play a role; corporations such as Citigroup Inc., Verizon Communications Inc., and governments in both developing and developed countries raised a record \$516 billion in green bonds in 2021, up from \$235 billion in 2020, used to fund environmentally friendly projects⁵⁶. This financing is likely to increase as a result of plans from the European Union (EU) to start green bonds, and from the U.S. government's reprioritization of climate policies. The ongoing COVID-19 pandemic has also catalyzed a boom in social bonds, with issuance up eight times from the previous year. Corporations such as Walmart, Amazon, Nestlé, Alibaba, and Mahindra Group are pledging to slash carbon emissions and invest in nature as a carbon sink. To meet the increasing demand, banks and investors are working to transition financial instruments as there are currently insufficient green bonds to satisfy investor appetite. A near-record bidding for a debut green bond in Germany was observed recently with the securities trading at a premium to the country's conventional debt.

The global market for climate finance was estimated at \$622 billion in 2019⁵⁷. The demand for forest carbon offsets could outstrip supply by 2025; carbon prices could quadruple by 2030 and offset values could be worth \$125–\$150 billion a year by 2050⁵⁸. In order for these values to be realized, existing carbon trading schemes such as the EU Emissions Trading System, the north-eastern U.S. states' Regional Greenhouse Gas Initiative, and forest-based emissions reduction initiatives such as REDD+, will have to overcome some major hurdles.



⁵⁴ Liberia: Domestic Timber Value Chain Analysis

⁵⁵ Source: Forest Economic Advisors

⁵⁶ <https://esginvest.co/the-complexities-of-esg-bonds/>

⁵⁷ <https://www2.deloitte.com/us/en/insights/topics/strategy/international-climate-finance.html>

⁵⁸ <https://www.fitchratings.com/404.html?slug=infrastructure-project-finance/tightening-climate-policy-to-drive-carbon-offsetting-emissions-trading-09-2020>

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Liberia’s forest cover makes up approximately 69% of the country’s total land surface and extends over 6.7 billion hectares, making it the most forested country in West Africa. Since 2008, national and international stakeholders in Liberia, such as the World Bank’s Forest Carbon Partnership Facility (FCPF), have been working on forestry reforms. The country’s efforts to reduce emissions from deforestation and forest degradation (REDD+), as outlined by the Government of Liberia’s National REDD+ Strategy in 2017, aim to deliver community, conservation, and commercial benefits while preventing further loss of its forests.

Liberia is now in the final stages of its REDD+ readiness, having made important strides in a REDD+ Feedback and Grievance Redress Mechanism, a Strategic Environmental and Social Assessment, completing its first National Forest Inventory (NFI), institutionalizing a National Forest Monitoring System, and operationalizing its forestry stakeholder information platform. Early REDD+ initiatives in Liberia did not adequately consider channels to delivery climate finance to communities in agricultural areas, who managed forests and were responsible for the nature reserves. There are international networks and models designed for this purpose, such as the SourceUp online platform that links local sustainability coalitions in sourcing areas with international markets, which can improve local community inclusion and engagement.

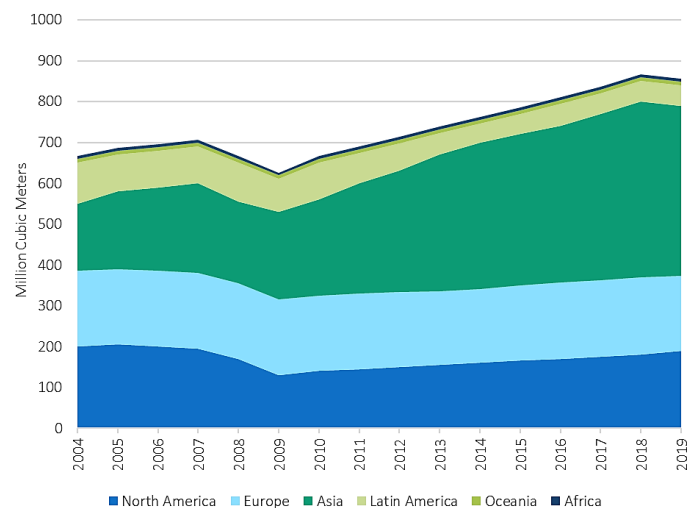
At this juncture, Liberia’s natural endowments and recent progress under the REDD+ strategy opens the door to a wide range of results-based financing opportunities in the country’s forestry sector. However, investors must continue to keep abreast of developments globally, as forestry investment opportunities linked to the production and sale of carbon credits is currently limited by the lack of effective global compliance and monitoring mechanisms for emission offsets.

Key Takeaways

In summary, three clear arguments arise for investors to place capital in a lumber manufacturing facility:

- (i) Macroeconomic trends suggest there is growing demand exists for building products.
- (ii) Investments by wood product companies in new or retrofitted manufacturing facilities have lagged behind current market growth in the building products sector globally.
- (iii) A diverse local wood market can be leveraged to create a competitive advantage for a milling facility that is targeted for capitalization

Chart 4. Global Solid Wood Consumption



Source: Forest Economic Advisors

Investment Impacts

Investments in forestry can generate the following impacts:

- 1) Improvements in well-being and prosperity as a result of increased jobs and incomes
- 2) Increase in sustainable harvesting practices will preserve and protect primary and secondary forests
- 3) Increased carbon capture for climate change mitigation



Investment Risks

The key constraints for farmers to expand market opportunities are:

- Lack of regulation and monitoring
- Lack of equipment, low productivity, and quality
- Lack of consumer considerations
- Insufficient community engagement

Forestry Value Chain

Between 207,583 m³ and 276,777 m³ of sawn timber is sold annually on the Liberian domestic market. Demand is assumed to be concentrated in Liberia's urban population as it is the base for the majority of construction and furniture-making businesses, and there is higher demand for timber in urban homes compared to rural homes. Currently, the supply of planks increases in response to growing demand for sawn wood, which is not filled by sales from the formal logging sector. As a result, and because the quality of finished products is not currently the top priority for harvesters or traders, domestic market prices remain low. Given an efficiency rate of 30%, we calculate that the total volume of logs processed by chainsaw milling is between 700,000 and 900,000 m³ RWE. While large chainsaw milling businesses control a good portion of the domestic timber flow, there are many small, independent operations active across the counties due to the relative ease of finding and harvesting trees, low costs of entry, and a general absence of regulations.

Production & Sales

Prior to the ban on formal logging, operations were typically restricted to converting unused felled logs and brush in formal concessions to produce sawn wood. The ban on timber exports in 2003 and the annulment of concession agreements in 2006 led to an increase in the use of chainsaw milling, as chainsaw millers became the only source to meet local market demand. The number of chainsaw millers grew exponentially to meet the construction needs of a booming urban population. Chainsaw millers either sell their timber directly to a specific plank outlet or depot based on their order (pre-sale) or sell openly on the timber market (open sale).

The pre-sale model has several variations. In one, the plank outlet owner places a specific order to the chainsaw miller and pays for the transportation of the timber (often using trucks). The plank outlet then pays their employees in the bush to cut up the planks. In a second variation, the chainsaw miller owns or rents saws and produce a plank specific order for the plank outlet owner. This transaction may be facilitated by the Liberia Chainsaw and Timber Dealers Union (LICSATDUN) via personal connections. In a third variation, a business owns saws and trucks, and has employees in the bush that cut planks; these planks do not pass-through Monrovia markets but are instead transported directly to private businesses.

With an open sale model, the chainsaw miller owns or rents saws to cut the planks, and a middleman purchases planks from multiple operations to transport to plank outlets in Monrovia to sell on the open market. Alternatively, the chainsaw miller owns or rents saws to cut the planks and then hires trucks to transport the planks to Monrovia for sell on the open market.

Forestry is essentially a supply-driven sector, where the needs and expectations of secondary processors and end user are not considered throughout the supply chain and do not currently drive the create of value. Domestic opportunities are not well-communicated to suppliers, and regional opportunities are not considered at all.

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Transport

Transportation of timber by trucks from the counties to Monrovia utilizes three roads—the Buchanan-Monrovia highway, the Bomi-Monrovia highway, and the Margibi-Monrovia highway. FDA officials operate checkpoints along the route to collect the FDA tax of \$0.06 per plank. However, a portion of timber may pass through alternative routes to reach Monrovia; a feeder road that is in good addition allows trucks to travel from Gbarpolu, Grand Cape Mount, and Lofa, skirting the Bomi-Monrovia highway checkpoint.

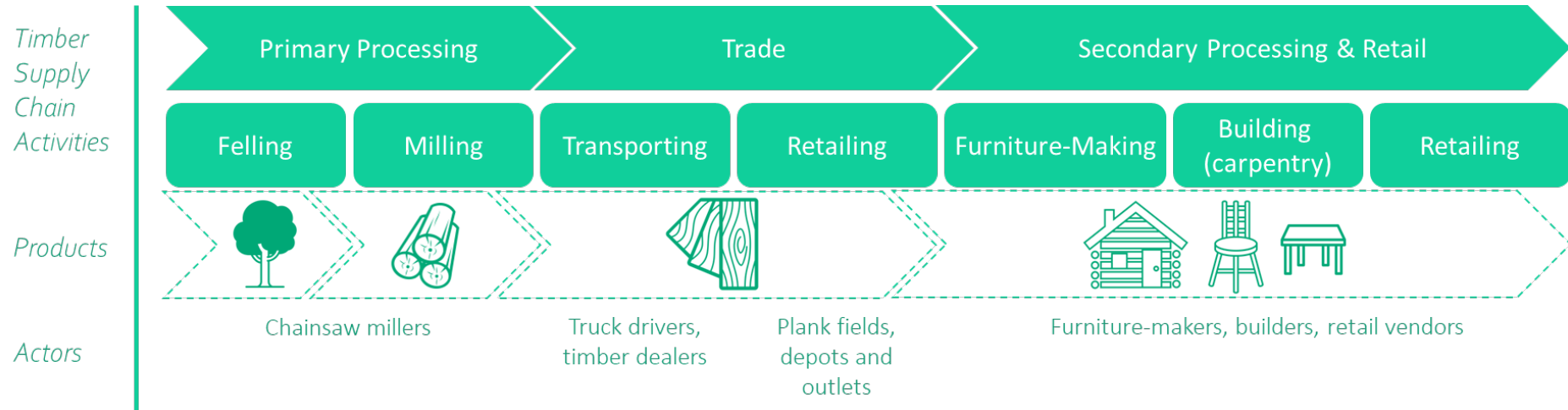
Market Price Information

The volume and prices of sawn wood entering the urban markets is not tracked on a regular basis.

Regulatory Enforcement

Because the majority of the forestry value chain remains in the informal economy, there is no formal monitoring or regulation mechanism in place that can be used to increase the sector's competitiveness, manage its environmental impact, or bring the activity into the formal sector. The 2012 Chainsaw Milling Regulation requires that chainsaw millers register for permits that define their areas of operation, but there is no formal enforcement of these procedures. The plank tariff described above is the only regulation actively enforced by the FDA; however even this process is sometimes circumvented as chainsaw millers reported negotiate with officials for lower taxes.

