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THE MARKET FOR MAIZE, RICE, SOY, AND WAREHOUSING IN NORTHERN GHANA



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THE MARKET FOR MAIZE, RICE, SOY, AND WAREHOUSING IN NORTHERN GHANA

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THE EAT PROJECT

The Enabling Agricultural Trade (EAT) project, funded by the United States Agency for International Development (USAID), supports the U.S. 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 pre-requisite to economic growth in the agricultural sector. EAT offers a suite of targeted and customizable analytical tools and implementation support to identify, diagnose, and reform agribusiness enabling environment (AgBEE) constraints that hinder start up and growth 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.

ACRONYMS

ABCs	Agribusiness Centers
AFD	Agence Francaise de Development (French Agency for Development)
AGRA	Alliance for a Green Revolution
BAT	British American Tobacco
DANIDA	Danish International Development Agency
E-ATP	Expanded Agribusiness and Trade Promotion Project (USAID)
EU	European Union
FAO	Food and Agriculture Organization (United Nations)
FAOSTAT	Food and Agriculture Organization (United Nations) Statistical Databases
FASCOM	Farmer Services Company
FBO	Fixed Base Operation
GFDC	Ghana Food Distribution Company
GMO	Genetically Modified Organism
GoG	Government of Ghana
MIDA	Malaysian Investment Development Authority
MoFA	Ministry of Food and Agriculture
NADMO	National Disaster Management Organisation
NAFCO	National Food Buffer Stock Company
NGO	Non-governmental Organization
PPP	Public Private Partnership
PPRSD	Plant Protection and Regulatory Services Directorate
RSSP	Rice Sector Support Project
SADA	Savannah Accelerated Development Authority
SRID	Statistical Research and Information Directorate
SSA	Sub-Saharan Africa
VAT	Value-Added Tax
WFP	World Food Programme (United Nations)

CONTENTS

EXECUTIVE SUMMARY	4
INTRODUCTION AND METHODOLOGY	5
KEY FINDINGS	5
MAIZE	7
Market Demand	7
Market Supply	10
Market Opportunities	15
RICE	16
Market Demand	16
Market Supply	19
Market Opportunities	23
SOY	27
Market Demand	27
Market Supply	31
Market Opportunities	34
WAREHOUSING	35
Current Context	36
Evaluating Potential Business Models	44
Mitigating Factors	
Conclusions	45
APPENDIX A: RECOMMENDATIONS FOR FURTHER ANALYSIS	46
APPENDIX B: CALCULATING SOY AND MAIZE EQUIVALENTS FROM POULTRY	47
APPENDIX C: SOY PRICE FORECASTS	48
APPENDIX D: MAIZE MONTHLY PRICE TRENDS 2002–2011	49
APPENDIX E: ESTIMATED COSTS OF PRODUCTION	50
BIBLIOGRAPHY	53

EXECUTIVE SUMMARY

Northern Ghana is relatively poor, isolated, dry, and politically unstable when compared to the rapidly developing and urbanizing south. However, in recent years the northern regions above the 8th parallel (the “SADA North”) have received much government and donor attention in the form of agricultural subsidies and social programs. This so-called Breadbasket Initiative aims to transform the north into a more stable and prosperous area, with a focus on smallholder production of staple grains and legumes, particularly maize, rice, and soybean. Much of this investment has paid off, with higher agricultural yields and greater market connectivity contributing positively to local economic development.

The Government of Ghana, its bilateral and multilateral donors, and commercial agricultural investors now have an opportunity to refine their goals and target future investments. The key to success will be a thorough, nuanced, and disaggregated assessment of market demand for Northern Ghana’s agricultural products, and a candid evaluation of its productive potential. This rapid study was conducted over several weeks of field interviews and site visits, and is based on the premise that acceptance of market realities will result in lower risk and greater returns for small and large agribusinesses.

Each commodity (maize, rice, and soy) market was assessed independently to evaluate current market demand; current supply (production, processing, and imports); likely future market demand; and potential supply to meet this shifting market. In addition, the study evaluated a number of proposed warehousing investments to determine which are likely to thrive.

The following market opportunities were determined to be viable and of interest to serious investors:

- Import substitution for 485,000 MT of non-aromatic, moderate- to low-quality rice over the short- to medium-term, approached in phases and targeting specific market segments;
- Import substitution for 35 to 63,000 MT of soybean equivalent in processed meal, with the potential to substitute an additional 80 to 90,000 MT contingent on growth in the domestic poultry broiler industry;
- Private outgrower schemes, particularly in maize, when designed to profit an investor through a combination of margins on inputs and commodities; and
- New construction or rehabilitation of bulk storage capacity in the form of throughput facilities near market hubs and increased storage at processing sites.

Riskier propositions include the following:

- Investment in Northern Ghanaian production of high-quality aromatic rice in an attempt to compete directly with 0 percent broken Thai jasmine rice imports;
- Widespread smallholder-based production of soy and maize utilizing high-quality (and high-cost) inputs to generate increased yields;
- Win-win farm service centers designed to profit an investor while providing an otherwise inaccessible service to rural producers; and
- Temporal speculation, particularly in maize.

