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LIBERIA MARKET STUDY

FOR SELECTED AGRICULTURAL PRODUCTS



JANUARY 2015

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ABOUT THE ENABLING AGRICULTURAL TRADE (EAT) PROJECT

The Enabling Agricultural Trade (EAT) project, funded by the United States Agency for International Development (USAID), and implemented by Fintrac Inc., supports the US government's global efforts to create conditions for agricultural growth. USAID established EAT based on substantial academic and field experience suggesting that a sound legal, regulatory, and institutional environment is a prerequisite to economic growth in the agricultural sector. EAT offers a suite of targeted and customizable analytical tools to support the startup and growth of businesses across the agricultural sector.

DISCLAIMER

The views expressed in this publication do not necessarily reflect the views of the United States Agency for International Development or the United States Government.

CONTENTS

ACRONYMS	4
INTRODUCTION AND METHODOLOGY	5
KEY FINDINGS	6
Lack of data thwarts investment	6
Smallholder rice growers cannot compete with imports	6
Short-term, cassava is not investable	7
Goats, poultry, and fish farming can be viable enterprises	7
Vegetable production can be profitable for smallholders	7
Cocoa production is the best opportunity for smallholders	8
Palm oil production can be profitable on a small scale	8
Beekeeping and honey hold promise	9
Production of pulses and peanuts can nudge out imports	9
ASSESSMENT OF CURRENT USAID VALUE CHAIN FOCUS	10
Rice	10
Cassava	11
Goats	11
Vegetables	12
MARKET OPPORTUNITIES AND POTENTIAL FOR AGRIBUSINESS INVESTMENT	13
Vegetables – The Business Case for Peppers	13
Cocoa	16
Fish Farming	17
Smallholder Oil Palm and Palm Kernel Processing	17
Honey and Beekeeping	21
Poultry and Eggs	22
Pulses and Peanuts	23
APPENDIX A: SEVEN RECOMMENDATIONS FOR FURTHER ANALYSIS	24
APPENDIX B: CONTACTS AND INTERVIEWS	26
APPENDIX C: BIBLIOGRAPHY	28
APPENDIX D: CROP ENTERPRISE BUDGETS	29

ACRONYMS

BRAC	Bangladesh Rural Advancement Committee
CARI	Liberia's Central Agricultural Research Institute
CGIAR	Consultative Group on International Agricultural Research
EAT	USAID'S Enabling Agricultural Trade project
FTF	USAID's Feed the Future initiative
ICCO	International Cocoa Organization
IITA	International Institute of Tropical Agriculture
LIFE	USDA-funded Livelihood Improvement for Farming Enterprises program
LISGIS	Liberian Institute of Statistics and Geo-information Services
MOA	Liberia's Ministry of Agriculture
NGOs	Non-governmental organizations
PKC	Palm kernel cake
SHOPS	USAID'S Smallholder Oil Palm Support program
USAID	United States Agency for International Development

INTRODUCTION AND METHODOLOGY

Feed the Future (FTF) is the US Government's global initiative to reduce hunger and improve food security. Under the FTF umbrella, the US Agency for International Development (USAID) has concentrated its food security donor assistance programs primarily on four value chains in Liberia: rice, cassava, goats, and vegetables. ¹ USAID/Liberia's goals include increasing economic opportunity and income generation for smallholder farmers.

The USAID Enabling Agricultural Trade (EAT) project was engaged to support the USAID/Liberia mission to analyze and evaluate ongoing and future program priorities. Specifically, this report analyzes and evaluates:

- » Domestic market demand and market dynamics for specific agricultural commodities in order to identify areas of unfulfilled demand.
- » Analyzes business and investment opportunities in the food and agriculture sector in Liberia.

LIBERIA MARKET OPPORTUNITIES STUDY TEAM

- » John Addaquay, Consultant
- » Brian Foster, Consultant

The overall goal of this analysis is to identify “ground truth”² market opportunities, support potential proposals with market data, refine them to target specific opportunities, and reject them if they turn out to not be grounded in market realities. The EAT team focused on the economic returns of theoretical investments in order to identify the most promising, financially sustainable opportunities in Liberia, taking the point of view of an investor or entrepreneur.

The fieldwork for this report was based on the EAT project's tested methodology for conducting rapid, deep-dive qualitative and quantitative diagnostics. The team relied mainly on primary-source interviews with the private sector—specifically, producers, traders, input suppliers, wholesale and retail market participants, consumers, large-scale private agro-enterprises, institutional buyers, and agro-processors. In addition, select interviews were conducted with government officials at the federal and county levels, donors, and project implementers (primarily non-governmental organizations, or NGOs), in the field. To the extent practical, this assessment also aggregates and evaluates existing secondary-source data and commonly cited statistics such as average yields, market prices and margins, and trade volumes.

To ascertain the “ground truth,” the EAT team spent two weeks in the field, from January 20 to February 1, 2014, conducting extensive private and public sector interviews in Monrovia and the counties of Grand Bassa, Bomi, Bong, Lofa, and Nimba. Field work was followed up, and to the extent possible validated, with desk research when the team returned home.

¹ For more information, please visit <http://www.feedthefuture.gov/>.

² “Ground truth” in this context means sending representatives to gather data in the field to assess what exists in reality. For example, in cartography, “ground truth” refers to having people on the ground to compare a satellite image to what actually exists. “Ground truthing” can help minimize errors caused by overbroad generalizations and assumptions. For general concepts, see http://en.wikipedia.org/wiki/Ground_truth.

KEY FINDINGS

LACK OF DATA THWARTS INVESTMENT

Overall, meaningful and actionable analysis of business in Liberia in general, and agribusiness in particular, is hamstrung by limited or outdated production and pricing information about agricultural commodities and foodstuffs. A key finding of this analysis, therefore, **is the lack of timely and accurate market data for most food and industrial crops and livestock**, including production statistics over time, pricing patterns, costs of production, farm budgets, analysis of marketing margins, and trade flows. The Ministry of Agriculture's (MOA's) Food Security and Nutrition Program, along with county-level offices of the Liberia Institute of Statistics and Geo-information Services (LISGIS), collect monthly prices around the country on imported rice, palm oil, rubber, cocoa, labor, charcoal, and gasoline that are then summarized and reported—but only several months later.³

MOA no longer has a statistics department. Simply put, the EAT team did not find anyone collecting production cost data or analyzing farm budgets and profitability.⁴ There are no economists working at Liberia's Central Agricultural Research Institute (CARI), and no one the team interviewed there had any idea about farmer costs or crop budgets.⁵ These wide information gaps have significant implications for the various value chain participants in Liberia—producers, input suppliers, traders, and consumers. It means that potential value chain investors have no reliable way to make sound investment decisions, which in turn means that investments are avoided altogether, or are made on onerous terms to mitigate the risk.