Forestry Supply Chain



Forestry Sector SWOT Analysis

Strengths	Weaknesses	Opportunities	Threats
<ul style="list-style-type: none">• Abundant resources widely available in rural areas• Rich in traditional know-how• High interest in local level enterprises	<ul style="list-style-type: none">• Poor marketing of products• Weak management capacity• Poor transportation network and technology• Insufficient community engagement	<ul style="list-style-type: none">• Growing demand in domestic and international markets• High potential for income and employment• Interest from private sector• Developing value addition and brand recognition	<ul style="list-style-type: none">• Decreasing resource base due to over-harvesting and unsustainable harvesting practices

Oil Palm

Oil Palm Thesis

Oil Palm is one of the more established agriculture value chains in Liberia and includes multiple large concessions, large commercial farms, cooperatives, and small holder farmers. It has been a source of food in Liberia for most of its existence and is now a major source of export earnings primarily due to the major large concessions operating in the country. According to the Ministry of Agriculture, Oil Palm covers over 1 million hectares of land, with just over 20% of farming households producing oil palm. The sector is said to employ over 220,000 persons in various aspects of the value chain. There continues to be a steady increase in production from one year to the next. In 2019, Liberia produced 22,265 MT which was an increase from 18,104 MT in 2018.⁵⁹ As an emerging player in the global Oil Palm trade, Liberia stands to benefit as prices increase in trading of the commodity and given the increasing demands for crude palm oil, which Liberia exports. There are opportunities for value addition and production of various nutritional and non-nutritional products that derive from Oil Palm. Globally, Malaysia and Indonesia lead the world in Oil Palm production, but Africa and Latin America are increasing their share of production.

Oil Palm Sector

The Oil Palm sector in Liberia is overseen by the Ministry of Agriculture in coordination with stakeholders from across relevant Agencies and Ministries. The National Oil Platform of Liberia (NOPOL) was created to enhance coordination and includes all major stakeholders including public and private sector actors, donors and key partners, and community organizations. Collectively and in coordination, these stakeholders have developed two National Policies have guided activities in the sector.

The Government of Liberia has identified Oil Palm as a priority crop in its national agenda for development, and developed a national strategy with the following seven objectives:

- Objective 1: Compliance with National Standards for the Liberian Oil Palm Sector.
- Objective 2: Develop an Enabling Regulatory Framework for the Oil Palm Sector.
- Objective 3: Develop a 5-Year Financing Mechanism to Guide Sustainable Oil Palm Development.
- Objective 4: Provide Support to Improve Livelihoods for Smallholder Farmers and Communities.
- Objective 5: Develop a Conflict Resolution Mechanism and a Feedback Grievance Redress Mechanism.
- Objective 6: Develop an integrated land use plan in conformity with the Liberian Land Rights Act (2018), with specific focus on the acquisition of deeds for customary land.
- Objective 7: Integrate Sustainable Conservation Practices in Oil Palm Production Landscapes, in conformity with the Liberia National REDD+ Strategy and other Relevant National and International Commitments

History of Oil Palm in Liberia

Prior to Liberia's 14-years intermittent civil wars, most of the Oil Palm plantations in Liberia that were planted in the 1970s were owned by the Government and co-managed with Local Communities and Cooperatives. These farms were located in Bong, Nimba and Lofa where most of Liberia's agriculture activities were concentrated. The onset of the wars ravaged many of the farms and destroyed processing facilities—many left in ruins and abandoned. The good aspect about oil palm is that it grows relatively fast (three years to

⁵⁹ National Oil Palm Strategy of Liberia 2021-2025, Ministry of Agriculture

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maturity), and with proper techniques, and training of farmers, Liberia would once again develop its Oil Palm sector through the granting of four major Oil Palm Concessions. They included between 2009-2010 Golden Veroleum in Sinoe County, Sime Darby (Now Mano Palm Oil Industries) In Cape Mount County, Maryland Oil Palm Plantation in Maryland County, and Equatorial Palm Oil in Grand Bassa County. Major Concessions (National Oil Palm Policy 2021-2025)

Name of company	Area under concession contract (hectare)	Year of commencement of the agreement	Duration of Contractual Agreement	Out-grower scheme in concession contract (hectare)	Planted oil palm area 2016 (hectares)
Golden Veroleum Liberia (GVL)	220,000	2010	65 years	40,000	15,005
Sime Darby (Now MPOI)	220,000	2009	63 years	44,000	10,411
Maryland Oil Palm Plantation	8800	2011	25 years	6400	Unknown
Equatorial Palm Oil (EPO)	70,524	2008	25 years	18,201	18,201

Source: Basta (2016): Live or drive, a choice has to be made: A Case Study of Sime Darby Operations in Liberia

In addition to the major Concessions exporting edible oil and mostly crude palm oil (CPO), several large farms exist in counties around the country owned by private individuals, some of who participate in out grower schemes with the large Concessions. In addition, small companies that package the oil for cooking or used it to produce things of value are also part of the key actors, such as J-Palm, which is a successful producer of cosmetics and soaps using Oil Palm and other natural ingredients.

Investment Opportunity

Liberian firms such as J Palm Liberia and Atlantic Beverage Company have ventured into significant value added in the sector. In the case of J Palm Liberia, it focuses on skin and hair products, and Atlantic Beverage Company was focused on producing and packaging edible palm oil. Another company, Dunia Lotomai manages a farm implementing an out-grower scheme with 248 smallholder farmers and establishes a standard for processing based on hygiene, moisture and FFA levels, produces red palm oil packaged in wine like glass bottles designed for table serving and fine dining. With adequate capital infusion into the sector for companies such as these with the capacity and ability to scale up for value added production, that would provide the necessary capital for many of these companies and others like them to significantly scale up and create sustainable opportunities for the sector.



J Palm Liberia

Atlantic PUR Company

Dunia Lotomai Palm Oil

The Business Opportunity is for a Financing Facility developed for selected local banks as pass-through financing for small businesses, thereby creating value added products in the Oil Palm sector. These facilities should be offered at a lower than usual interest rate with a longer repayment schedule. The banks will conduct the normal underwriting due diligence, for which they will earn fee income and share on the interest levied with the investor. Ideally, in addition to private financing from an investor, the Government can contribute to the fund. However, the Government contribution will serve only as a guarantee to the investor on the principal invested in creating the facility.

Proposed Fund Amount to be Invested in Facility	USD \$5M
Target Beneficiaries	Existing Agribusiness Companies in the Oil Palm Sector with a track record of success
Guarantor	GOL through the CBL and Interested Donor Partners to collateralize investor’s principal investment, limiting risks to interest income.
Underwriting/Fiscal Agent	Selected Local Banks (Earning Fee for Underwriting Due Diligence and Servicing Facilities)
Pricing	Offer should be below CBL Prime Rate –for example offered at 8-9% per annum; and 2-3% Origination and Facility Fees
Tenor	5 Years

Oil Palm Sector Challenges

The Oil Palm sector in Liberia is dominated by an “extract and export” model, and very little value-added production activity at scale. With limited Government resources for investment, the extractive model generates lesser revenue as there is little to no value added upon which additional income, job creation, and other economic benefits would derive.

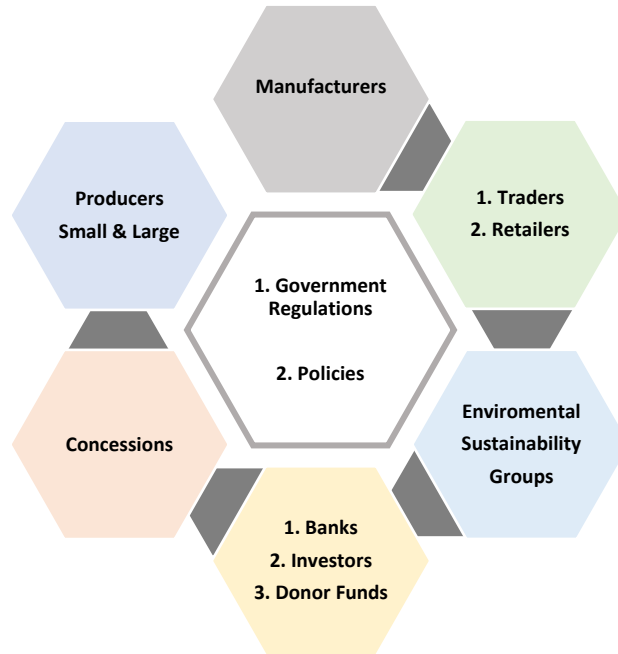
By fully implementing the sustainability guidelines identified by stakeholders and outlined in Liberia’s National Oil Palm Policy, the sector could see a significant increase in production and create clear opportunities for value added production. The good news for Liberia is that the current discussions and dispensations have brought key issues to the forefront for resolution in order to move the sector ahead. As indicated in the National Strategy, sustainability objectives should address these factors:

- Address land tenure conflicts resulting from the way some concessions were initially awarded
- Increase government funding and support

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- Protect human and social rights of communities affected and impacted by concession activities
- Clarify ambiguous environmental protections laws and policies
- Implement proper inspection and certification schemes

Oil Palm Value Chain



CONSUMABLE GOODS

Ice Cream
 Palm Oil (Red & Kernel)
 Vegan Cheese
 Margarine
 Chocolate
 Pastries
 Baby Formula
 Instant Noodles
 Comercial Pizza Dough



COSMETICS

Deodorant
 Washing Powder
 Lipstics/Cosmetics
 Creams/Lotions
 Shampoos
 Hair Grease
 Liquid Detergents
 Soap Bars



SUSTAINABILITY CONCERNS

Deforestation Methods
 Carbon Dioxide
 Greenhouse Gas Emission
 Displacement of Rural/Forest Communities
 Impact on Forest Species
 Biodiversity Impact
 Land Tenure/Land Rights

Possibilities and Potential Environmental Consequences to Mitigate

Roundtable on Sustainable Palm Oil (RSPO)⁶⁰

GOL policy includes an emphasis on RSPO standards, as reflected in oil palm concession agreements between GOL and palm oil companies. The RSPO Principles and Criteria for Sustainable Palm Oil Production set out seven major principles and forty specific criteria to guide sustainable production of palm oil.⁹ These are accompanied by performance indicators and guidance to support compliance and compliance assessment for RSPO certification.

The seven RSPO Principles

- Principle 1: Behave ethically and transparently
- Principle 2: Operate legally and respect rights
- Principle 3: Optimize productivity, efficiency, positive impacts and resilience
- Principle 4: Respect community and human rights and deliver benefits
- Principle 5: Support smallholder inclusion
- Principle 6: Respect workers' rights and conditions
- Principle 7: Protect, conserve and enhance ecosystems and the environment

⁶⁰ Targeted Scenario Analysis (TSA): Sustainable Palm Oil Concessions in Liberia, November 2020, UNDP and UN Partnership for Action on Green Economy.