Appendix A provides recommendations for future analysis beyond the EAT team’s observations and conclusions.

INTRODUCTION AND METHODOLOGY

As part of the U.S. government Feed the Future Initiative to strengthen food security in developing countries, United States Agency for International Development (USAID)/Ghana will support the Government of Ghana (GOG), other donors, and private investors to increase the competitiveness of rice, maize, and soy value chains in the north of the country. USAID conducted this study in order to gather more detailed and disaggregated information on potential markets for these commodities, particularly for smallholder production in the “SADA north” above the 8th parallel, in keeping with the government’s “breadbasket” strategy. Each commodity market was assessed independently to evaluate current market demand; current supply (production, processing, and imports); likely future market demand; and potential supply to meet this shifting market.

In addition, this study aimed to consolidate information about supply of and demand for storage and postharvest services in the northern part of Ghana. Numerous warehouse-based business models have been proposed and advocated, and USAID sought to project which models would be supported by market forces and which would be riskier investments.

The overall goal of this report is to “ground truth” hypothetical market opportunities that have been proposed, support the proposals with additional market data, refine them to target more specific opportunities, and reject them if they turn out not to be grounded in market realities. In order to hone in on the likely financial sustainability of models or opportunities, for the purposes of this analysis, only economic return on investment is considered. Certainly, the GOG and funding partners have myriad social, humanitarian, and development objectives in mind when designing strategies and programs for the agricultural sector. However, this report approaches the sector from the point of view of an investor or entrepreneur. In other words, this report isolates the factors of financial profitability or sustainability in order to support decision making.

The methodology for fieldwork was based on the Enabling Agricultural Trade (EAT) Project’s tested approach for conducting rapid, deep-dive, qualitative diagnostics. The EAT team relied predominantly on primary-source interviews with the private sector: input providers, producers, processors, investors, financial institutions, traders, importers, and retailers. This assessment also sought to aggregate and evaluate existing secondary-source analysis and commonly cited statistics such as average yields, prices, trade volumes, and other market data.

After completing a preliminary literature review, the multidisciplinary team conducted three weeks of fieldwork, again focusing on private sector interviews, in Greater Accra, Tamale, Kintampo, Techiman, Kumasi, Lambussie, Paga, Nkwanta North and South, and other key rural production areas in each of the regions included in the SADA North. Over 200 unstructured, in-depth, and off-the-record interviews were conducted.

KEY FINDINGS

Detailed findings are presented in separate sections on maize, rice, soy, and warehousing. Overall, the team identified a number of opportunities for which producers and markets in northern Ghana are well positioned. At the same time, some opportunities that have been proposed and considered by the government, donors, and investors were characterized by unacceptable risks or uncertain returns. It is this team’s opinion that such initiatives would not, in purely financial terms, offer sufficient return on investment.

KEY MARKET OPPORTUNITY

One of the most important opportunities identified as viable is **substitution for imported non-aromatic rice, approached in phases and targeting specific market segments**. The market for rice in Ghana, as in other countries, is highly segmented. The near-term opportunity for northern Ghana is to substitute for the modest amount of imported, non-aromatic, low-quality (high-percentage broken) rice. In the medium term, those same northern producers and processors may start to look at substitution for higher quality (lower-percentage broken) rice, which represents the lion’s share of the market.

**RISKIER INVESTMENT**

However, a riskier proposition would be to **steer northern Ghana's rice production toward high-quality jasmine**. The potential margins are very attractive, but northern Ghana is a long way from those yields, production and harvesting efficiencies, milling, and local marketing. Some domestic commercial production will successfully compete with these imports, but ventures already launched in the Southern Volta area are more likely to contend. Expected yields from these farms will satisfy this specific import substitution opportunity. As Ghanaian incomes rise and more consumers shift into this market segment, demand will grow, but production around urban centers in the south is likely to keep pace.

**KEY MARKET OPPORTUNITY**

The market indeed presents **an interesting but limited demand for soy**, with prospects for steady growth only if the poultry sector grows. In the near term, modest expansion of local production processed in existing facilities can substitute for the imported soybean meal demanded by the poultry industry, which is dominated by layers. The soybean oil produced as a result will substitute for crude soybean oil imported by the paint industry located in Accra. Over the longer term, the domestic soybean market will roughly double with the development of a strong, competitive broiler (poultry) industry, capturing the market currently met by imports of "ready to cook" chicken. The production opportunity can be met largely through a focus on yield gains and concentrated production zones to decrease the logistical costs of origination by the industry.

**RISKIER INVESTMENT**

However, **widespread smallholder production of soy and maize** would be a dangerous venture. Any maize and soy production support for smallholders without enforceable buyer contracts with a price floor would be irresponsible, and those types of contracts are hard to come by. When small, targeted support is merited, investors and donors must fully understand the incentives at play for the smallholder. Producers are inherently risk-averse and unlikely to produce more consistently if the market demonstrates uncertainty; investors should not underestimate the risk entailed with accepting expensive inputs on credit, when trends in the market for Ghanaian maize and soy have been intermittently volatile or flat. Export markets may indeed exist, but trade policy is uncertain and the linkages are not currently in place.