SMALLHOLDER RICE GROWERS CANNOT COMPLETE WITH IMPORTS

Liberia's national food security policy priorities are principally (1) to keep the cost of food affordable and (2) to avoid civil strife.⁶ These priorities surround the most important basic foodstuff in the country: rice, which accounts for 85% of the calories consumed in Liberia. With respect to the first priority, the government of Liberia (GOL) keeps rice affordable by allowing it to be imported duty-free. This means that **it is not feasible for smallholder rice producers to compete with zero-duty imported rice**. Therefore, further investment in the rice sector should be carefully considered.

With respect to the second priority, rice riots in 1979 were sparked by a GOL proposal to raise the price of imported rice. This remains fixed in the collective consciousness government officials as a cautionary tale.

There might be some niche market opportunities for locally produced "country rice" at higher than import parity prices, but the volume of market demand is limited. For the time being, rice production for smallholders can contribute to a family's food security, but will remain on a household/subsistence level—not investable.

Research on lowland "swamp rice" production may be warranted, but rice production costs will remain high until weaknesses throughout the rice value chain are addressed. Efficiency gains are needed in seeds and inputs, transportation and aggregation, post-harvest handling and storage, and financing.⁷

³ Tamue D. Koiwou, Food Security & Nutrition Program, Ministry of Agriculture, personal communication.

⁴ Deroe Weeks, Executive Director, Food Security & Nutrition Program, Ministry of Agriculture, personal communication.

⁵ Samuel V. Norris, Central Agricultural Research Institute, personal communication.

⁶ For more information, see "The Road to Rice", The Yale Globalist, Summer 2012.

⁷ USAID, "Global Food Security Response: Liberia Rice Study, August 2009.

SHORT-TERM, CASSAVA IS NOT INVESTABLE

Likewise, cassava is, and will remain, an important food security/subsistence crop for smallholders, playing an important role in caloric intake for large number of Liberian households. Cassava is well-adapted to growing conditions in Liberia, quite resilient to pests, and easy to store in the ground until needed.

However, only fragmented landholdings are dedicated to cassava—on average 0.5 hectares (ha)⁸ per farm—and yields are low (on average 4 metric tons [MT] per hectare). These factors have resulted in relatively high raw cassava prices and little investment in cassava processing.⁹ Therefore, **in the short term, cassava has little prospect for commercialization or value addition that would benefit smallholders.**

Whether or not investable, CARI has ongoing breeding, testing, screening, and outreach programs in both rice and cassava, and those programs should be supported to the extent possible. With respect to rice, AfricaRice, an institution that is part of the Consultative Group on International Agricultural Research (CGIAR), has an active rice breeding program at CARI.¹⁰ With respect to cassava, CARI is screening many cultivars developed by the International Institute of Tropical Agriculture (IITA).

GOATS, POULTRY, AND FISH FARMING CAN BE VIABLE ENTERPRISES

Liberia's civil conflict greatly reduced livestock herds and poultry flocks in rural areas. Today, the main source of animal protein in Liberian diets is from fish and wild animal "bush meat." Most of the eggs, chicken, pork, and other meats sold in Liberian markets are imported. In order to resurrect production in Liberia, two main hurdles must be overcome—specifically, obtaining sufficient and adequate feed, and resolving persistent health issues that jeopardize herds and flocks. **If (1) feed requirements can be addressed by utilizing mostly local, affordable raw materials and (2) animal and poultry health issues can be resolved to reduce mortality and increase productivity, then production of goats and poultry (both broilers and for eggs) can be viable enterprises for smallholder farmers.**

As mentioned above, fish, mostly from the sea and inland rivers and lakes, plays an important role in the Liberian diet as a source of much-needed protein. *Tilapia*, an omnivorous fish, is especially adapted to smallholders because it can be farmed and a wide array of feedstuffs can be used to raise them. Catfish are another option, for the same reasons. Therefore, **fish farming, especially of *Tilapia* species¹¹ and catfish, represents an opportunity to produce low-cost, high-value protein at the smallholder level.**

Realizing this opportunity depends on sufficient farmer training, technical assistance, and some basic research into utilizing local feedstuffs. If those components can be supported, aquaculture can play a significant role in supplying vital protein for the Liberian diet, while also giving smallholders access to a viable commercial activity.

VEGETABLE PRODUCTION CAN BE PROFITABLE FOR SMALLHOLDERS

During Liberia's dry season, local production of vegetables plummets, demand is met by a spike in imports—especially from Guinea, Sierra Leone, and Cote d'Ivoire—and prices soar. Market prices for many vegetables, including chili peppers, tomatoes, "bitter ball," eggplant, okra, and cabbage, are two to five times higher than during the rainy season.

⁸ A hectare is equal to 10,000 square meters, or 2.471 acres.

⁹ USAID/FED, "Cassava Value Chain Assessment," May 2012.

¹⁰ Dr. Akintayo, Country Director, AfricaRice in Liberia.

¹¹ For ease of reading, the species *Tilapia* will not be italicized for the remainder of this report and will be referred to with the common lower-case epithet "tilapia."

This represents a significant opportunity for local farmers who can fulfill dry-season demand. **Vegetable production for commercial sales can be a profitable commercial activity for small farmers, especially if simple, affordable, and effective irrigation systems can be developed and delivered.**

COCOA PRODUCTION IS THE BEST OPPORTUNITY FOR SMALLHOLDERS

Four of the world's top five cocoa producing countries, including the world leader and Liberia's neighbor Cote d'Ivoire, are in west or central Africa, and much of Liberia is suited to cocoa production. In fact, cocoa cultivation has a long history in Liberia, but production fell off dramatically during the civil conflict and has yet to recover. **As a cash crop for Liberian farmers, cocoa production is the best chance for smallholder producers to diversify incomes and access a world market with strong and growing demand.**

Commercial-grade cocoa production in Liberia will require:

- » Organization a new generation of farmer cooperatives.
- » Obtaining and using improved cocoa varieties from Cote d'Ivoire.
- » An agricultural diversification strategy for the initial phase of establishing the cocoa crop.
- » Providing shade for the cocoa trees.
- » Giving smallholder access to credit for inputs, from trading companies that commercialize the cocoa crop.

PALM OIL PRODUCTION CAN BE PROFITABLE ON A SMALL SCALE

In Liberia, oil palm is a large-scale plantation crop. It is grown on vast government concessions granted to foreign companies in order to attract foreign direct investment.

But oil palm is also a smallholder crop in Liberia. Locally produced palm oil is a common commodity for sale in every marketplace and along the road throughout the country.

Palm kernel is a by-product, obtained when the oil palm fruit is initially crushed. The kernel is the proverbial tough nut; it is often discarded by small producers because of the energy and effort required to crack it, de-hull it, and then extract another oil product from the seed inside. But tossing the kernel is tossing away value: a by-product of extracting palm kernel oil is a valuable animal and fish feed called palm kernel cake (sometimes referred to below as PKC), rarely utilized in Liberia, but of significant value and use in other countries, especially Malaysia.