RICE

Rice Thesis

Grown by more than one-third of all smallholder farming households, rice remains the primary staple food in Liberia. In fact, Liberia has the highest per capita rice consumption in Africa (127 kg), but only 2% of its arable land is used to grow it.⁶¹ Locally produced rice typically is not price-competitive with the tariff-free imported rice that dominates the retail space. Additionally, most of the rice produced is consumed within the household because farmers have limited financing, feedstock, and skills to produce at a commercial scale. If high post-harvest losses, processing quality, limited seed varieties, and price challenges are effectively addressed, domestic production would still need to double to satisfy the ever-growing local demand for rice in Liberia. The rice sector has huge potential - the acreage to triple the amount of land that is harvested and the scope to double yields. Liberia has the natural resources to be self-sufficient in rice production with its exceptionally high rainfall, low-cost labor, warm weather year-round, and wide sweeping uplands and lowlands. As an added incentive, the importation issues that plague the country are not unusual across the continent, which implies that returns from investing in Liberia can be realized from meeting demand across Africa. So, an integrated approach is required to address the limited local production and mitigate substantial volumes of imported rice. A focus on innovation, cost control and processing can transform this underutilized industry into a pan-African supplier.

Rice Sector

Every year, people in sub-Saharan Africa (SSA) consume 34 million tons of milled rice, of which 43% is imported. The average wholesale price for a 25kg bag of rice in Liberia is about \$13 (and the going international price of price is \$400/ton), implying that the value of rice consumption in SSA is \$14-18 billion and the value of what is imported is about \$6-8 billion. This \$8 billion is the market that an export-focused rice investor in Liberia can target, i.e., the value of rice that countries in the sub-region alone import annually from around the world.

The COVID-19 pandemic greatly disrupted global supply chains. During that time, importing anything, including rice, was dramatically slowed causing massive shortages across the continent, and consequently driving the price up by as much as 22% for the popular *Indica White* rice in some countries. Even the rice imports from Thailand, one of Africa's largest suppliers, declined by 30% due to lockdowns, border closures and general limitations on supply chains. The strain on national food systems was palpable but the message was again clear – a national plan of self-sustainability by focusing on reducing imported rice is necessary.

The continent, and Liberia, already have resources for adequate rice production. It needs only to focus on targeted investments and supportive policies. For example, investments in the rehabilitation and modernization of irrigation systems would enable farmers to explore high-yielding upland rice farming in addition to lowland farming, which is more commonly seen in big rice producing countries. Additionally, growing schemes, processing facilities and transportation links are all key value chain bottlenecks that could totally transform the industry. Liberia will see a rise in self-sufficiency as farmers start to produce commercial quantities of international standard rice that can compete with imported products on price, taste, and packaging.

The role of the supportive policies would be to de-risk market failures while speeding up the implementation of innovations in local rice production, including those that relate to genomics and e-commerce. Market failures could include the inconsistent supply and high costs of fertilizers, inefficient pricing market caused by low tariffs on imported rice, and the lack of adequate financial support for farmers to procure equipment and

⁶¹ USAID Agriculture Value Chain Assessment 2014

inputs. Innovations in the rice industry can look like the use of seed film for cultivation or creating the pathway to establish a new sector where previously discarded rice husk is used to make rice husk ash, a substance rich in silica that can replace cement in making concrete. The variables are many, but the end goal is always the same, uplift Liberia's grossly underutilized rice industry.

All efforts must be backed by campaigns to sensitize local consumers of the benefits of buying local. Partnering with organizations like AGRA could give Liberia access to the support and technical assistance that has proven successful in other countries like Ghana. With the right adjustments made to increase production yield and output demand, Liberia has the scope to double yields and triple the amount of land that is harvested; currently over 230,000 hectares is harvested, but this can increase to at least 600,000 hectares.

Rice importation to Liberia is projected to grow at 2.2% per year increasing from 298,000 tons in 2015 to 382,000 tons by 2025 while consumption is expected to increase by 3.5% per year from 461,000 tons in 2015 to 652,000 tons by 2025. The domestic production projection, reflecting an annual growth of 5.6%, is based on an expansion in area harvested of 1.2% per year and an increase in yields of only 4.4% per year (yields are currently around 1.5 tons/hectare). With consumption outpacing production, the dependency on imports narrows only marginally from 65% in 2015 to 59% by 2023.⁶²

In addition to demand pressures, the price of locally produced rice compared to its imported substitutes is an inherent weakness in the sector. The real FOB price of the international reference Thai 100% B is around \$400/ton. India 5% parboil has accounted for the bulk of the Liberian rice imports since 2013. In 2015 this origin and rice type accounted for over 80% of Liberia's rice imports. FOB prices of India IR-64 parboil typically follow closely with the Thai 100% B price.⁶³ Without clear and aggressive policies and innovative new technologies, it is difficult for Liberian rice to compete against Indian rice imports. For example, Seed Film Cultivation (SFC) is a new method created in Korea that involves growing rice using rainwater and irrigation outside the water-filled lowlands that is expected to be able to push Liberian rice yield to 6 tons/hectare from 1.5 tons/hectare of paddy rice and, concurrently, reduce the labor required for harvesting. Rice farming in swampy lowland areas is suitable for river-rich countries, including Liberia, but if the farmers can control weeds and prevent the loss of fertilizer, as in the case of SFC, upland farming could be optimized.

Rice Opportunities

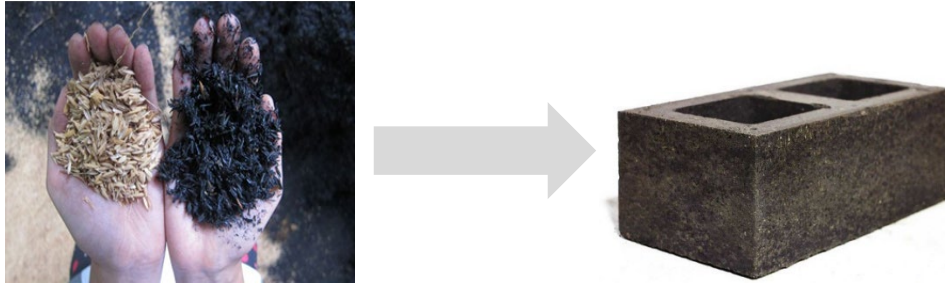
1. Rice Husk Ash (RHA)

Rice husk (RH) is the shell that is removed and discarded as part of the rice milling process to reveal whole brown rice, which upon further milling to remove the bran layer yields white rice. RH constitutes about 20% the weight of rice and when burnt generates rice-husk ash (RHA), an abundantly available renewable agriculture waste material found in all rice producing countries. What makes it unique is that it has the highest proportion of silica content among all plant residues and so can be utilized instead of cement in concrete making. Adding organically produced silica to concrete results in improved impermeability, workability, and strength.

⁶² USAID FED VC Report 2016

⁶³ USAID FED VC Report 2016

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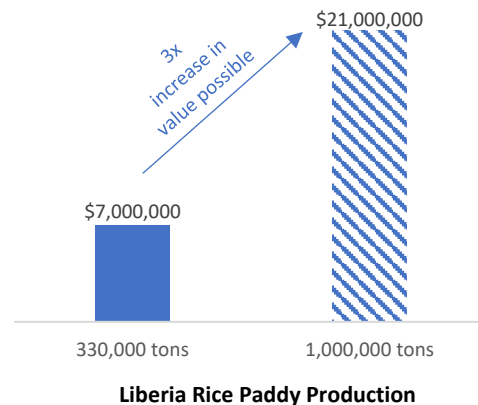


Completely burnt RH is grey to white in color, while partially burnt rice-husk ash is blackish

Chemical analyses of RHA produced under different burning conditions show that the higher the burning temperature, the greater the percentage of silica in the ash. Other research, has demonstrated that RHA is one of the most promising supplementary cementing materials, given its high specific surface and great amount of silica soluble in alkaline conditions. So, what is silica? Silica is an excellent admixture for concrete as it is the property that reduces thermal cracking caused by the heat of cement hydration, improves durability, reduces materials costs and, most importantly, increases strength. It is a substitute for ordinary Portland cement, which is a highly expensive component of concrete. This substitution ultimately reduces a fundamental cost in construction and is known to be preferred in both Kenya and Nigeria.

For the period of 2021 to 2031, the rise in the use of RHA in building and construction is expected to boost global demand, growing at a CAGR of 5% over that time frame. The global RHA market was valued at \$1.3 billion in 2020 and is expected to be valued at \$ 2.2 billion by the end of 2031. For every 1,000 kg of paddy milled, about 200 kg of husk is produced, and when this husk is burnt, about 50 kg of RHA is generated, implying a 5% RHA yield from paddy rice. Liberia’s highest production volume over the last 5 years was about 310,000 tons of rice, implying that there was 86,800 tons of rice husks available, and nearly 22,000 tons of RHA that could have been produced. The expected price per ton of RHA ranges from \$100 - \$500 or more depending on the market. But using the median price of \$300/ton, the value of the RHA market in Liberia was nearly \$7 million. That said, analysts suggests that Liberia should be producing at least 1 million tons of rice paddies to reduce importation costs and increase self-sufficiency. At this level of productivity, the value of the RHA market could rise to \$21 million.^{64, 65, 66, 67, 68}

Chart 5. Liberia RHA Value



⁶⁴ <https://www.tandfonline.com/doi/abs/10.1080/09613219608727497?journalCode=rbri20>

⁶⁵ https://link.springer.com/chapter/10.1007/978-3-540-74294-4_7?noAccess=true

⁶⁶ <https://www.sciencedirect.com/science/article/abs/pii/S0008884614000763#:~:text=Abstract,silica%20soluble%20in%20alkaline%20conditions>

⁶⁷ <https://www.transparencymarketresearch.com/rice-husk-ash-market.html>

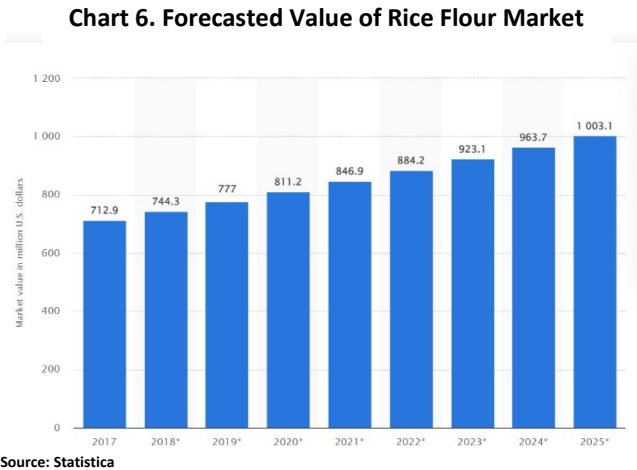
⁶⁸ <https://www.entrepreneurindia.co/blog-description/327/>

earn+profits+from+rice+husk+ash+make+products+from+rice+husk+hull+and+rice+husk+ash+rha

2. Organic Rice Flour

Organic rice flour is created from grinding finely milled brown or white rice. It is high in nutrients and commonly used to make fresh rice noodles and desserts. It can also be used for other purposes such as thickening coconut milk to get a smooth and creamy consistency.