**KEY MARKET OPPORTUNITY**

Ghana has seen a few successful **private outgrower schemes, driven by profits from both margins on inputs and commodities**. This study found that outgrower models with a profit structure that favors the primary investor are sustainable and result in increased yields. Farmers benefit from these systems because they guarantee a market, and the most successful outgrowers provide a wide range of business and social services to their suppliers, understanding that it is good business to do so. The positive impact on smallholder participants is enhanced if marketing surplus to the investor is voluntary, and there are multiple private outgrower schemes operating in the same area, competing for producers.

**RISKIEST INVESTMENT**

However, **win-win farm service centers** are not a sustainable model in the context of northern Ghana. When the concept for an agribusiness center is designed to provide farmers with easier access to what they *need*, not necessarily what they will pay for, the model is not sustainable from a purely financial perspective. This is not to imply that such a center is not a valuable social service, but it will require continued donor or government support. Service providers instead must operate as profit-motivated rather than mission-driven businesses with responsive and tailored operations—something that will often but not always increase farmer access to the full spectrum of needed pre-production and postharvest services. The history of failure of such farm service models in northern Ghana underscores this conclusion, but this study found disincentives in the current market context as well.

**KEY MARKET OPPORTUNITY**

In terms of new warehouse construction or rehabilitation, there is evidence of market demand for **throughput centers near market centers**. While storage is sufficient in total capacity in the north, supply near market hubs is scarce and therefore rents are at a premium. Returns justify the investment for the construction of large, simple warehouses, whether they are built by a real estate investor and rented to medium-scale traders (in three-month leases) or built by traders themselves if their operations are large enough to justify year-round use. However, the business of being a landlord is quite different from that of grain trading, so care should be taken before credit is extended to traders frantic to own their own facilities. An effective business plan would quantify financial returns from improvements over

the status quo (e.g., reduced transport costs due to the strategic and centralized location, reduced losses from improper storage). In addition, **increased storage capacity at rice mills** for paddy is a necessary part of reaping returns on investments in the rice sector; but must come hand-in-hand with improvements in efficiency and infrastructure at the mill itself, and should not be considered as a separate investment.

**RISKIER
INVESTMENT**

However, warehouses designed for long-term storage are not necessary. For the past few years, in a trend that appears to be structural, Northern Ghana's producers and traders have not reaped profits from **temporal speculation, particularly in maize**. Unpredictable trade policy and "government intervention" (NAFCO—the National Food Buffer Stock Company—as well as other government procurement and sporadic market involvement) have made traders justifiably wary. Furthermore, the unique timing of northern and southern staggered harvests for maize means that when northern farmers harvest maize there is market pressure to send it south, and the staggered harvests mean relatively flat prices throughout the year. As transport links improve, this market dynamic will only be enhanced. If an investor must incur any opportunity or finance cost associated with tying up liquidity, there is very little margin for profit. Therefore, for smallholders in particular, storing grain to "play" the market is not advisable. Traders and analysts reported that "Northern Ghana's farmers don't want to store and play in this risky market; they want to feel confident about who will buy their grain." This producer preference is one of the reasons why some well-run, trader-driven outgrower models are gaining traction in the north.

MAIZE

MARKET DEMAND

The total quantity of maize marketed annually in Ghana is widely reported by maize market stakeholders to be about one million MT. A significant volume of Ghanaian-produced maize remains within producer households as a primary staple food (see Tables 1 and 2). Imports and exports are minimal and thought to have a net neutral effect on the market. Limited yellow maize is imported for the poultry feed industry and internal cross-border trade with the Sahel occurs, but has not been sufficiently studied and quantified.

TABLE 1: ESTIMATED GHANA MAIZE MARKET COMPOSITION¹

QUANTITY (MT)	% OF TOTAL CONSUMPTION	% OF MARKETED MAIZE	
1,785,000			Total Maize Consumption
801,000	45		Subsistence Consumption by Producer Households and Postharvest Loss (does not reach market) ²
410,000	23	42	Animal Feed Market (largely poultry)
328,000	18	33	Human Consumption (informally traded)
246,000	14	25	Formally Traded for Processing (industrial and processed foods)

¹ Updating a previously published market assessment, WABS Consulting, Maize Value Chain Study in Ghana (December 2008). This update should only be used to give a general view of market proportion between uses, as consensus within the market regarding actual volumes was not possible.

² Waste and postharvest loss was reported to be 15 to 33 percent. Nucleus producers and aggregators gave higher estimates, so it is assumed that part of the loss is attributed to on-farm consumption. The total maize market was verified to be about 1 million MT, and production estimated at 1.79 million MT, with an estimated waste loss of roughly 15 to 20 percent and on-farm consumption of about 25 percent. The previous study listed subsistence consumption at 57 percent, while interviews reported such consumption closer to 30 percent. This estimate indicates a combined postharvest loss and subsistence consumption as maize that does not reach the market.