The production of palm kernel oil and cake is a value-adding agro-processing opportunity in Liberia that can be carried out profitably on a small scale. By using palm kernels, smallholder oil palm producers will have another cash-generating product to sell, and the oil extraction process produces a much-needed, low-cost livestock and fish feed ingredient.

BEEKEEPING AND HONEY HOLD PROMISE

In Europe and the USA, demand is strong for honey produced by sustainable methods, especially since bees face increased threats and falling numbers in many countries. Liberia seems to have a natural solution: it has one of the largest expanses of intact African rainforest, a rainforest teeming with bees. Yet to date, honey production has been barely exploited.

However, a small movement is emerging that promotes **beekeeping as a low-technology, low-cost, and profitable enterprise that can produce honey and several by-products** (such as beeswax and pollen).

PRODUCTION OF PULSES AND PEANUTS CAN NUDGE OUT IMPORTS

Many types of pulses (cowpeas, mung beans, black and red kidney beans, lima beans, pinto beans, chickpeas) and peanuts are sold in every food market in Liberia.

Pulses and peanuts are compelling production options for three reasons. First, they are relatively easy to grow with limited inputs since they are legumes and fix their own nitrogen. Second, they add valuable plant protein to household diets. Third, similar to vegetables (as noted above), during Liberia's dry season the majority of pulses and peanuts are imported from neighboring countries.

Import substitution of pulses and peanuts, especially for dry season production, represents an opportunity for smallholder producers, particularly in Lofa, Bong, and Nimba counties.

ASSESSMENT OF CURRENT USAID VALUE CHAIN FOCUS

As mentioned above, USAID/Liberia's programming has focused on four value chains: rice, cassava, goats, and vegetables. Following is a brief discussion of each, which may also provide context for some of the statements made in the previous section of this report.

RICE

Commodity and food prices spiked in 2008. In response, GOL intervened by declaring a zero tariff for rice imports and imposing a government-determined limit on wholesale margins of US\$1 per 50-kilogram (kg) bag. These policies have not changed since 2008 and have created a significant disincentive for Liberian rice farmers. In every part of the country visited, rice producers complained about trying to compete with low-quality, cheap imported rice ("butter rice")—which constitutes 90% of rice imports.

Liberia's Ministry of Agriculture (MOA) acknowledges this problem. According to MOA,

The fact that the Liberian market is dominated by low-quality, imported rice makes it much harder for local producers to compete on cost, crushing any incentive to invest in local production.¹²

Producers and traders interviewed for this report confirmed that at current low productivity levels, domestically produced rice is more expensive than imported butter rice, and less attractive from a quality standpoint than imported par-boiled rice. Until the input supply situation improves for rice farmers, transportation costs decrease, and rice yields significantly increase, domestic rice is not going to gain market share in Liberia.

TABLE 1: MILLED RICE AND FRESH CASSAVA PRODUCTION IN LIBERIA, 2008 – 2013, MT¹³

COMMODITY	2008	2009	2010	2011	2012	2013	AVERAGE
Rice	159,000	167,010	168,771	165,671	169,398	135,519 ¹⁴	160,895
Cassava	496,290	495,300	493,000	489,270	485,190	491,810	496,296

Liberian rice production averaged 161,000 metric tons (MT) per year from 2008 to 2013 (Table 1, above). During that same period, rice imports averaged about 280,000 MT per year; imports typically make up 60% of the rice supply in Liberia. The rice produced in Liberia is predominantly upland rice, generating one crop per year, during the rainy season, using mostly slash-and-burn practices. Productivity is low, at about 0.8 MT/ha for upland rice compared with 1.2 MT/ha for lowland, rain-fed production.¹⁵

Compare Liberia's rice production to Bangladesh, a country of very similar geographic size to Liberia, but with a population of more than 160 million. Bangladesh is self-sufficient in rice, producing some 34.2 million MT per year with an average yield of 2.9 MT/ha.¹⁶

¹² Republic of Liberia, Ministry of Agriculture; "The State of Food and Nutrition Insecurity in Liberia." October 2010.

¹³ CILSS/FAO, "Crop Assessment Joint Mission in Liberia," September 2013.

¹⁴ Interviews suggest this production drop is because of dry conditions.

¹⁵ Dr. Akintayo, Country Director, AfricaRice in Liberia, personal communication.

¹⁶ USDA/FAS; "GAIN Report: Bangladesh, Grain and Feed Annual, 2013."

Improving the rice-production segment in Liberia, and reducing dependence on imported rice, depends on expanding the planted area and increasing productivity. To do that, intense focus will have to be made on (1) swamp/lowland rice production, including supplemental irrigation for the dry season, and (2) increased availability of agricultural inputs, especially seed of improved varieties and fertilizers.¹⁷

There are also some opportunities for niche rice markets in Liberia, including country/unpolished rice. For example, in Kakata, Margibi County, Fabrar Rice company produces red rice that retails for \$3/kg, purchased from farmers for around \$20/50-kg bag. This business appears to be profitable, but volumes are very small.¹⁸

CASSAVA

As mentioned above, from a food security standpoint, cassava is a critical alternative to rice, ranking second to rice as the most important source of calories in the Liberian diet (see Table 1). Cassava is a well-adapted crop: It is resistant to pests. It grows under almost all conditions and is easily stored in the ground un-harvested until needed.

As a commercial activity, there may be some opportunity to add value through processing, such as by producing gari, fufu, and dumba for rural and urban markets. For example, a farmers' cooperative associated with the Farmers Union Network in Bomi county is producing Bomi Gari, for sale in supermarkets in Monrovia.¹⁹

Overall, however, the combination of high transportation costs, low on-farm productivity (around 4 MT/ha), and lack of raw material for even medium-scale processing, suggest that for the time being, cassava will remain a food security crop. That is, a crop important to a household's caloric intake but not produced in sufficient volumes or commanding high enough prices to encourage commercialization, and not a cash crop for Liberian farmers.²⁰

GOATS

As a meat source, goat is in high demand and well-accepted in the Liberian marketplace.²¹ Traditionally, goat production is at the household level, free-range, and of relatively low productivity, in large part due to high kid mortality rates in the first year of life.²² According to the authors' direct field observations, projects to aggregate goats in a ranch/pen system during maternity and early post-birthing is well-accepted by producers in some locales and not accepted at all in others.²³

A USDA-funded project is underway to renovate a slaughterhouse near Careysburg, outside Monrovia. According to a meat processing and marketing specialist involved in the effort, once renovated, the slaughterhouse should provide some market pull for fattened goats and other fed livestock by making locally produced meats more available and affordable.²⁴

The consumption of fish and wild animal (bush) meat in many Liberian dishes suggests a healthy demand for animal protein. Part of that demand could be met new local sources, such as those from the renovated Careysburg plant.