The global rice flour market is likely to grow to \$1 billion by 2027 from \$713 million in 2017 and from 2022-2027 the market is projected to grow at a CAGR of 4.5%.^{69,70} The increasing awareness about healthy flour alternatives to substitute commonly used gluten-containing wheat flour will be the driving force behind this growth. In fact, consumers in the bakery and confectionery sub-sectors held the largest share of the market in 2021, followed by the ready-to-eat sub-sector (i.e., frozen pizzas, burger, and other fast foods).⁷¹



A study by Digestive Disease Week in 2016 stated that hospitalizations for celiac surged more than 600% from 1998 to 2013. Celiac disease is a digestive disorder that causes the immune system of people who are intolerant to malfunction and deteriorate when it encounters the gluten protein. Fortunately, rice flour, much like cassava flour (a market that could already be valued at over \$13 million in Liberia at today’s low production levels), is manufactured from a gluten-free grain, making it a healthier alternative for those who are sensitive to gluten, found in wheat and rye, the main ingredients in all-purpose baking flour. Gluten-free baked foods and snack items have recently gained popularity as a growing consumer base embraces healthier ready-to-eat options to fit their busier lifestyle. As a result, rice flour makers are expected to capitalize on the massive growth potential in the baking industry.

Additionally, the increased popularity and acceptance of organic rice flour is a significant trend in the rice flour market. Organic rice flour is made from rice that has been grown in compliance with organic farming rules and guidelines, meaning without the use of pesticides, synthetic fertilizers, or other harmful agents. It basically contains no carcinogens, preservatives, or pesticides. Increasing customer understanding of organic products, as well as strong public support for the development of natural and nutrient-rich products, are the primary reasons why growth in the demand for organic products will continue to propel the rice flour market. Organic rice flour is in great demand for bread, cookies, processed foods, desserts, and meats and sauces.⁷²

Liberia rice production has oscillated between 250,000 and 310,000 tons for the past decade. The general rule of thumb is that for every cup of rice produced, 1.5 cups of flour is yielded.⁷³ Therefore, assuming a production of about 310,000 tons of rice, 20% market penetration (because all rice harvested in the country cannot be used for flour production) and a price per ton of \$400, the value of the rice flour market to Liberia is over \$23 million.

⁶⁹ <https://www.transparencymarketresearch.com/rice-flour-market.html>

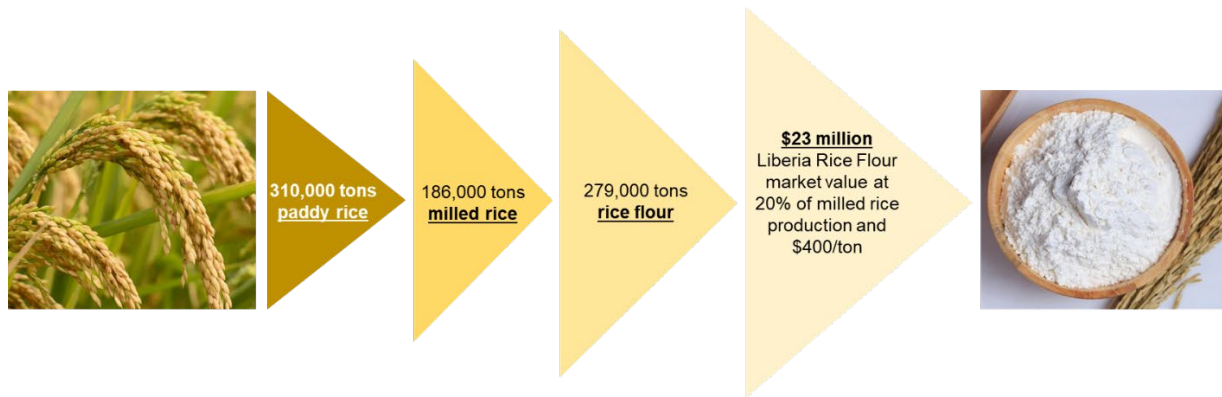
⁷⁰ <https://www.marketdataforecast.com/market-reports/rice-flour-market>

⁷¹ <https://www.prnewswire.com/news-releases/rice-flour-market-size-to-grow-by-usd-339-63-million--64-of-the-growth-will-originate-from-apac-17-000-technavio-reports-301539681.html>

⁷² <https://www.transparencymarketresearch.com/rice-flour-market.html>

⁷³ <https://carolinarice.com/cooking/how-to-make-your-own-rice-flour-for-baked-goods/#:~:text=And%20now%2C%20the%20moment%20you,2%20cups%20of%20rice%20flour.>

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3. Seed Film Cultivation

The amount of labor required to develop lowland areas for rice production in Liberia is large and requires substantial technical assistance, given the low level of development of the agriculture industry. Additionally, because many lowland rice fields are lying idle, one can assume that continuous cropping on them is quite difficult.⁷⁴ Fortunately, Liberia's rice ecosystem is characterized by abundant rainwater, wide uplands, and a temperate climate, and rice is actually not an aquatic plant (it is typically grown submerged in water to control weeds (WWF 2007)). So, if farmers can control weeds and prevent the loss of fertilizer that may wash away during heaving rains, it is presumed to be better to grow rice outside the lowland swampy areas, commonly used for rice production around the world, and in the uplands instead. Most rice production in Liberia is already, sensibly, in upland areas.

Seed Film Cultivation (SFC) is an innovative system that increases the sustainability of rice farming, allowing farmers to grow rice in dry fields with simple drip irrigation. The benefits to SFC are that it naturally forms seedbeds, maximizes seed-to-soil contact, enables fast and uniform germination and boosts seedling establishment. In addition, the film protects against loss of warmth, moisture and fertilizer, controls weeds, all while minimizing greenhouse gas emissions.



SFC produces optimal harvests when rice is grown in upland areas as data shows it can increase yield to over 6 tons/hectare; this tremendous yield increase would be significant for Liberia, where yields hover closer to 1.5 tons/hectare. For the SFC method to work, over 300 mm per month for 3 months of rainwater must be captured in an upland ecosystem. Annual rainfall in Liberia is approximately 1,700 mm in the north and over 4,500 mm in the south between June and October (80–95% of the total annual level) and most areas across the country have a water surplus for 5–8 months each year. Additionally, average temperatures vary between 24 and 28°C, while relative humidity ranges from 65–80%. In short, Liberia's high volumes of rainfall over an average 6 months per year and warm humid climates year-round make it a perfect candidate to use the SFC method.

⁷⁴ USAID Agriculture Value Chain Assessment 2014

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In Liberia, rice production covers more than 200,000 hectares of land and research shows that no added farmland is needed for SFC production even if Liberia is to achieve its optimal levels of productivity of 1,000,000 tons per year (up from 300,000 tons per year). The recommendation is for 100,000 hectares (50% current coverage) of rainfed upland, far from flood damage, to be earmarked for SFC farming. If 1 million tons of paddy rice production is achieved, then millers will have an output of about 600,000 tons of white or brown rice. At \$400/ton, the value of this rice market would be \$240 million. The cost of the equipment for the SFC method of farming is about \$90 million, so investment costs could be fully recovered within one full year.^{75, 76, 77, 78}

Key Takeaways

The value today of the aforementioned latent opportunities is over \$280 million. This valuation is a base case scenario meant to illustrate what has been left on the table. It does not factor in expected local and international growth trends so there is huge upside potential to be captured from investing in the rice industry in Liberia. Put simply, rice holds a leading role in the achievement of food security and economic stability for the continent.

Investment Impact

1. Food security as dependence on imports is reduced
 - a. Exposure to market risk (availability and price), combined with the high dependence on imports, directly translate into a basic food security risk for millions of people
2. Reduce hard currency expenses while increasing reserves of it
 - a. Liberia runs a dual-currency economy that is exposed to macro-economic risks that could be mitigated by having a large reserve of foreign currency
3. Job creation
 - a. Jobs created all along the value chain from land preparations, operating machines, procuring supplies, sowing, harvesting, processing, and distributing
4. Rural development
 - a. Farmers to develop new skills working with new tools and learning new methods
5. Improvements in infrastructure
 - a. Roads and warehouses will be built to improve access to the products

Make Local Rice Competitive⁷⁹

- Full water control irrigation to boost yields, allow double crop cycles and cash crops rotation
- Adopt the use of agro-inputs and mechanization

⁷⁵ Preliminary Proposal on Rice Self-sufficiency in the Republic of Liberia using Seed Film Cultivation and Rainwater, SOLVE MIT 2018

⁷⁶ <https://ubuntoo.com/s/green-and-seed-1>

⁷⁷ <https://seedfilm.co.kr/en/>

⁷⁸ <https://climate.mit.edu/posts/these-3-tech-innovations-are-transforming-rice-farming>

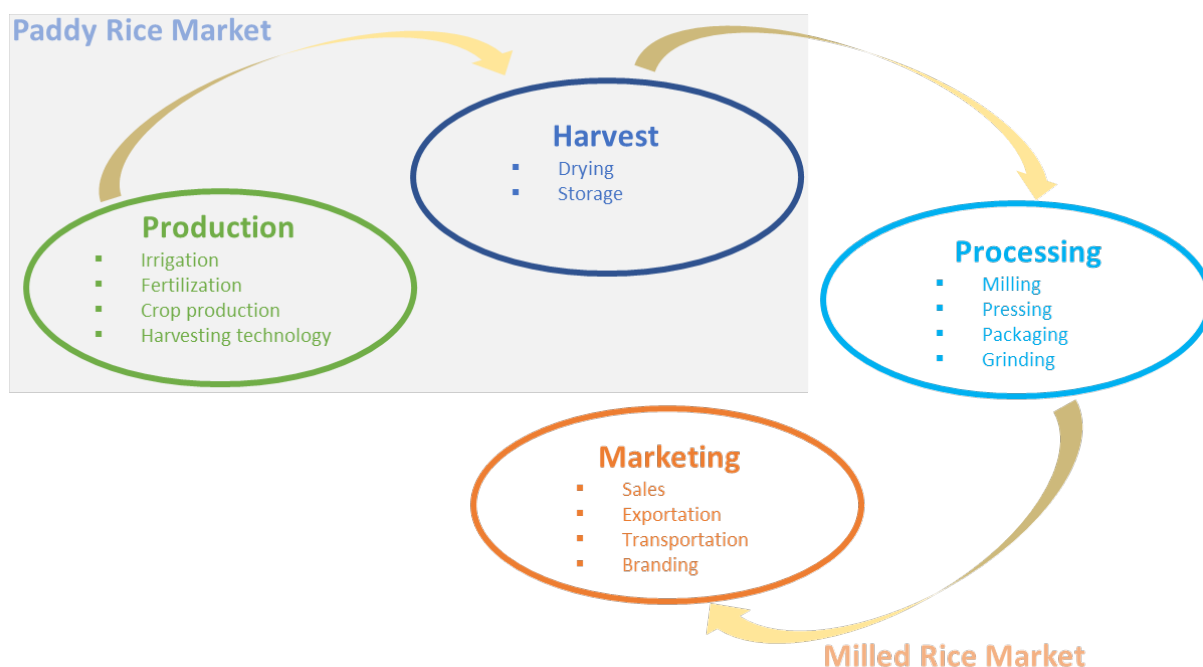
⁷⁹ West African Rice Corridors, Intervalle 2019