Human Consumption

Maize, specifically white maize, is an important staple food in Ghana, particularly for the approximately 1 million households involved in primary production of maize. Many consumers though are showing an increased preference for rice over maize due to ease of rice preparation. This trend is more pronounced in urban areas, and is significantly less apparent in rural maize-producing areas. Considering that annual population growth has been between 2 percent and 3.5 percent since 1980,³ any decline in per-capita human consumption of maize due to changing consumer preferences is likely to have been offset by overall population growth. This results in essentially stagnant overall human consumption of maize.

Poultry Feed Market

Poultry consumes about 400,000 MT of maize annually (approximately 40 percent of the maize marketed).⁴ The volume of high-quality yellow maize going into commercial poultry feed is about 200,000 MT. Roughly 150,000 MT of this is produced in Ghana, primarily in the Northern Region. Imports represent the balance of about 50,000 MT. The remaining 175 to 200,000 MT of maize required for feed is locally produced white maize. White maize remains more widely produced and thus more available in the market, but the poultry industry prefers yellow maize. The poultry industry is dominated by layers, and yellow maize contributes to a more pronounced yolk color. Commercial poultry feed producers and large integrated poultry companies use an additive in feed produced with white maize to compensate for the yolk color impact. Small-scale poultry producers do not, and the eggs produced are significantly paler.

Maize accounts for about 60 percent of the average poultry feed ration. Commercial poultry production is struggling to compete with cheap broiler imports from Brazil,⁵ which is one explanation for why the industry is dominated by layers for table egg production. Most poultry operations mix their own feed, buying ration components from various sources. The white maize is mostly purchased from traders and in the local informal markets, while the yellow maize is more often purchased by the few large, formal final feed millers and the largest integrated poultry operations.

Industrial Maize Use

Industrial maize buyers estimate that processing and utilization of maize represents up to 20 to 25 percent of the total maize marketed. Breweries are a small but interesting player in the Ghana maize market. Sorghum is preferred to maize in brewing, but breweries will substitute maize if attainable at a competitive price. According to one key industry player, the general rule of thumb is that a maize grits price of US\$0.80/kg is the highest amount at which brewers consider substituting grits for sorghum. Breweries and beverage manufacturers have also done trials with corn syrup as a substitute for sugar and are eager about the possibilities for using corn syrup due to unique fermentation properties.

Some processors use maize for ready-made or processed traditional foods (such as banku), which meet with mixed consumer reviews. While some prefer the convenience of “quick prepare” products, many perceive these products as lower quality and are unwilling to pay a premium. These products largely target the small export market for Ghanaians living abroad whom show a higher rate of adoption and acceptance.

³ World Bank, World Development Indicators (July 28, 2011).

⁴ Appendix B presents maize and soy volumes currently used in the poultry feed industry, based on the reported number of commercial poultry produced.

⁵ One interviewee reported that Ghanaian broiler production is 50 percent more expensive than imported ready-to-cook chicken. The impact of feed cost on broiler competitiveness is discussed more in the soybean section below, but greater in-depth analysis is needed to understand the potential competitiveness of Ghanaian (and regional) broiler production.

TABLE 2: PRICE, TRENDS, AND DEMAND CHARACTERISTICS FOR MAIZE AND SOME MAIZE PRODUCTS, GHANA 2011

PRODUCT	WHO IS THE MARKET?	ILLUSTRATIVE PRICE IN THE MARKET (observed US\$/kg)	CONSUMPTION TRENDS	DEMAND CHARACTERISTICS
White Maize Grits	Breweries	Maximum \$0.80/kg (above which brewers will not substitute maize)	Considered an inferior raw material; brewers prefer sorghum or imported barley	Highly price elastic
Corn Syrup	Breweries and beverage producers		Beverage producers interested in sourcing corn syrup at a competitive price	Corn syrup must be competitive in price with local sugar
Cornflakes/ Breakfast Cereals	Supermarkets and local markets	\$15/kg—Kellogg's Corn Flakes	All imported in processed/packaged form	
Processed Foods	Supermarkets and local markets	\$2.75/kg –\$7/kg	Flour for convenient local meals, e.g., banku, but mainly for exports	Mostly export market with a small local demand
Yellow Maize Grain	Poultry feed industry	\$320/MT–\$480/MT	Preferred over white varieties for poultry	Easily substituted for by white varieties, especially during the lean seasons
White Maize Grain	Local markets (human consumption) and poultry feed	\$320/MT–\$480/MT	Decreasing per-capita consumption due to preference for rice	Inelastic in June, when substitutes are not available

Pricing

Wholesale maize prices were found to be in the range of US\$320 to \$480 per MT, depending on proximity to regional markets and time of year. Farmgate prices decrease as distance to major market locations and transport costs increase. The majority of maize in Ghana is grown in the Center, Transitional Zone, which has two harvest seasons.