¹⁷ Dr. Akintayo, Country Director, AfricaRice in Liberia, personal communication.

¹⁸ Mr. Mentee, Fabrar Rice, Kakata, personal communication.

¹⁹ Daniel E. Bondeh, Farmers Union Network, Tubmanburg, personal communication.

²⁰ USAID/FED, "Cassava Value Chain Assessment," May 2012.

²¹ Authors' observations and interviews at markets, shops, and restaurants.

²² McCarthy, Dennis B.; "Goat value chain upgrading strategy," April 2012; USAID/FED.

²³ Ekramul Kabir, Chief of Party, Land O'Lakes, Liberia Food for Progress, personal communication.

²⁴ Ronnie Stratton, Land O'Lakes Food Processing Consultant, personal communication.

VEGETABLES

Of all the current value chains, horticulture has the highest potential to benefit smallholders, particularly via substituting for imports. The EAT team was struck by the extent to which imported horticultural products—for example, tomatoes from Cote d'Ivoire and dried peppers from Guinea—dominated Liberian markets during the dry season.

Therefore, the greatest opportunity for smallholder farmers is to produce vegetables during the dry season when, as already noted, wholesale and retail prices in Liberia soar by two to five times, and large quantities of produce are imported. Lowland cultivation and low-cost irrigation would give smallholders an opportunity to exploit high market prices. There are also opportunities for vegetable drying and storage that would allow for sales at increased prices during the dry season, and even exports—especially to Europe—via back-hauling on air cargo transport.²⁵

²⁵ Agnes Luz, DAI, USAID/FED Project, personal communication.

MARKET OPPORTUNITIES AND POTENTIAL FOR AGRIBUSINESS INVESTMENT

The value chains discussed in this analysis constitute opportunities for smallholder producers, as well as commercial potential for input suppliers, aggregators/traders, and agro-processors. They were considered according to their importance with respect to:

- » Market potential, including export demand for cash crops (cocoa).
- » Profitability for producers and others in the supply chain.
- » Feasibility – smallholder capacity to produce.
- » Value addition through aggregation, storage/packaging, agro-processing, and/or marketing opportunities over time and geography.
- » Import substitution.

Described below are the areas of most promise for commercial agricultural production for smallholders in Liberia. Data related to pricing, costs, and margins across the supply chains were collected from numerous sources in the field and used to calculate marketing margins and to produce farm-level crop budgets.

VEGETABLES – THE BUSINESS CASE FOR PEPPERS

Demand for peppers is year-round, but production in Liberia is mostly during the rainy season. Consumers prefer the fresh, Liberian pepper, but during the dry season, supplies disappear and imports of dried peppers substitute, especially from Guinea, increase dramatically. Prices for peppers range from \$1/kg to \$4/kg over the marketing year at the retail level. A similar situation exists for other vegetables with prices increasing several-fold from the rainy to the dry seasons.

Table 2, below, summarizes wet (rainy) season and dry season price data for peppers, bitter ball, tomatoes, and okra. These data were collected in January 2014 from interviews at farms, wholesale and retail markets, and Monrovia supermarkets. Note the significant price increases for the four products at farm gate, wholesale, and retail levels from wet season to dry season. Seasonal prices vary much less at the significantly higher supermarket price levels.

TABLE 2: VEGETABLE PRICES, LIBERIA, JANUARY 2014²⁶

FARMGATE					
		PRICES L\$		PRICES PER KG US\$	
	Weight Kg	Wet Season	Dry Season	Wet Season	Dry Season
Peppers	50	500	2,500	0.13	0.63
Bitter Ball	100	700	3,000	0.09	0.38
Tomatoes*	33	3,960	6,600	1.50	2.50
Okra	50	500	2,000	0.13	0.50

*Derived from Chinese Farms | Source: authors, direct observations, and interviews.

²⁶ Source: authors, direct observations, and interviews.

WHOLESALE Gobachop Monrovia

	Weight Kg	PRICES L\$		PRICES PER KG US\$	
		Wet Season	Dry Season	Wet Season	Dry Season
Peppers	50	1,500	12,000	0.38	3.00
Bitter Ball	100	2,000	6,000	0.25	0.75
Tomatoes	33	7,000	8,000	2.65	3.03
Okra	50	1,000	4,000	0.25	1.00

MARKET RETAIL Gobachop Monrovia

	Weight Kg	PRICES L\$		PRICES PER KG US\$	
		Wet Season	Dry Season	Wet Season	Dry Season
Peppers	0.3	25	100	1.04	4.17
Bitter Ball	2.35	75	350	0.40	1.86
Tomatoes	1	220	265	2.76	3.31
Okra	2.5	100	300	0.50	1.50

SUPERMARKET RETAIL Exclusive Abijalah

	Weight Kg	US\$ PER KG		PRICE VARIATION
		Low	High	
Peppers	1	10.00	11.00	10%
Bitter Ball	1	2.20	2.86	30%
Tomatoes	1	4.95	5.50	11%
Okra	1	2.00	2.50	25%

AVERAGE PRICE MARKUP IN MARKETING CHAIN FROM ONE LEVEL TO NEXT Gobachop Monrovia

	FARMGATE	WHOLESALE	LOCAL MARKET	SUPERMARKET
Peppers	100%	450%	154%	403%
Bitter Ball	100%	216%	226%	224%
Tomatoes	100%	142%	107%	172%
Okra	100%	200%	160%	225%
AVG. MARKUP		252%	162%	256%

A farmer in Bomi County interviewed reported that prices for fresh peppers at the farm-gate can range from L\$500 /50-kg bag in the rainy season to L\$2,500/50-kg bag in the dry season. This price differential represents a significant opportunity for Liberian farmers if they can produce fresh peppers for the dry season market. Low-cost irrigation systems coupled with the use of lowlands that remain moist in the dry season will be necessary for smallholders to take advantage of this market opportunity. There is an additional opportunity for drying and storing rainy season-produced peppers for dry season markets that could replace some of the dried pepper imports from Guinea.

Smallholder vegetable producers operate in farmer associations in an area called Chinese Farms located near Mount Barclay, outside Monrovia. A farmer there reported that dry season prices for peppers can reach L\$12,000/50-kg bag at the Gobachop²⁷ market in Monrovia.²⁸ Several of the vegetable producer associations are supported by the USAID/FED project.

In the same Chinese Farms locale, the authors of this analysis also observed a pair of Chinese road construction workers/farmers with approximately two hectares of irrigated vegetables under production. Their crops included peppers, tomatoes, eggplants), and cucumbers, as well as cabbage, lettuce, radishes, and onions under a 1-acre net to protect the cool-season crops from the sun. These farmers are marketing their produce directly in Monrovia via a company called East International Group.