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- Build storage and mill facilities on site to reduce costs and the risk of side selling
- Co-ownership/participation of farmers organizations builds loyalty and boosts farmer income
- Professional management leads to significantly higher quality and consistency
- Launch a full PR campaign to create message that encourages local rice consumption
- Collaborate with carefully selected large local off-takers and retail outlets
- All stakeholders in the value chain need to be organized and well-trained
- Create a digitally supported system of knowledge and information dissemination

Rice Value Chain

Figure 13. Rice Value Chain



Rice will always be in demand in Liberia. It is a staple crop, core to the very fabric that makes up Liberian culture and cuisine. This is one of the reasons why increasing local production is critical. But increasing production is not as straightforward as planting more rice seedlings. Farmers generally benefit when their yield exceeds 3 tons/hectare of paddy rice; below 1.5 tons/hectare and the farmer will suffer losses. In Liberia, the average yield typically does not exceed 1.5 tons/hectare, showing that the average rice farmer in Liberia engages in the work for subsistence purposes only. Therefore, investments to increase the yield rates, which is at the first stage of the value chain, would have a material impact in terms of return on investment and social impact. To increase production yield, focus should be turned to ensuring adequate irrigation, utilizing organic fertilizers, incorporating harvesting technologies to increase efficiency, and accessing a network of drying facilities and warehouses for proper storage. This is only at the Paddy Rice phase of the value chain but getting this phase right determines how much value rice businesses will truly be able to extract from the milled crop. This is, in effect, the first bottleneck of the rice value chain that needs to be addressed from an investment side and public sector side. The GoL will need to consistently implement incentives and regulations that would result in farmers gaining access to affordable financing, consistently accessible and affordable agro-chemicals like organic fertilizers and seedlings, and appropriate equipment. The second bottle neck of the rice

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value chain leads to processing and marketing. Whether the end-product is white or brown milled rice or organic rice flour, having the facilities to process them near the source is a big determinant in cost savings, and consequently, price competitiveness versus imported products and on international markets, if exported. Ultimately, these considerations must be underpinned by the right regulatory environment to make doing business in the sector as easy as possible for investors, whether it is through tax holidays on the importation of equipment or R&D tax incentives.

Rice SWOT Analysis

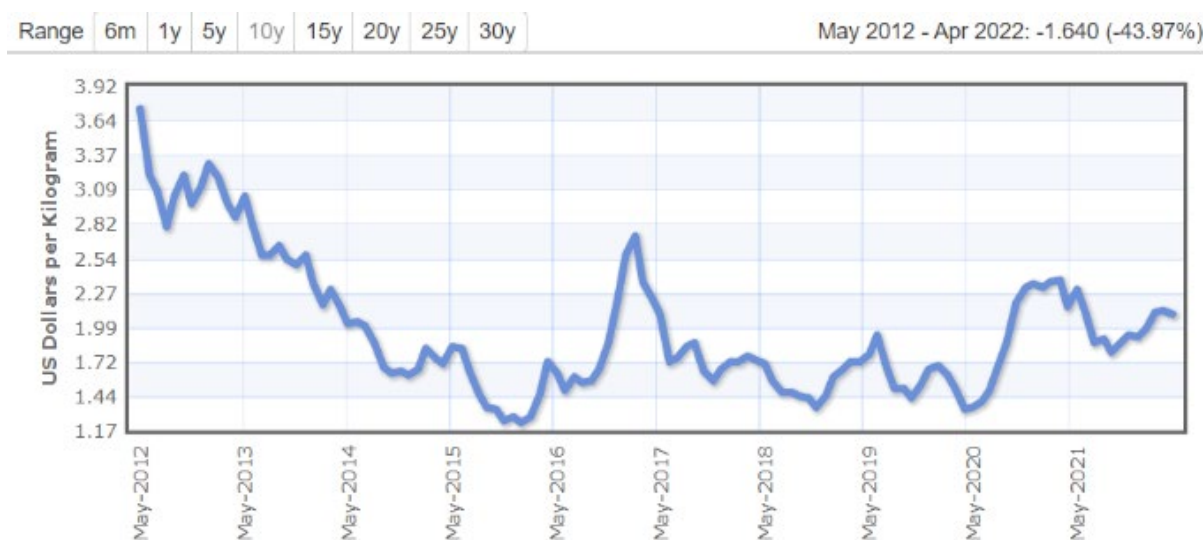
Strengths	Weaknesses	Opportunities	Threats
<ul style="list-style-type: none"> • All part of the grain can be put to use • Rice needs copious amounts of water to grow and Liberia has copious amounts of rainfall throughout the year 	<ul style="list-style-type: none"> • Insufficient availability and use of adapted certified seed and fertilizer • Limited access to finance for farmers to purchase inputs • Poor mechanization • Lack of irrigation of rice fields • Poor infrastructure of connecting roads • Limited processing capacity • Insufficient linkages between producers and millers • Limited quality control • High production and processing costs make local rice more expensive than imported rice • Poor image of local produce 	<ul style="list-style-type: none"> • Low yields relative to other regions (between 1.5 and 3.6 tons of paddy rice per hectare) • Poor storage infrastructure • Husks can be used to make concrete • Avoid environmental damage cause when rice husks are burned and discarded instead of used • Eco-friendly construction 	<ul style="list-style-type: none"> • Droughts • Low priced imported rice • Established rice brands dumped on the market • Torrential downpours may wash away fertilizers

RUBBER

Rubber Thesis

Rubber remains key to the Liberian economy. It serves as one of the country’s strongest foreign exchange earners and primary agricultural export crop. Some data indicate that in Liberia rubber trees cover up to 200,000 hectares of land, but despite this, the rubber industry has experienced a drastic slowdown in recent years due to a lack of investments in concessions, which represent 70% of the country’s production, and the abandonment of private farms, 30% of production.⁸⁰ Additionally, over the last two decades, an inadequate amount of existing rubber farms have been replanted. These issues are compounded by the effects of a volatile international market for the last 10 years; the price of rubber has not fully recovered since the crash in commodities in 2015 and the peaks and troughs since then have been even more extreme.⁸¹ This unpredictable market has pushed manufacturers that use rubber to explore alternate sources and for investors to seek opportunities with more security than found at the raw material level. Both outcomes have left the Liberian economy vulnerable.

Chart 7. 10-year Rubber Price (US\$/kg)



Rice and cassava are the main staple foods, while oil palm, cocoa, and rubber are the dominant export tree crops. So given the volatile price of rubber on international markets as shown in Chart 3, the GoL must be aggressive in its efforts to push the rubber industry away from only harvesting and selling the raw material to incentivizing investments in value added production and exportation. There is scope for the expansion of Liberia’s capacity for natural rubber production since access to land is not a constraint, and there is a large regional and international market for ribbed smoked sheets, rubber crepes and various rubber products from concentrated latex.⁸²

⁸⁰ LADA Value Chain Analysis Assessment Report June 2016

⁸¹ <https://www.indexmundi.com/commodities/?commodity=rubber&months=120>

⁸² <https://www.rvo.nl/sites/default/files/2018/07/Sector-Scan-Liberia-Agric.pdf>

Rubber Sector

Natural rubber comes from latex, a sticky, milky colloid, that is collected from the Para rubber tree then mixed with chemicals, refined, and processed for manufacturing. It is used to produce various products from rubber gloves to tires to chewing gum and running shoes. Its wide application makes it a commodity that could boost and transform the Liberian economy if appropriately managed.



Latex is harvested by making incisions into the bark of the tree to cause a milky fluid to flow into “collection cups” in a process called tapping. The latex is then allowed to coagulate in the collection cups and ultimately processed into dry forms for marketing and commercial manufacturing; natural rubber is processed either alone or in combination with other materials.

Rubber plantation concessions are extremely integral to the sector as they generate over 70% of the country’s rubber output and account for roughly 50% of the area of all tree crops under cultivation; smallholders account for the rest. The extent of the influence concessions has on the economy goes beyond physical land coverage and volume output but also on the prices paid for raw products in the domestic market. These concessions use volatile world market prices to guide the prices they offer smallholder farmers for their produce but since smallholder farmers do not have the

capacity to export, the prices set by large concessions is directly proportional to the sustainability of the smallholder rubber farming sub-sector.

The share of rubber exports to total exports rose from 24% in 1987 to 77% in 1997 as the economy became more agriculture-based through periods of instabilities, but it has since fallen to close to 11% in 2020 as sales from iron ore, gold, and shipping licenses have risen.⁸³ That said, rubber is one of the top three (by USD value) products exported by Liberia and brought in \$115 million in 2020. It is a strong hard currency earner and, consequently, one of the pillars of the Liberian economy. As such, the MoA, in collaboration with its stakeholders, developed a plan for the rubber industry up to 2040 that details the replanting and new planting of 200,000 hectares at a total projected cost of over \$1 billion to yield direct export income of \$12 billion.⁸⁴

Documented commercial rubber production in Liberia started when in 1926 Firestone obtained a 99-year lease for one million acres of land suitable for producing rubber and other agricultural products in exchange for a \$2.5 million loan to GoL. Since then, Firestone continues to produce 90% of the rubber in the country. Firestone is now owned by Bridgestone, ranked the world’s most valuable tire brand in 2017.⁸⁵ Over the years the agreement between Firestone and the Liberian government has been reviewed and edited to better meet the demands of the government but overall, Firestone remains a major player in the industry, often dictating purchase prices to farmers and significantly influencing the contribution of the sector to public funds.

⁸³ <https://oec.world/en/profile/country/lbr>

⁸⁴ LADA Value Chain Analysis Assessment Report June 2016

⁸⁵ <https://www.tyremarket.com/tyremantra/worlds-most-valuable-tyre-brands-2018/>

Aside from Firestone, another major player in the industry is Salala Rubber Corporation (SRC), which was established in 1959 by the Liberian Agriculture Corporation (LAC) when the company signed a 70-year lease to develop 125,000 hectares of land. Today, SRC is the fourth largest rubber company in the country, not only harvesting rubber, but also operating a processing plant and exporting latex.⁸⁶ The company currently runs under the auspices of Socfin which also owns Weala Rubber Company.