Prices are highest in July, as major (rainy) season harvest gets underway in Central Ghana, including the SADA districts in Brong Ahafo, and Volta. Prices are lowest in January and February as the minor harvest in the Central and the only harvest in the North is completed and fully hits the market (see Figure 1).

The rest of the SADA region (Northern, Upper West, and Upper East regions) has one growing season, from May to October. Maize from these areas typically has lower moisture content at harvest and a higher price than major (rainy) season maize. Minor (dry) season maize has a lower moisture content at harvest. If the moisture content is less than 11 percent, it is often characterized as “old” maize. The term “old” is used because maize that has been in storage typically had been dried properly prior to storage and has lower moisture content upon marketing. It is preferred for poultry feed, has a higher milling rate, and receives up to a 40 percent price premium in the retail market. Major (rainy) season maize is not as clean at harvest and may have moisture content of more than 20 percent at harvest.⁶ If dried and stored properly, it may be considered part of the “old” maize market.

⁶ Information on price seasonality and moisture content collected from the maize trader's association in Techiman market.

FIGURE I: MAIZE SEASONS IN GHANA AND 2010 MONTHLY PRICES⁷

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Central Ghana (including only a few SADA districts)							Major Harvest				Minor Harvest	
Northern Ghana (including the rest of SADA)										Only Harvest		



Price per bag was often found to be an inaccurate measure throughout the marketing process, as bags tend to be larger at the farm gate (up to 135kg), with traders and middlemen taking commissions in grain rather than cash. Quality premiums are also normally applied in this manner; as high-quality maize may be bagged in 100kg bags, while lesser quality maize may be bagged up to 135kg. Though informal, this is a structured and accepted practice, and is not considered skimming by players in the marketing chain.

MARKET SUPPLY

Ghana’s production largely meets current domestic demand (see Appendix E). As noted in the previous section, limited yellow maize is imported for the poultry feed industry, roughly 50,000 MT. Traders do indicate some cross-border trade with the Sahel, particularly Burkina Faso, but it is a relatively small percentage of the market with no trader attempting to estimate actual volumes.

Production in the North

Current maize production in Ghana is estimated to be about 1.79 million MT, with about 438,000 MT, or 25 percent, produced in the SADA region, including the relevant districts of Brong Ahafo and Volta. If all districts of Brong Ahafo and Volta were included, this production number would double. These two regions represent more than half of total production in Ghana. Brong Ahafo and Volta are representative of the southern half of the country in that they have two growing seasons rather than one, as in most of the SADA region. Despite having only one growing season, the SADA region harvests after the rains have stopped, allowing the maize to dry in the field prior to harvest. Maize harvested in this manner is typically cleaner, contains lower moisture, and is of higher quality than maize grown in the center of Ghana, which harvests into a rainy period.

Table 3 presents a regional breakdown of hectares cultivated, observed yields, and estimated production for each region. Hectares were estimated by the Ministry of Food and Agriculture (MoFA). Average yield estimates and corresponding production figures are based on reported averages for the last three years, with consideration given for expected yield anomalies this year.

⁷ Prices are from the Esoko website (www.esoko.com) and represent an average of five maize markets across SADA. December 2010 is used to indicate typical price trends in order to show a complete year.

TABLE 3: ESTIMATED MAIZE PRODUCTION IN SADA REGION, 2010

PRODUCT	MOFA STATED AREA PLANTED (HA)	OBSERVED YIELDS PER HECTARE	TOTAL PRODUCTION (MT) EAT ESTIMATE
Brong Ahafo (select districts)	52,000	Up to 2.5 MT/ha reported in Kwame Danso. Other areas reported as low as 1.5 MT/ha. Average of 1.9 MT/ha	99,000
Northern	110,000	4.5 MT reported by some outgrower operations. Average of 2.1 MT/ha	230,000
Upper West	45,600	< 0.7 MT/ha reported in Jirapa. Average of 0.8 MT/ha	40,000
Upper East	38,000	Yields of 1.5 MT/ha reported and assumed average	57,000
Volta (Select districts)	10,000	Yield of 1.2 MT/ha reported and assumed average	12,000
TOTAL SADA	255,600	1.7 MT/ha	438,000
GHANA TOTAL	992,000⁸	1.8 MT/ha	1.79 million

Brong Ahafo (select districts): The SADA districts in the Brong Ahafo Region include Kintampo North, Kintampo South, Pru, Sene, and Tain. About 52,000 hectares of maize are cultivated in these districts. Yields as low as 1.5 MT/ha were reported around Techiman and Nkoranza. Reported and observed yields were higher in the eastern part of the region, with yields as high as 2.5 MT/ha in Kwame Danso. An average yield of 1.9 MT/ha was approximated, resulting in an estimated production of 99,000 MT for the selected districts.

Northern Region: The Northern Region has almost half of the cultivated hectares of maize for the SADA region at 110,000 hectares. Masara reported yields of 4.5 MT/ha of yellow maize, using Panar hybrid seeds, proper fertilizer mixes, and farming best practices. This yield is an anomaly, as less than 10 percent of producers in the Northern Region were reported to have access to improved seeds.⁹ Other producers around Tamale reported yields of 2 to 2.2 MT/ha, so an average yield of 2.1 MT/ha was used to estimate total production of 230,000 MT.