A similar situation as described above for peppers exists for many other horticultural crops in Liberia, including tomatoes. The authors looked for Liberian tomatoes at the Gobachop market and found only small quantities of cherry tomatoes available. The only other tomatoes for sale anywhere were from Cote d'Ivoire (all were a Roma-type variety) and had suffered significantly in transport; we witnessed at least 40% damage/loss in the wooden boxes in which the tomatoes had been transported.

Interviews with restaurant and hotel buyers Liberia confirmed the authors' observation. They are unable to source domestic fruits and vegetables of consistent quality and reliable supply, and therefore turn to imports—settling for frozen or canned product instead of fresh. According to the director of an up-scale hotel, "If we could get quality fruits and vegetables on a regular schedule, of course we would source locally."²⁹

All of this background points to an economic opportunity for Liberian farmers and traders. In that regard, Table 3 summarizes the average marketing margins for the four products analyzed from farm-to-wholesale and wholesale-to-retail for both wet and dry seasons.

TABLE 3: MARKETING MARGINS FOR FOUR VEGETABLE PRODUCTS, WET AND DRY SEASONS

	PEPPER	PEPPER	BITTERBALL	BITTERBALL	TOMATO	TOMATO	OKRA	OKRA
Season:	wet	dry	wet	dry	wet	dry	wet	dry
Farm-to-wholesale	192%	376%	178%	84%	77%	21%	120%	50%
Wholesale-to-retail	174%	39%	60%	148%	4.2%	9.2%	100%	36%

To further support the conclusion that opportunity awaits, Appendix D of this report includes a model crop enterprise budget for rainy-season and dry-season (irrigated) production of peppers. As reflected in Appendix D, based on (a) production conditions, (b) crop production and marketing costs in Bong County, (c) and wholesale market prices in Monrovia, an acre of peppers (excluding capital costs) can return to the producer around \$200 in the rainy season and \$2,500 in the dry season (with irrigation).

²⁷ Term used for "market women" who exert large influence over wholesale markets.
²⁸ Daily Observer, "Montserrado Farmers Prioritize Pepper Production," January 9, 2014.
²⁹ Chawki K. Bsaibes, Director, Mamba Point Hotel, Monrovia.

COCOA

Export demand for cocoa is surging because of increasing consumption world-wide, especially in China, and supply is not keeping up. In fact, world-wide supply shortages are expected to grow over the coming years—signaling another opportunity for Liberia's agriculture sector.

The available evidence bears this out. In its April 1, 2014 market update, the World Cocoa Foundation reported that demand for cocoa and chocolate products has increased 3% per year from 2008 to 2012, with demand expected to continue to grow and support strong prices. In fact, the International Cocoa Organization (ICCO) daily cocoa price increased 37% from April 2013 to March 2014, passing \$3,000/MT for the first time on February 12, 2014.³⁰ The Cocoa Barometer 2012 states that “due to ageing cocoa farms and farmers, and a depletion of available arable land, cocoa yields have at best remained stable, if not declined. As a result, market experts and the industry as a whole expect a substantial shortfall between supply and demand by 2020.”³¹

Cocoa, therefore, represents an opportunity as an important cash crop that Liberian smallholders can grow and market profitably. Better yet, the supply chain in Liberia for cocoa export markets is already established and expanding. Buyers in Liberia include Wienco Liberia, an input supplier that provides credit to producers and takes payment in cocoa.

From the team's field observations, there appears to be effective technical and material support for smallholder cocoa producers in Bong, Lofa, and Nimba counties from the USAID-funded, ACDI/VOCA³² Livelihood Improvement for Farming Enterprises (LIFE) project. This effort includes cooperative development, farm management training, farm record keeping, nursery seedling assistance, and perhaps most importantly, input supply on credit from Wienco.³³

On the other hand, initiating cocoa production requires ramp-up time—about three years. Therefore, it is crucial that first-time, market-entering smallholder cocoa farmers get support services. For example, an effort is underway with the LIFE project that promotes (a) crop diversification for smallholders to ensure cash flow in the cocoa development years and (b) effective shade management for the developing cocoa plants. Crops utilized in the diversification scheme include vegetables, pulses, plantains, and fruit trees.³⁴

The breadth of the potential is notable. ACDI/VOCA personnel estimate there are 22,000 potential cocoa growers in the three counties where they operate. But even without the potential surge of new producers, important pieces are already in place: the average cocoa producer in the LIFE program has six hectares of cocoa, sufficient to create a viable, commercial business.

Cocoa is currently being marketed by LIFE project producers under a three-tier quality pricing scheme for members of its cooperatives: Grade 1 (guide price of \$1.86/kg at the farm-gate); Grade 2 (\$0.98/kg); and Sub-grade (\$0.60–\$0.65/kg). ACDI/VOCA estimates that smallholders should be able to obtain 1 MT/ha from year 3 to year 25 when using improved farm management practices and good planting material.³⁵ Interestingly, during 2014, the LIFE project is also exploring local processing of sub-grade cocoa for Liberia's domestic market, which could represent an income-generating, value-adding agro-processing enterprise for LIFE cooperatives or other entrepreneurs.

³⁰ World Cocoa Foundation, “Cocoa Market Update,” April 1, 2014.

³¹ “Cocoa Barometer 2012;” www.cocoabarometer.org.

³² The name ACDI/VOCA dates back to the 1997 merger of Agricultural Cooperative Development International and Volunteers in Overseas Cooperative Assistance. Both were nonprofit international economic development organizations founded by the U.S. cooperative community. <http://www.acdivoca.org/site/ID/OurStory>.

³³ Wout van Koppen, General Manager, Wienco Liberia, personal communication.

³⁴ Augustine Zaizay, ACDI/VOCA Field Coordinator, Voinjama, personal communication.

³⁵ David Parker, ACDI/VOCA Chief of Party, personal communication.

FISH FARMING

Fish is an important protein source throughout Liberia, well-accepted and in high demand in the market. Most fish now comes from the sea and rivers, and prices rise as one moves inland. The future for fishing rights in the territorial waters is uncertain, according to one source.

Cultivated fish, especially tilapia, represent an excellent opportunity for small-scale, sustained protein production at modest prices for the consumer. Tilapia is an omnivore, hardy, and relatively easy to manage. Tilapia can be fed many vegetable sources that are easily and locally found. The assessment team visited several small tilapia production operations that had benefited from the technical assistance of a Farmer to Farmer volunteer; Dr. Joe Sullivan, who emphasized utilizing local feedstuffs for farmed tilapia and catfish.³⁶ This effort, it seems, has led to a successful technology transfer that is ready to be scaled up to support a local feed industry.³⁷

There are three Ministry of Agriculture-run fish hatcheries operating in Liberia as sources of fingerlings, including the Klay Fish Hatchery (pictured at right). These MOA fish hatcheries also provide training and technical assistance to fish producers.

A private fish farming operation, the Ganta Rehabilitation Center for Leprosy and Tuberculosis, also sells tilapia fingerlings.³⁸ Fish farming (and other on-site production including pigs, vegetables, and tree crops) provides nearly all the food needed by the Center's patients and staff.