Overall, there are seven major concessions in Liberia, but three are owned by Socfin covering the three contiguous counties of Margibi, Bassa and Bong. That in combination with Firestone's huge concession in Margibi county, it is clear that rubber production is largely concentrated in the middle of the country which presents opportunities beyond production but also in services that create or capitalize off synergies in transportation, warehousing, and centralized trade centers.

Rubber Rehabilitation

About seven and a half acres of rubber has the potential to earn \$500 per month when tapped (assuming adequate investments, efficient operations, and access to international markets).⁸⁷ Given the 200,000 hectares (494,000 acres) of land covered by rubber trees in Liberia, this translates into \$32 million per month (nearly \$400 million per year) in potential gross income. This is a critical data point because without any value addition, presumably, Liberia could monetize this resource to benefit from much needed windfalls. The only way to fully optimize rubber plantations to meet this milestone is by planting new trees and rehabilitating existing rubber plantations. However, rehabilitating rubber is labor intensive because tapping and most of the maintenance work (such as biannual brushing) cannot be mechanized. Also, a significant amount of labor is required to remove previous vegetation since agricultural burning is not advised due to the large volumes of GHG emission that get released into the atmosphere.

The large amounts of capital and labor required for rubber cultivation and rehabilitation go toward felling old trees (either by power saw or manual labor), freeing up planting lines, planting new trees, and brushing existing plantations to keep the vegetation between the trees under control. While it is possible to monetize old rubber wood by making charcoal, the onward burning of charcoal in cooking is seen as environmentally unfriendly and so this revenue source is not a key focus in this report. That said, using rubber wood for furniture is a viable use of the felled trees and an avenue that can be explored to offset the costs associated with the rehabilitation. The time required to initiate the activity, bring unproductive rubber smallholder lands back into production, and provide a self-sustainable long-term income source is approximately seven years. Rejuvenated unproductive rubber smallholdings can provide significant long-term income for farmers.⁸⁸

In Liberia, only 1% of irrigable land is developed and agricultural production is generally characterized by poor productivity and low efficiency for all crops but notably low for rubber: 8 tons/ha (cassava); 2.5 tons/ha (crude palm oil); 1.5 tons/ha (rice); and 0.8 tons/ha (natural rubber). But ultimately, rubber is a profitable crop and well-suited to the climate and soil of Liberia. Rubber rehabilitation will enable companies to have access to substantial raw materials necessary to supply commercially viable operations that produce value added products demanded on world markets. It is through the rehabilitation of rubber plantations that significant protection of the biodiversity in the surrounding forests can be achieved, and massive economic windfalls can be tapped by investors and the GoL alike.

⁸⁶ <https://www.scirp.org/journal/paperinformation.aspx?paperid=113985>

⁸⁷ <https://www.rubberband.com/blog/facts-rubber-tree/>

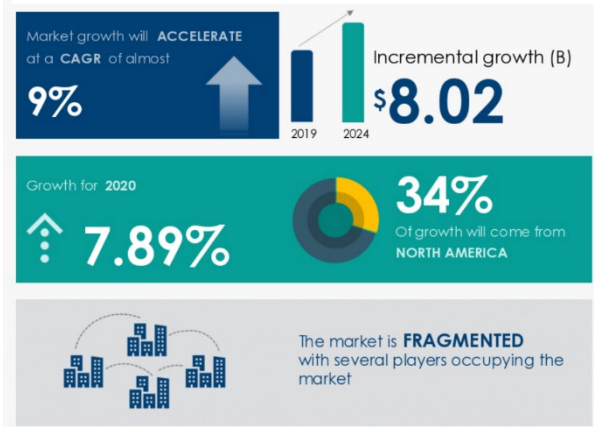
⁸⁸ https://www.land-links.org/wp-content/uploads/2018/04/USAID_Land_Tenure_PROSPER_Agriculture_Value_Chain_Assessment.pdf

Rubber Opportunities

1. Biodegradable Rubber Gloves

During the Covid-19 pandemic, demand for gloves worldwide surged over 100% for the first few months of 2020 to more than 200 billion pieces⁸⁹. The global rubber gloves market was valued at \$34 billion in 2020, is anticipated to generate over \$120 billion by 2030 and is projected to experience a CAGR of 12% from 2021 to 2030⁹⁰, showing that even more aggressive growth is expected in the long-term versus the medium-term forecasts shown in Figure 14. The surge in global health consciousness after the most recent pandemic has led to an increase in the demand for disposable gloves for medical and household purposes. That said, the huge demand has not been limited to healthcare businesses but also skincare salons, barber shops, restaurants, supermarkets, airlines, hotels, repair workshops etc. To meet the surging demand and expand their capacities, glove manufacturers have added additional production lines. By type, powder free, disposable, latex gloves dominated overall sales growth in 2020 (versus powdered, reusable gloves made of other materials) and is projected to continue to grow faster than the alternatives all the way up to 2030.

Figure 14. Global Gloves Market 2020-2024 Snapshot

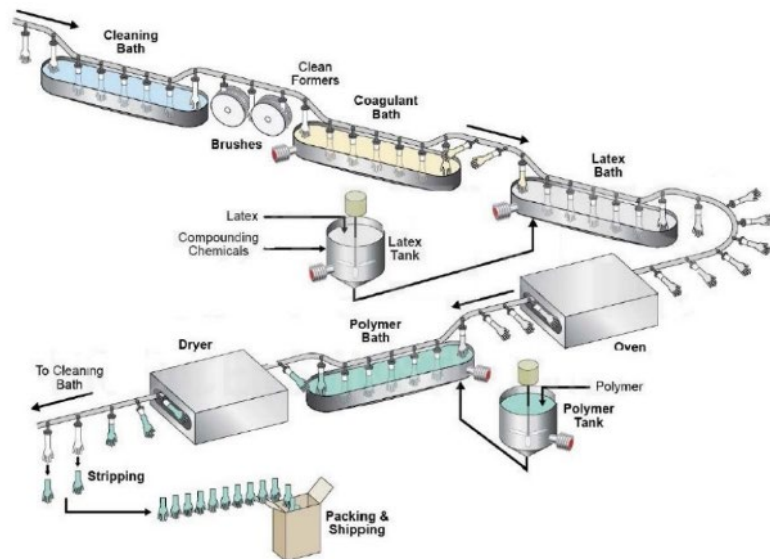


Source: Business Wire

Controversially, the nearly 80 million gloves used by COVID-19 health workers every month were made mostly of synthetic/nitrile rubber that are expected to stay in landfills for up to 100 years. So, with over 300 billion rubber gloves now being used each year - enough to fill New York City's landmark Empire State Building 25 times - Malaysia's

Meditech is poised to capture the fast-growing biodegradable gloves market. Not only does the company make natural rubber gloves that can biodegrade in one year or less and produce 30% less waste during production, its CEO has said that he is "prepared to share [the patent] with those who want [it]"^{91, 92}

Figure 15. Rubber Glove Making Flow Diagram



⁸⁹ MARGMA (Malaysian Rubber Glove Manufacturers Association), 2020

⁹⁰ <https://centaur.reading.ac.uk/100629/1/61497e8fc191f.pdf>

⁹¹ <https://www.weforum.org/agenda/2020/11/covid-19-prompts-pivot-to-green-alternative-to-rubber-gloves/>

⁹² http://www.msmedi-guwahati.gov.in/PDF/Project_profile_on_Rubber_Hand_Glove.pdf

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The annual average price of medical gloves imported into the US soared from \$0.56 for a dozen pairs in 2019 to \$1.77 in 2021. The price increases, likely driven by higher demand, saw the value of rubber glove imports to the US reach \$7 billion in 2021, up from just \$2.3 billion in 2020. By January 2021, a survey by Premier, a US healthcare group procurement organization with a membership of more than 4,000 hospitals and health systems, found that procuring exam gloves was second only to staffing issues as the biggest challenge in caring for covid patients.⁹³

Chart 8. Price of Imported Rubber Gloves in the US

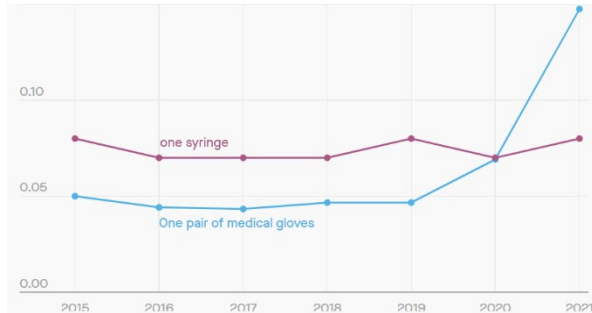
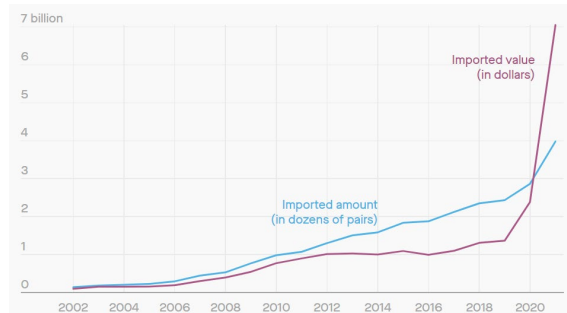
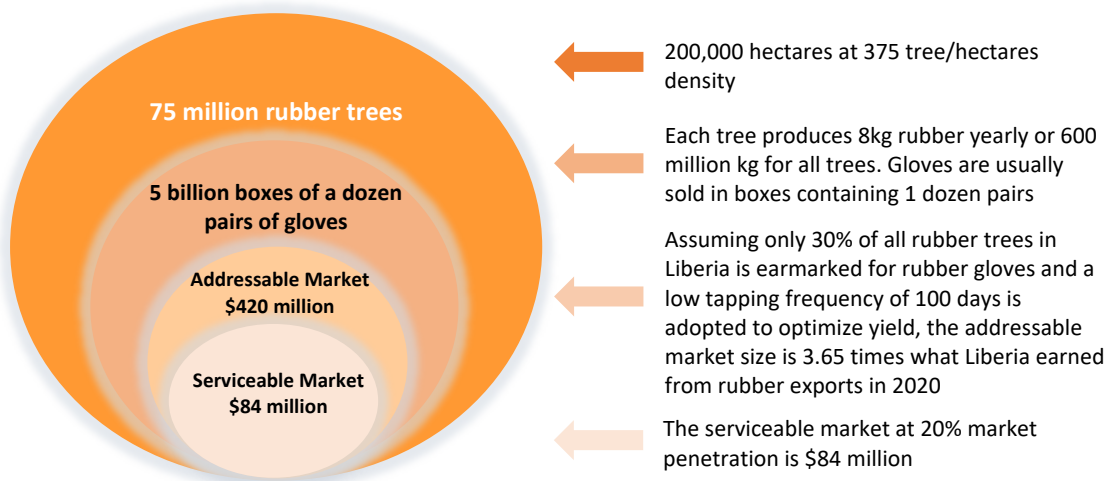


Chart 9. US Imports of Rubber Gloves



Therefore, Liberia could stand to benefit from at least two sides – (1) supplying companies like Meditech with export-ready rubber and (2) acquiring the technical know-how to produce commercially viable quantities of biodegradable natural rubber gloves in country to supply insatiable demand in places like the US market. With its 200,000 hectares of existing rubber plantations, Liberia could have over 75 million producing rubber trees across the country (considering the recommended planting density of 375 trees per hectare). Each healthy and well-managed rubber tree should be able to produce 8 kg of rubber per year which equates to up to 600 million kg of rubber for the 75 million possible rubber trees in Liberia. Using the estimate that each kilogram of rubber can produce 200 gloves and knowing that the average price of medical gloves imported into the US was \$0.56 for a dozen pairs the reasonable adjusted addressable market size for rubber gloves in Liberia is \$420 million.^{94, 95, 96} Conservatively, the serviceable market at 20% market penetration is \$84 million.