Upper West Region: Extreme drought plagued much of the Upper West Region in 2011, and fields were visibly distressed and burned from lack of rainfall. Producers around Jirapa reported yields of less than 0.7 MT/ha. An average yield of 0.8 MT/ha was used to estimate total production of 40,000 MT on 45,600 hectares.

Upper East Region: There were 38,000 hectares of maize cultivated in the Upper East Region in 2011. Yields of 1.5 MT/ha were reported and assumed to be average, for an estimated 57,000 MT produced in total.

Volta Region (select districts): The SADA districts in Volta Region include Krachi East, Krachi West, Nkwanta North, and Nkwanta South. These districts account for about 10,000 hectares of maize cultivation. Average yield was reported to be 1.2 MT/ha, for an estimated total production of 12,000 MT in the SADA districts of the Volta Region.

⁸ MoFA, Agriculture in Ghana: Facts and Figures, 2010 (2011).

⁹ Representatives from the Ghana Grains Council and ADVANCE both reported that less than 10 percent of farmers have access to proper inputs for maize production.

Production Costs

Production costs of \$338/ha for maize were quoted, assuming improved seeds and proper inputs. The ADVANCE study by Kwazdo (2010)¹⁰ shows costs to be higher for micro- and medium-scale producers, when fully accounting for family labor. The daily farm labor wage rate varied from approximately \$2.40 to \$6.00 depending on location, including food. Three evaluations of production costs were performed by the EAT team, and the average cost was about \$390/ha when fully accounting for food and family labor.

Kwazdo also showed optimal labor efficiency and lower production costs on farms of about 2 hectares than on larger operations. This, in addition to high marketing costs, may be the reason that many producers are reluctant to expand their operations. Food security concerns, however, necessitate some maize production, regardless of (negative) profitability in the market.

Current Efforts to Increase Production and Quality

Yield and production increases are necessary to attract investment by commercial maize buyers. Use of improved hybrid seeds, proper fertilizer application, use of best practices in production, and production promotion all contribute to yield increases in different ways, depending on growing conditions and how new technologies are combined. The following combines field observations with international and Africa-specific case studies to estimate the impacts of improved technology utilization.

Proactive adoption of these technologies is slow in the north. There are a variety of complex explanations for this, but a large concern for many producers is a reluctance to assume the increased debt associated with high-cost input packages, which is seen as high risk with uncertain returns. More investigation of the socioeconomic factors influencing adoption and the yield impacts of technology adoption combinations in Ghana is needed in order to define and target interventions for optimizing yield and production costs. This further measurement and analysis can also be crafted into effective messaging to farmers to improve their understanding of and confidence in the likely returns to investment.

Hybrid Seed Use: Key stakeholders reported that less than 10 percent of producers have access to improved hybrid maize seeds, and currently use local open pollinated varieties, generally obaatampa. Assuming the international rule of thumb for maize yield increases achieved through hybrid seeds is 15 percent,¹¹ adoption of hybrid seed technology by the remaining 90 percent of farmers would increase maize production in the SADA region by 60,000 MT, or 13.6 percent. It would increase maize production in Ghana by about the same rate, or more than 221,000 MT.

The Ghana Grains Council reported that MoFA requires five years of trials for the introduction of new seeds to the market. Pannar hybrid seeds have been in the testing phase for two years, and will be the next new seed introduced to the Ghana market in 2014. They have been in use by Masara farmers during this period, as a part of the field trials.

Fertilizer Use and Best Practices in Production: It was observed in the field that most producers, smallholders included, use some type of fertilizer each year. This may be due to the recent public sector fertilizer subsidy programs. A representative from Yara quoted instances of 100 percent increases in yield as a result of appropriate fertilizer mixes and application, but was unable to provide local average yield increases due to the high variability of growing conditions, socioeconomic factors, and technology mixes.

Farmers of all sizes also consistently reported planting in rows, with spacing of about 15 cm between plants. The level of understanding of production best practices by smallholder producers appears to be strong relative to producers in other countries in sub-Saharan Africa, but more investigation is required to optimize technology packages under diverse conditions and to better understand the local yield impacts.

Production Promotion: Several models are in place to support smallholder maize production with inputs and input finance, extension, mechanization services, and marketing. These are discussed in more detail in the warehouse analysis, starting on page 35. One such model was initiated by Wienco, an input company. The following box provides more details on this experience:

¹⁰ George Kwazdo, Crop Budget Analysis for Rice, Maize and Soy Beans in Ghana (ACDI/VOCA ADVANCE, July 1010).

¹¹ Donald N. Duvic, Heterosis: Feeding People and Protecting Natural Resources (2000).

CASE STUDY: THE MASARA N'ARZIKI FARMERS ASSOCIATION

Scope

Masara operates in the Northern, Upper West, and the Brong Ahafo regions of Ghana. The bulk of its operations (volumes, hectares under cultivation, and number of farmers) is concentrated mainly in the Upper West region, especially Tumu and Wa. The Tumu area alone accounts for over 62 percent of the hectares under cultivation and about 52 percent of the farmers.