SMALLHOLDER OIL PALM AND PALM KERNEL PROCESSING

Oil palm is both a plantation and smallholder crop in Liberia. Locally pressed palm oil is commonly seen for sale along the road in rural areas, selling for around L\$140/1.5 liters.

A smallholder oil palm 25-year crop enterprise budget is included in Appendix D. Two scenarios, low-input and modest input (essentially fertilizer), are presented. Under the low-input scenario (maximum yield 12 MT/ha fruit), cash flow turns positive at year 3, and is maximized in year 16 at L\$1,316/ha. Using fertilizer and other inputs (maximum yield 18 MT/ha), cash flow turns positive at year 4, and is maximized in year 11 at L\$1,863/ha.³⁹ For reference, large-scale commercial oil palm yield goals in Liberia are 20–25 MT/ha per year.⁴⁰

Smallholder processing of oil palm has been aided by the introduction of the Freedom Mill based on a design by Winrock International. To date, approximately 520 manual mills and 20 motorized mills have been manufactured and sold in Liberia. Annual sales of the manual mills average around 75 units but in 2013, 90 units were sold.⁴¹

³⁶ Dr. Joseph Sullivan, "Sexing fish and preparing feed rations, Liberia," ACDI/VOCA, April 2013.

³⁷ Dr. Joseph Sullivan, Farmer to Farmer volunteer; personal communication.

³⁸ James Flahmne & Whama, Rehab Center for Leprosy and Tuberculosis, Ganta, personal communication.

³⁹ Andrew Kovarik, Chief of Party, Winrock International, personal communication.

⁴⁰ Gobi Ramasamy, Sime Darby Plantation, Bomi Estate, Gbah; personal communication.

⁴¹ Andrew Kovarik, Chief of Party, Winrock International, personal communication.

The Smallholder Oil Palm Support (SHOPS) program, funded by USAID in Liberia, has conducted extensive economic analysis of oil palm processing using manual and motorized mills, and has also compared economic returns for processing Dura (country palm) and tenera hybrid (Mekindo palm).⁴²

Smallholders in Liberia rarely use the palm kernel (seed) because of its hard shell and the difficulty in removing the kernel. Processing the palm kernel into value-added oil is difficult for a small farmer, but a small soap-making industry based on palm kernel oil exists in Nzerekore, Macenta and Monrovia.⁴³

After extracting the oil from the palm kernel, a valuable feed ingredient—palm kernel cake (PKC)—is left over. PKC makes an excellent ruminant (cattle, sheep, and goats) livestock feed component, and if treated, can be used effectively in poultry, swine, and fish feeds.⁴⁴ In Liberia, PKC is currently relatively unknown as a livestock feed, although there is a palm kernel processing enterprise in Ganta that sells PKC to local pig farmers.⁴⁵

A machine shop in Gbarnga, Moonlight Metal Works & Garage, is fabricating several small-scale machines for palm oil pressing and for palm kernel cracking, de-hulling and extraction. The Freedom Mill being manufactured there is from the Winrock International design. A complete set of machinery for palm kernel processing, including two small (7–9 horsepower) Chinese diesel engines for stationary power, costs around \$10,000.⁴⁶ To date in Liberia, only three motorized units for processing palm kernel have been delivered.

These palm kernel processing machines were observed in operation at Paka Farm in Montserrado County, processing around 450 kg of raw palm kernels per hour; producing 40 gallons (gal) of oil and 30 kg of palm kernel cake. Mahmud Johnson, the entrepreneur who started this business, has a ready supply of palm kernels he buys from local small-scale producers, as well as strong market demand for palm kernel oil, palm kernel cake, and improved tenera oil palm seedlings.

A palm kernel processing enterprise budget is included below (Table 4), based on the volumes and prices from Mr. Johnson's operations. As reflected in Table 4, operating 330 days per year and processing 4,500 kg/day of palm kernels (bought at \$0.019/kg) produces (a) 126,225 kg/year palm kernel oil (sold at \$2/kg); (b) 126,225 kg/year palm kernel cake (sold at \$0.075/kg); and (c) 1,232,550 kg/year shells (sold at \$0.0125/kg).

⁴² Winrock International; "Economic Analysis (per Day) – Income, Jobs and Revenue Generated from Oil Palm Processing."

⁴³ Andrew Kovarik, Chief of Party, Winrock International, personal communication.

⁴⁴ F.B. Iluyemi, "Nutritional evaluation of fermented palm kernel cake using red tilapia," 2010.

⁴⁵ Andrew Kovarik, Chief of Party, Winrock International, personal communication.

⁴⁶ Benedict Sampson, Moonlight Metal Works & Garage, Gbarnga, personal communication.

TABLE 4: PALM KERNEL PROCESSING ENTERPRISE BUDGET USD⁴⁷

PALM KERNEL							
COST	QTY		YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5
Capital Expenditure							
Equipment depreciated	\$10,000	set	2,000	2,000	2,000	2,000	2,000
Recurrent Expenditure							
Kernels	1,485,000	kg/yr	27,658	27,658	27,658	27,658	27,658
Wages & Salaries			14,438	14,438	14,438	14,438	14,438
Overheads			18,563	18,563	18,563	18,563	18,563
Interest on Capital Exp (est)	14%		1,400	1,400	1,400	1,400	1,400
TOTAL COST			64,058	64,058	64,058	64,058	64,058
REVENUE							
Kernel Oil	126,225	kg/yr	252,450	252,450	252,450	252,450	252,450
Kernel Cake	126,225	kg/yr	9,467	9,467	9,467	9,467	9,467
Shells	1,232,550	kg/yr	15,407	15,407	15,407	15,407	15,407
TOTAL REVENUE			277,324	277,324	277,324	277,324	277,324
PROFIT			213,266	213,266	213,266	213,266	213,266

⁴⁷ Mr. Mahmud Johnson, Paka Farm, Koon Town, Todee District, Montserrat County.

PALM NUT KERNEL PROCESSING

CONVERSION ASSUMPTIONS

Palm Nut	100%	1 liter of kernel oil	.92 kg
Shell	83%	1 kg of kernel oil	1.09 ltr
Kernel	17%		
Kernel oil	8.5%		
Kernel cake	8.50%		

COST OF PRODUCTION 4500 KG/DAY	QTY	UNIT	COST L\$	COST US\$
Cost of kernels	4,500	kg	12,600	157.5
Labor			3,500	43.75
Overhead			4,500	56.25
Depreciation			2,000	25
TOTAL COST				283

REVENUE		KG	L\$	L\$/KG	US\$/KG	REVENUE L\$	REVENUE \$
Palm Nut	100%	4,500	220	0.05	0		
Shell	83%	3,735		1.00	0.01	3,735	47
Kernel	17%	765		3.50	0.04		
Oil		383		160.00	2.00	61,200	765
Cake		383		6.00	0.08	2,295	29
TOTAL REVENUE							840
NET PROFIT/DAY							558

In Liberia, the hybrid, high-yielding tenera oil palm is preferred by both large-scale plantation and smallholder oil palm producers. Smallholders also produce significant amounts of oil from the West African wild oil palm known as dura (“country palm”). It is estimated that among smallholders in Liberia, there are 60–80,000 ha of tenera in production and 20,000 ha of dura. Liberia’s civil strife interrupted oil palm plant breeding research and the tenera seedling production supply chain. Annual tenera seedling need for new smallholder plantings, as well as replacement of old trees, is estimated at 125–300,000. A major impediment to efficient nursery operations is lack of irrigation, but oil palm seedling production nevertheless represents a genuine business opportunity for smallholders in Liberia.⁴⁸

⁴⁸ Andrew Kovarik, Chief of Party, Winrock International, personal communication.