Figure 16. Rubber Gloves Market Sizing



⁹³ <https://qz.com/2128295/a-monopoly-explains-why-rubber-gloves-prices-are-up/>

⁹⁴ http://www.msmedi-chennai.gov.in/GARMS_Admin/basictools/images/Covidproject/Disposable-Latex-Gloves.pdf

⁹⁵ <https://www.rubberband.com/blog/facts-rubber-tree/>

⁹⁶ <https://www.britannica.com/science/rubber-chemical-compound/Tapping-and-coagulation>

This estimate showing underutilization aligns with the fact that neighboring Cote d'Ivoire, the largest rubber producer in Africa, planted around 550,000 hectares of rubber trees in 2020, nearly 3 times the volumes found in Liberia. Cote d'Ivoire is about three times the size in square kilometers of Liberia and earned about US\$1.3 billion in 2020. Therefore, if operating at comparably optimal levels, Liberia should have earned over US\$ 400 million from its rubber exports in 2020, instead the country earned only US\$115 million. This logic combined with the model above indicates that the lack of focus on the sector, investments in concessions and privately held farms, and public-sector incentives left at least US\$ 300 million of potential export revenue on the table and out of the hands of the GoL and rubber companies.⁹⁷

2. Carbon Credits – Carbon Sink

Climate change and biodiversity loss caused by an increase in the earth's temperature due to greenhouse gas emissions are some of the defining challenges the world faces today and one of the main sources to counter this change, the Amazon rainforest, is now emitting more carbon dioxide than it is absorbing.⁹⁸ Rainforests are critical for managing climate change as they stock and absorb carbon dioxide and are home to more than 50% of terrestrial biodiversity, while only covering 6% of the Earth's surface.⁹⁹ The Guinean forests of West Africa rank fourth in world hotspots for intact area, rank first for animal biodiversity, and rank eighth in plant biodiversity. Therefore, the Guinean sub-region is of immense significance for biodiversity and carbon storage - Liberia sits entirely in the Upper Guinea sub-region of the West Africa Guinea Forest Zone. The country alone contains the largest carbon sink in Africa outside of the Congo Basin, and accounts for 43% of the remaining Upper Guinean Forest ecosystem.¹⁰⁰ At the same time, Liberia faces the continued risk to its forestry due to both commercial and chainsaw logging; shifting cultivation; the clearing of forests for permanent agriculture; charcoal production; and rising urban and rural populations. With the continued growth in the use of carbon credits and the precedent set by Gabon as the first African country to receive results-based payments for reduced emissions from deforestation and forest degradation, Liberia is well positioned to benefit from its natural forest ecology.¹⁰¹

Figure 17. The Importance of Liberia in the Upper Guinea Forest



⁹⁷ <https://www.statista.com/statistics/1184220/natural-rubber-exports-value-from-liberia/>

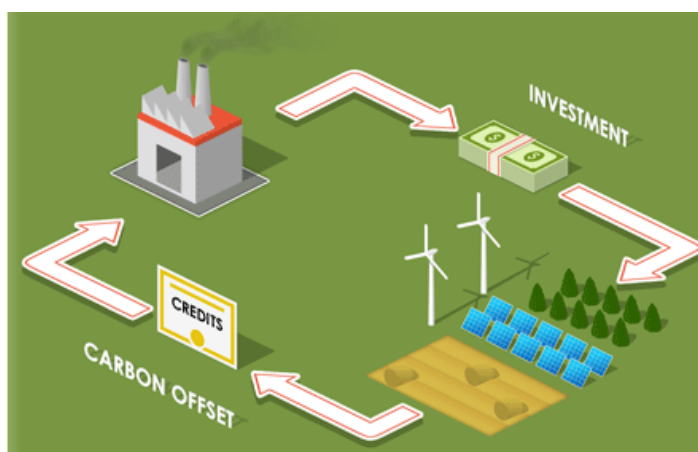
⁹⁸ <https://www.devex.com/news/gabon-plans-to-become-a-green-superpower-by-harnessing-its-rainforest-101636#:~:text=On%20Sept.,Gabon%20to%20offset%20their%20emissions>

⁹⁹ <https://www.un.org/africarenewal/magazine/july-2021/gabon-becomes-first-african-country-receive-payment-reducing-co2-emissions>

¹⁰⁰ https://www.profor.info/sites/profor.info/files/WAFS-draft-42111_0.pdf

¹⁰¹ <https://eros.usgs.gov/westafrika/land-cover/deforestation-upper-guinean-forest>

Figure 18. Carbon Credits Flowchart

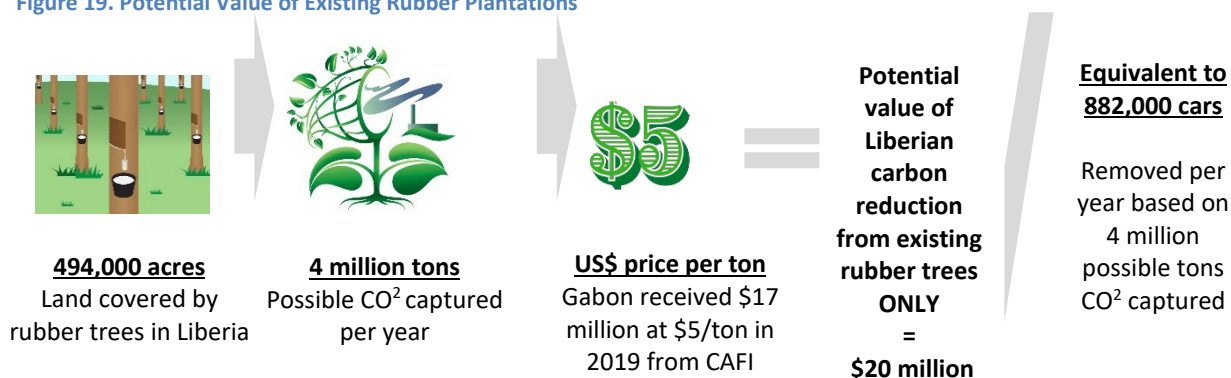


Carbon credits, are measurable, verifiable emission reductions from certified climate action projects that reduce, remove, or avoid GHG emissions. A carbon credit represents the right to emit one metric ton of carbon dioxide and can be exchanged in a carbon market voluntarily or as part of a regulatory framework. Essentially, large industrial companies must hold carbon credits proportional to its carbon emissions. If its emissions exceed the carbon credits allocated by its regulator, it must buy additional carbon credits on the carbon

market to offset its additional emissions; and this is how private capital can be directed to countries like Liberia if it can successfully create, regulate, and monetize its natural carbon sink.^{102, 103}

Market analyses show that global demand for carbon credits is surging as companies are in a race to offset their emissions, meanwhile countries are also striving hard to meet their emissions reduction targets. Countries and businesses are aiming to achieve net-zero emissions by 2050 (i.e. offsetting 100% of the carbon they emit) and for the same year the BloombergNEF, a clean energy research group, expects the market for carbon credits to surpass \$500 billion.¹⁰⁴ The value of the global carbon credits market grew 20% in 2020 to reach \$270 billion. In 2020, the markets captured its fourth consecutive year of record growth, and the total market value is now 5x the value it was in 2017.¹⁰⁵ In September 2021, a carbon credit traded for around \$16 per metric ton of carbon dioxide stored and as more businesses adopt net-zero goals, it is expected that the price of carbon offsets could increase by at least ten-fold in the next decade.¹⁰⁶ Rubber plantations act as carbon sinks – a one-hectare plantation captures 250 tons of carbon in 30 years.¹⁰⁷

Figure 19. Potential Value of Existing Rubber Plantations



¹⁰² <https://medium.com/unleash-lab/carbon-credits-as-a-means-of-financing-development-projects-3245a5ebc1e2>

¹⁰³ <https://landgate.com/news/2021/09/27/what-are-carbon-credits-and-how-do-they-work/#:~:text=Can%20farmers%20sell%20carbon%20credits,of%20CO2%20their%20land%20sequesters>

¹⁰⁴ <https://carboncredits.com/bahamas-sell-blue-carbon-credits/>

¹⁰⁵ <https://tambonthongchai.com/2019/09/30/cer/>

¹⁰⁶ <https://landgate.com/news/2021/09/27/what-are-carbon-credits-and-how-do-they-work/#:~:text=Can%20farmers%20sell%20carbon%20credits,of%20CO2%20their%20land%20sequesters>

¹⁰⁷ World Wide Fund for Nature

4 Ways Liberia can earn from its carbon sink

1. Quantify the carbon sink of unused areas of forests and sell on voluntary carbon markets
2. Companies operating in the rubber industry in Liberia to quantify CO₂ captured, earn carbon credits, and sell on voluntary markets – profit sharing with GoL
3. The GoL to lobby the United Nations to set up a facility like the Central African Forest Initiative (CAFI), the auspices under which Gabon was able to receive its first payment at \$5 per ton of carbon reduction for \$17 million in 2019, in West Africa
4. The GoL to concurrently establish a cap-and-trade system that would enable various rubber companies to trade carbon allowances to meet the government’s carbon reduction objectives. The government would use the net carbon reduction among the trading companies to receive funding from international agencies that could be partially redistributed to domestically operating companies, through tax or other allowances, for example.

Key Takeaways

The estimated combined serviceable value of these industries given the current availability of rubber trees planted across Liberia is over \$100 million clearly illustrating that Liberia is sitting on grossly underproducing assets. From an investor’s standpoint, considering Liberia for the manufacturing of rubber gloves means tapping into huge reserves of readily available latex in a market that is very close to the second and third largest rubber surgical gloves consumers in the world (United Kingdom, \$202 million and Germany, \$227million).¹⁰⁸ In addition, these companies would also be able to capitalize off the \$20 million, and growing, carbon sink capabilities of Liberia. Attracting investors and achieving these milestones means the GoL needs to promote a carbon credits industry by introducing landmark legislation to regulate carbon credits in a user-friendly way for companies.