Operations

Masara N'Arziki has its headquarters in Tamale and is incorporated as a company limited by guarantee, as a subsidiary of Weinco, Inc. Conditions for being registered and participating as a producer include: a willingness to belong a group of between five and 12 members; signing up to two contractual forms: the Group Resolution and a legally enforceable Masara Contract; agreeing to co-guarantee for peers in the group; and a willingness to cultivate a minimum of two hectares en bloc. [En bloc refers to 10 to 15 hectares of production collocated in one block with each producer cultivating at least two hectares of the combined area.] Farmers enter into a contract to sell all production to Masara.

Under the program, farmers receive agronomic training, inputs, extension, and business development services. Inputs received include seeds, herbicides, fertilizers, insecticides, and optional use of a planting dibbler and sprayer. Masara facilitates the harvest and credit recovery by providing maize sheller services, which the farmers pay with one-tenth of the maize (1 bag for every 10 shelled). Farmers, however, can also utilize other shellers or hand shell.

Advantages of the Model

- The input credit is used to facilitate the utilization of new and improved technologies for maize production. The package introduces higher-yielding varieties of maize and provides training on maize agronomy to boost productivity.
- Farmers receive timely quality inputs. Since both Yara and Wienco are the sole agents of the agro-input brands used and the sole suppliers for Masara, they are able to ensure that the inputs are delivered on time.

Disadvantages of and Challenges with the Model

- The inability to accurately assess farm sizes results in farmers either receiving more inputs than they actually need or less than they require. Where the farmer receives more than they require, they may side sell to finance other farm operations and/or apply them on non-Masara farms. Consequently, yield estimates based on input provision are over- or understated. Farmers who receive more than they require have difficulties repaying credit.
- Participating maize farmers are guaranteed a market as all production is contracted to Masara. This eliminates the uncertainty of marketing at harvest into the open market, relying on traders that come to the farmgate.
- Farmers report that they do not have a voice. Although the Masara program is promoted as farmer-owned, the package is non-negotiable; the prices of inputs and production purchase, even the date to begin harvesting, are set by Masara. There are instances of pre-harvest losses because the farmer must wait to begin harvest until Masara permits
- The program may indirectly contribute to a reduction in food security for participating households. The legally enforceable contract binds the farmer into contract farming for which he is to sell all the production to Masara. Thus, even after paying for the credit received, the farmer is obliged to sell any additional maize to Masara. The farmer is only able to reserve some maize to feed his family without the explicit consent of Masara. This risk is, of course, greatest for those farmers whose only farm is the Masara farm. Farmers must therefore proactively source other inputs to produce a separate plot for household consumption.

- Delays in paying the farmers for the maize produced and the lack of aggregation centers leave farmers without immediate cash at harvest and retaining responsibility for the product until it is hauled to the Masara warehouse.
- The program struggles for accurate data on yields and is unable to provide in-depth analysis on its operations, which may have implications for long-term sustainability.

Viability, Replicability, and Profitability of Masara

- With increasing input credit recovery rates (82 percent at the 2010 season and still counting), the Masara model of input delivery and extension is viable. The target for 2011 is 95 percent, and may be achieved thanks to adjustments to the model and improvements in efficiency. The key drivers of the program's profitability are the margins on the inputs and the quantity of extra maize the farmer sells to Masara that is then sold for a brokerage fee to a commercial trader.

Wienco Ghana and Yara Ghana have sole distribution licenses of nearly all the inputs supplied (Pannar seeds, Syngenta herbicides, etc.). This exclusivity plays in Masara's favor when it comes to attracting program participants. The margin on inputs represents the primary business for Wienco, with the difference between the buying and selling price of the maize representing a secondary but important profit element. Therefore, in a model such as this one, profitability is contingent on the following factors: consistently low farmer default rates; exclusive, negotiated input prices; and contracts that include a pre-negotiated commodity purchase price.

The soybean processing industry presents opportunities to secure buyer contracts and set purchase prices pre-production (the final factor). However, profit margins from input sales in soy may not be as profitable as they are in maize, since quantity and value of inputs are lower. Rice production may be more interesting to consider for replication of the model, and it appears that Wienco is already undertaking feasibility studies for rice. Further analysis should be done on a case-by-case basis to determine which factors of sustainability are in place.

The integrated input delivery, extension, and marketing model can be replicated with other crops. The model will be attractive to an agro-input dealer for other crops that respond to the use of high margin or significant volumes of inputs, e.g., rice. Processors could adapt the model to secure commodity supply, but this takes them further from their core business. Farmers will prefer some flexibility in marketing production—either to reserve some for household consumption or to sell to alternative markets after meeting their credit obligations (which makes the overall model less attractive to processors). Farmer location would need to be concentrated to increase production density and reduce operational expenses. The production promoted within the model should be sufficiently large to achieve economies of scale. Payment terms should be negotiated to prioritize farmer loyalty.