HONEY AND BEEKEEPING

World-wide production of honey is falling and there is a high demand for imported honey in the US and European Union. Before Liberia is ready for the export market, however, there is an opportunity to produce honey for the domestic market. This industry is well-suited to smallholders, because (1) little capital is required, thus offering a low barrier of entry, and (2) expensive, complicated technologies are not needed.

The EAT team observed a well-suited beehive design in the field called the Kenyan top bar. It can be produced for less than \$30, using local materials and labor. A local enterprise, Liberia Pure Honey, is experimenting with even more cost-effective hive designs utilizing bamboo and other readily available materials.

Bees forage in the natural forest, and a typical hive can produce 3 to 5 gallons of honey per year, selling for \$20/gal at the farm-gate. The largest beekeeper we discovered in Liberia, who is also a member of the Liberia Pure Honey network, has 300 hives and produced \$7,800 of honey in 2013.⁴⁹ On the retail side, we observed retail honey prices in the supermarkets and most Total *Bonjour* shops of around \$7 per 455g bottle. A honey enterprise budget based on 20 hives is presented below, in Table 5.

TABLE 5: HONEY PRODUCTION ENTERPRISE BUDGET, LIBERIA USD⁵⁰

HONEY PRODUCTION					
COST	QTY		YEAR 1	YEAR 2	YEAR 3
Capital Expenditure					
Bee Hives	20	set	600	0	0
Bee suit	2	set	4	0	4
Cutlass	2	pc	4	4	4
Harvest implements	1	set	20	0	0
Recurrent Expenditure					
Labor Maintenance	60	days	90	90	90
Labor Harvest	40	days	60	60	60
TOTAL COST			778	154	158
REVENUE					
Honey	40	gals	800	800	800
TOTAL REVENUE			800	800	800
PROFIT			22	646	642

⁴⁹Jenkins Zarweh, Liberia Pure Honey, Ganta, personal communication.

⁵⁰ Liberia Pure Honey.

POULTRY AND EGGS

Amazingly, most of the fresh eggs for sale in Liberia—in both urban and rural areas—are imported from India. In rural areas, eggs retail for around L\$15 (\$0.20) each. In the supermarkets, both locally produced (hard to find) and imports sell for around \$6.50 per 30 eggs.

Producing poultry for meat (broilers) on a commercial scale will be difficult in Liberia given the intense competition from low-cost producers around the world, especially Brazil. Feed quality is the main driver of broiler productivity, and feed cost is the main driver of profitability. At present, quality feed for chickens is difficult to come by and expensive, and for commercial poultry farms such as Obasanjo Farms in Grand Cape Mount County, all feed (corn and concentrate) is being imported.⁵¹

Egg production, on the other hand, appears to be a viable enterprise for smallholders if the following conditions are met:

- » Improved laying breeds are used and poultry husbandry is improved.
- » Bird health is improved to reduce mortality. Currently, 50% of all chickens die in Liberia each year due to the lack of a \$0.01/bird Newcastle vaccination.
- » Local, affordable feedstuffs are used to make a complete, quality feed.

BRAC (formerly Bangladesh Rural Advancement Committee) is implementing an interesting business model for commercial egg production among smallholders in Liberia. BRAC is constructing a chicken hatchery and breeding farm near Buchanan in Grand Bassa County. The complex will include a new feed mill. Another project aim is to train local entrepreneurs as community animal health workers and setting them up with small-scale input supply/vet med pharmacies. The health workers, a sort of vet tech, will provide vaccines and consulting on a fee-for-service basis.⁵²

Feed quality and cost remain significant hurdles to profitable layer/egg production in Liberia, even in the BRAC smallholder poultry model. It is not yet known how the feed issues can be addressed but at the same time, as livestock enterprises expand, the demand for feedstuffs will also expand—creating new opportunities for Liberian farmers.

⁵¹ Dr. Otufowora Ayodele, Obasanjo Farms Liberia, personal communication.

⁵² Abdul Hakin, Marketing Manager, BRAC-Liberia, personal communication.

PULSES AND PEANUTS

Lofa, Bong, and Nimba counties have traditionally been known as the breadbasket of Liberia. Many types of pulses (cowpeas, mung beans, black and red kidney beans, lima beans, pinto beans, chickpeas) and peanuts are produced there. Pulses and peanuts have untapped potential because they:

- » Are sold in every food market in Liberia.
- » Are relatively easy to grow with limited inputs because they are legumes and fix their own nitrogen.
- » Add valuable plant proteins to household diets.

Similar to vegetables in Liberia, during the dry season the majority of pulses and peanuts are imported from neighboring countries, especially Sierra Leone and Guinea.⁵³

The authors of this report believe that production of pulses and peanuts could be greatly increased in Liberia, contributing to the local food supply and substituting for imports. Additional analysis is needed on the subject to provide updated data on production costs, availability of seed and other inputs, post-harvest handling and storage, transportation costs, status of distribution networks, market prices over the marketing year, and the overall efficiency of the supply chain. However, there was evidence of strong demand based on (1) the presence of beans, cowpeas, lentil, and groundnuts in every market visited, and (2) anecdotal interviews with traders regarding pre-war production, mainly in Lofa, which is now idled—thereby opening the door to the current high level of imports.

⁵³ Interviews with Gobachop traders/retailers, Red Light market.

APPENDIX A: SEVEN RECOMMENDATIONS FOR FURTHER ANALYSIS

The market opportunities identified in this assessment are based on the best available information gathered in Liberia over a limited period of time. Broadly stated, the EAT team uncovered critical gaps in the types and breadth of data and analysis that are required to (a) identify opportunities in Liberia's farming and agribusiness sectors and (b) make sound investment decisions. These gaps have a chilling effect on investment.