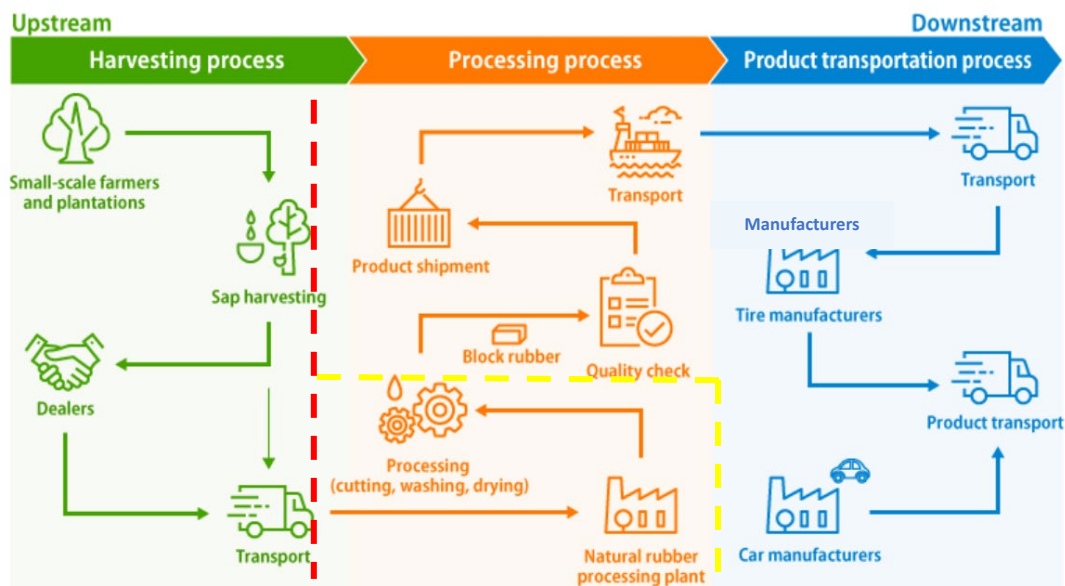
Investment Impact:

- Increase in jobs due to the opening of rubber gloves factories and labor-intensive plantation rehabilitation initiatives
- New carbon credit monitoring and monetizing capabilities will create jobs and new skillsets
- Quantifiable positive impact on climate change due to forestry management
- Acquisition and transition into skilled-labor force through the introduction of rubber gloves factories

¹⁰⁸ <https://oec.world/en/profile/hs/rubber-surgical-gloves>

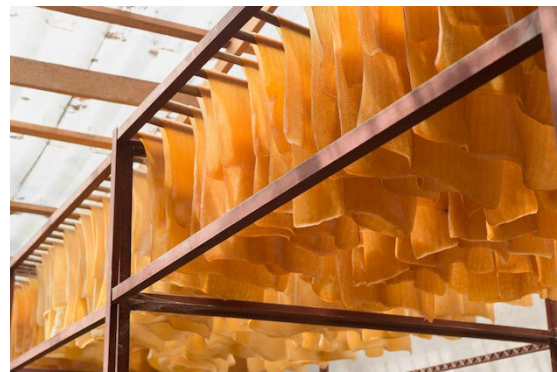
Rubber Value Chain

Figure 20. Rubber Value Chain



In Liberia, the rubber value chain has been dominated by upstream activities, namely harvesting. A large number of small-scale farmers supply a small number of foreign concession companies, the largest being Firestone - the country’s principal buyer of smallholder produce. These international companies have been known to dictate the specification of the product they will accept (Firestone only accepts cup lump - solidified raw rubber) and the price they will offer, clearly exploiting the imbalance of economic power that has repeatedly caused farmers to struggle to break even. In recent years, the sector has begun to transition into midstream activities (yellow dotted line) having been

introduced to Ribbed Smoked Sheets (RSS), a semi-processed molded wet sheet rubber product made of latex collected from the farms and imported chemicals. These sheets are passed through a roller and processed overnight in a smokehouse in a relatively low-cost process, the output of which is a ready-for-export product that international manufacturers transform into finished goods such as tires and footwear. While farmers in Liberia are typically offered \$500 for a ton of cup lump, buyers in Thailand pay over \$1,700 for the same quantity of RSS.¹⁰⁹ Even though there is only one RSS processing facility operating in Liberia, RSS should be used as a gateway for the Liberian rubber industry to evolve beyond harvesting into processing and eventually transportation/exportation. This is a clear illustration that the true value to Liberian rubber sector stakeholders is in the midstream and downstream verticals of the value chain.¹¹⁰



¹⁰⁹ <https://www.growliberia.com/insights/rubber/rss-how-rubber-processing-is-bringing-profit-to-an-ailing-industry>

¹¹⁰ <https://www.y-yokohama.com/global/csr/rubber/what/>

Rubber SWOT Analysis

Strengths	Weaknesses	Opportunities	Threats
<ul style="list-style-type: none"> •Substantial and sustainable demand due to the myriad industries it supplies, such as medical and healthcare, hotel, restaurants, airlines, manufacturing •Rubber gloves for medical and healthcare purpose cannot be substituted with other glove materials because they have a virus and bacteria protection coat •Sufficient land acres for new factories •No shortage of workers 	<ul style="list-style-type: none"> •New trees take 7 years to harvest •Feedstock required to make rubber products need to be imported •Labor intensive production •Limited financial support from government •Very limited existing midstream market for goods and services 	<ul style="list-style-type: none"> •Carbon credits sales •High job creation potential •Import substitution •Many large MNCs with strong financial positions and cutting edge technologies interested in expansion •Large growth in many subsectors •Expand sales and business models to digital platforms for direct sales •Increase demand for natural versus synthetic rubber products 	<ul style="list-style-type: none"> •Pressure from international organizations to reduce felling rubber trees •Illegal logging •Increasing demand for products that can be made with synthetic rubber

APPENDIX

Social Impact Overview

By working across all value chains with thousands of small holder farmers and directly employing female workers across the country, the MoA, through operators and investors, can create an ecosystem of social impact that circles through communities and back into the economy.



The MoA must strengthen partnerships with development agencies and impact firms to build capacity and encourage impactful investments in agriculture. To achieve true social impact in this space, said investments must, among other things, include equipping youth around the country with skills to become efficient and competitive, target female farmers, and reduce burned agricultural wastes, which improves soil quality, soil acidification and crop yields. In the United States, the 4th leading cause of death is a lung disease directly correlated to exposure to the smoke from air pollutants like those released during biomass burning, therefore, reducing the burning of agriculture wastes to improve air quality and respiratory health for the communities that surround operations is critical.¹¹¹ Additionally, firms should aim to improve commercial agriculture knowledge through career counselling and increase financial literacy to help promote more saving for family and future business expansion.

¹¹¹ www.cdc.gov/dotw/copd/index.html#:~:text=Chronic%20lower%20respiratory%20disease%2C%20mainly,genetics%20can%20also%20cause%20COPD

Guidelines to Creating Regulatory Considerations to Incentivize Investments

Investing in agriculture and food systems can produce multiplier effects for complementary sectors, such as service and manufacturing industries, thus further contributing to food security and nutrition and overall economic development. But any investment structure must ensure: (1) there is an alignment of interests between investors and managers/operators; and (2) the structure meets the commercial objectives of the investor. [For example, the lack of scale of some potential opportunities in certain food and agribusiness sectors can be a critical factor. Some investment structures, such as hybrid company/trust or hybrid co-operative/trust structures lend themselves more to ease of aggregation, as opposed to partnerships and unincorporated joint ventures.] This guide is not an exhaustive analysis as investors will need to customize their investment structure to match their appetites, investment criteria and market trends at the time of investment.

It is the responsibility of the GoL, led by the MoA, to not only attract investors to Liberia by presenting market data, emphasizing opportunities, and highlighting gaps in the markets, but by also creating and implementing incentives for said investors. Incentives may come in all forms but paramount to investors is how their investments can be optimized and protected; therefore, it is important that investment structures and programs like those outlined in the table below are readily available to investors in Liberia.^{112,113}

Factors	Considerations
Establishment	Can the structure be created relatively easily and affordably? Is the structure distinct to that of the investors? Does the structure need to be registered with a government agency? Does the structure suit the tax circumstances of each investor?
Funding	Is raising capital through issue of equity securities possible? Is raising capital through issue of hybrid securities possible? Is raising capital through debt possible?
Control/management	Do investors have day-to-day control over the business and affairs of the structure? Is a board of directors or a trustee responsible for the day-to-day management of the structure? Do investors have the right to vote on key decisions of the structure?
Returns to investors	Can income/profits be distributed to investors? Can capital be distributed to investors (regardless of income/profits)? Is there a degree of flexibility to flow through taxable income to investors? Are franking credits available for the investors on payment of dividends?
Ability to exit	Can investors sell their interests to other existing or new investors? Can outside investors acquire newly created or newly issued interests in the entity? Can the structure be listed on a securities exchange? Does the structure have an indefinite lifespan?

¹¹² <https://www.oecd-ilibrary.org/docserver/5km7nzpjlr8v-en.pdf?expires=1651843178&id=id&accname=guest&checksum=095307DD4285692FF1113AE56A5B3328>

¹¹³ <https://assets.kpmg/content/dam/kpmg/br/pdf/2016/09/agribusiness-investment-structures-guide.pdf>

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Governance/Risk	<p>Is investors' liability limited to a fixed amount (such as paid-up capital)?</p> <p>Do investors have a statutory right to receive financial reports?</p> <p>Are the costs related to the continued operations of the structure relatively low?</p> <p>Is the structure subject to regulatory reporting requirements?</p> <p>Does the structure need to make income tax payments and lodge tax returns?</p>
Other Tax considerations	<p>What is the applicable income tax rate under the investment structure and who is the taxpayer?</p> <p>Is a discounted CGT tax rate for individuals and qualifying superannuation funds available?</p> <p>Can tax losses flow through to the investors?</p> <p>Have the relevant loss testing rules been satisfied in order to utilize carried forward tax losses?</p> <p>Does the structure meet the requirements for claiming the R&D tax incentive?</p>
R&D Tax Incentives	<p>Stakeholders in the agribusiness sector could be incentivized through tax reductions on imported equipment or any operating taxes to develop innovative solutions that help overcome technically challenging problems. The nature of the R&D activities performed could be integrated scientific investigations or improving engineering processes. Focus areas may include growing methods, product treatment, or processing technology. Environmental protection and sustainability should be high on the agenda to ensure that no irreversible damage ensues from agricultural-related activities.</p>

United Nations Sustainable Development Goals