Here are seven recommendations for further analysis, all aimed at closing the information gaps—and thereby encouraging, if not stimulating, investment:

- 1. Improve GOL data sources.** Prospective investors in value chain activities lack accurate and up-to-date market price, production cost, and trade volume statistics for many commodities, especially those most important to smallholder producers. This critical gap constrains sound decision-making, thus chilling investment or misguiding it, and in either way which has negative consequences for all stakeholders in Liberia's value chain—producers, input suppliers, traders, and consumers. A good first step toward alleviating this problem: identifying, investing in, and supporting the appropriate departments at the Ministry of Agriculture, LISGIS, and CARI.
- 2. Follow cross-border trade flows.** Many of the products discussed in this report cross regional borders. Anyone considering an investment, large or small, in Liberia's food and agriculture sector must be able to quantify and characterize these trade flows, and understand regional production competitiveness and markets.
- 3. Probe concessionaire-smallholder interactions.** Concessions and their related investments play a large role in Liberia's agribusiness sector; and in Liberia's tenuous land tenure system, which is actually a dysfunctional amalgam of co-existing traditional/tribal and westernized/formal legal systems. This set-up has important—and usually unfavorable—implications for smallholders, especially in relation to oil palm. Further study is needed of the interactions between concessions and smallholders in specific value chains.
- 4. Expand irrigation.** Irrigated agriculture is barely developed in Liberia. This is baffling, because the country has abundant water resources. Research and development of irrigation systems, especially at the smallholder level, are much needed across numerous value chains.
- 5. Beef up livestock.** The livestock sector in Liberia (meat, poultry, and eggs) is small, weak, and highly fragmented. Although the EAT team found evidence of limited investment in livestock production and processing, along with donor-funded activities, there is a need for in-depth analysis of the challenges facing this sector, including animal health and feeding—starting with feed production. An integral part of that analysis: how to use local feed ingredients, such as palm kernel cake, to foster a commercial feed industry.

6. Find low-hanging fruit. Liberia's climate, particularly its abundant rainfall, is perfect for producing countless fruits, but our assessment team found scant investment in, or even attention to, the sector. For example:

- » Demand for citrus is strong and offers good returns to smallholder growers, but citrus groves are badly overgrown, diseased, and require re-planting and rehabilitation.
- » The more marketable mango varieties are badly affected by anthracnose fungus disease in the lowlands, and have not been successfully grown to date in Liberia.
- » Bananas and plantains are grown in many household plots, but post-harvest losses are estimated at more than 50% and Liberia's notoriously poor transportation system results in high costs to deliver these fruits to urban markets.⁵⁴

7. Take the pulses. Lofa is often referred to as the breadbasket of Liberia. Time and again, the EAT team heard from traders and market sellers that the pulses (such as cowpeas, beans, chickpeas, and mung beans) and groundnuts now found in the markets used to come from Lofa, but are now imported. The ubiquitous presence of pulses and groundnuts in every market visited clearly reflects strong demand. This strong demand, combined with the fact that vast stretches of arable savannah land in Liberia lay idle, signal that this segment is ripe for investment—and certainly warrants additional analysis.

⁵⁴ David Parker, ACDI/VOCA, personal communication.

APPENDIX B: CONTACTS AND INTERVIEWS

LIBERIA MARKET ANALYSIS, JANUARY 2014

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APPENDIX D: CROP ENTERPRISE BUDGETS

PEPPERS – RAINY SEASON

ITEM	UNIT	COST/UNIT	LIB. DOLLAR	USD	NOTES
COST					
Land preparation	1 acre	\$100		\$100	Mechanical tillage
Seed	200 g		1,000	\$12.50	Local seed; plant 2'x2'
N-P-K	3 * 50-kg	5,500 LD	16,500	\$206.25	
Urea	1 * 50-kg	5,000 LD	5,000	\$62.50	
Furidan	5 * 1-kg	800 LD	4,000	\$50.00	Soil insecticide
Decis	1 * 1-L	\$25		\$25.00	Insecticide (deltamethrin)
Mancozeb	2 * 1-kg	\$20		\$20.00	Fungicide
Lambda Super	10 cans	375 LD	3,750	\$46.88	Insecticide (cyhalothrin)
Spayer	1	\$40		\$40.00	Back-pack
Transport	5,000 kg	25 LD/kg	125,000	\$1,562.50	Peppers to market
Labor	175	\$3/day		\$525.00	
SUB-TOTAL				\$2,650.63	
Interest	6 months	20%		\$530.13	
TOTAL				\$3,180.75	

REVENUE					
Fresh peppers	1 bag/500 plants	2,500 LD/bag	300,000	\$3,750.00	Harvest every 2 weeks for 3 months; 10,890
Losses	10%		30,000		Post-harvest loss
TOTAL			270,000	\$3,375.00	
NET				\$194.25	

Notes: Fx=80LD/\$1. Capital costs of land clearing, de-stumping and initial plowing not included.

LABOR BREAKDOWN	PERSON-DAYS
Nursery seeding	5
Seedbed preparation	20
Transplant seedlings	10
Weed (5x)	20
Spray fungicide (5x)	15
Spray insecticide (5x)	15
Harvest	90
TOTAL	175

PEPPERS – DRY SEASON (IRRIGATED)

ITEM	UNIT	COST/UNIT	LIB. DOLLAR	USD	NOTES
COST					
Land preparation	1 acre	\$100		\$100.00	Mechanical tillage
Seed	200 g		1,000	\$12.50	Local seed; plant 2'x2'
N-P-K	3 * 50-kg	5,500 LD	16,500	\$206.25	
Urea	1 * 50-kg	5,000 LD	5,000	\$62.50	
Furidan	5 * 1-kg	800 LD	4,000	\$50.00	Soil insecticide
Decis	1 * 1-L	\$25		\$25.00	Insecticide (deltamethrin)
Mancozeb	2 * 1-kg	\$20		\$20.00	Fungicide
Lambda Super	10 cans	375 LD	3,750	\$46.88	Insecticide (cyhalothrin)
Spayer	1	\$40		\$40.00	Back-pack
Irrigation op.				\$500.00	Gravity, drip
Transport	5,000 kg	25 LD/kg	125,000	\$1,562.50	Peppers to market
Labor	285	\$3/day		\$855.00	
SUB-TOTAL				\$3,480.63	
Interest	6 months	20%		\$696.13	
TOTAL				\$4,176.75	
REVENUE					
Fresh peppers	1 bag/500 plants	5,000 LD/bag	600,000	\$7,500.00	Harvest every 2 weeks for 3 months; 10,890
Losses	10%		60,000		Post-harvest loss
TOTAL			540,000	\$6,750.00	
NET				\$2,573.25	

Notes: Fx=8OLD/\$1. Capital costs of land clearing, de-stumping and initial plowing not included. Capital costs of irrigation system equipment and installation not included.

LABOR BREAKDOWN	PERSON-DAYS
Nursery seeding	5
Seedbed preparation	20
Install irrigation	20
Transplant seedlings	10
Weed (5x)	20
Spray fungicide (5x)	15
Spray insecticide (5x)	15
Irrigation	90
Harvest	90
TOTAL	285

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