MARKET OPPORTUNITIES

Short-Term Opportunities

There is an immediate but limited short-term opportunity for import substitution of yellow maize for commercial poultry feed. Imports represent about 25 percent of the total market for yellow maize, or about 50,000 MT. This is on the high side of officially reported import figures, but a USAID E-ATP value chain analysis of Ghana's poultry industry also estimated maize imports of 42,000 MT in 2008.¹² Anecdotal evidence suggests that imports may be even greater, presenting a larger opportunity for import substitution in the short run. In addition, as long as yellow maize is cost-competitive with white maize, as supply becomes available it is likely that more poultry farmers, small and large, will be interested in substituting yellow for white for feed to layers. This would raise the ceiling on the total short-term yellow maize market opportunity to roughly 200,000 MT, considering the total current size of the layer industry (150,000 MT would be a shift from white maize to yellow maize production, and not an expansion of the overall maize market).

Achieving this import substitution opportunity requires improved linkages between feed mills and production areas, with increased yellow maize volumes accomplished through increased yields and/or increased production area. The Masara outgrower model has been effective in making improved technology available to producers, as well as targeting producers who are willing to adopt new technologies.¹³ As a result, Masara outgrower average yields are about 4.5 MT/ha, compared to a national average of 1.8 MT/ha.

However, there is a notable risk to increasing smallholder yellow maize production. Since yellow maize is less preferable for human consumption, smallholders are more reluctant to invest in increased production if they are unsure of where the surplus will go, i.e., if not to feed the family or be sold in local markets as white maize would be.

Medium-Term Opportunities

The poultry sector in Ghana could compete with the over 100,000 MT of imported, ready-to-cook chicken.¹⁴ If local broiler production were substituted for these imports, an additional 175,000 MT of yellow maize for poultry feed would be required, presenting a greater opportunity for increasing the maize market in Ghana. A study of potential agricultural investment projects in Ghana, undertaken by AgDevCo, also found that substituting for broiler imports could present an additional 175 to 225,000 MT of yellow maize.¹⁵

Consumption of animal protein in the form of chicken and fish will drive the medium-term demand for both maize and soy for animal feed. Competitively priced feed is needed in order to make a competitive local poultry industry feasible. To take advantage of this opportunity, a number of parallel investments would be required to strengthen the market for locally produced poultry and ensure adequate maize supply at a competitive price as a primary input for poultry production.

An in-depth strategy to improve Ghana's broiler competitiveness is necessary, but would most likely include advocacy with the public sector and coordination with importers, lower-cost grain for feed production, and "buy local" campaigns to promote consumer preferences for locally produced chicken. The supply of maize would need to be increased via yield and margin improvements such that smallholder producers become more cost competitive with imported yellow maize. Risk management for producers would also be a critical component to encourage adoption of higher-cost input packages and the production of yellow maize, which is not a food security crop. Animal protein production represents a significant value-addition opportunity for Ghana's maize and grain sector.

¹² USAID E-ATP, An Initial Overview of the Poultry Value Chain in Selected West African Countries (2010).

¹³ Adoption of technology implies that the producers not only accept the inputs but also adopt production best practices learned through training and extension programs.

¹⁴ Appendix B provides background on the volume of imported ready-to-cook chicken and maize and soy equivalents.

¹⁵ AgDevCo, Pre-Feasibility Studies of Agricultural Investment Projects in Ghana (2011).

Long-Term Opportunities

Long-term opportunities in maize markets may exist in the industrial maize sector. Corn syrup for beverages, malted corn for brewing, and prepared foods containing maize all offer opportunities that require a significant increase in quality maize availability, investment infrastructure for expanding the production of these products, and a shift in consumer preference toward these products.

Sustained increased quality maize production is the common thread for short-, medium-, and long-term opportunities. Only by increasing the production and supply of maize, and thus driving down local prices, will industry investors be tempted to invest in expanded industrial use of maize and production of industrial maize products. This point was emphasized by every commercial buyer of maize contacted by the EAT team. Other market factors, such as the price of sugar or malted barley or trends in consumer preferences, also impact the competitiveness of maize as an industrial substitute.

Mitigating Factors

Traders are extremely concerned about the possibility of government interventions, and consistently expressed an unwillingness to hold maize beyond harvest as a result. To date, institutional procurement and distribution of maize by players like NAFCO or the World Food Programme (WFP) have been in relatively insignificant volumes and thus have not had a major impact on the maize markets. Large transactions are on the order of 5,000 MT, or about 0.4 percent of the total maize market. While these shocks are significant enough to have small, temporary impacts on localized markets, they have been insufficient to meaningfully affect the investment climate for maize producers or commercial users of maize. Given the relatively recent experience with NAFCO (it was only formed in 2009), it is not specifically named by the trade as indicative of distorting government interventions.

The main concern of speculators and traders is the existing export licensing system, which is set up to allow for trade policy changes without warning in response to political or food security pressures. Traders are apprehensive, as they have been burned by sudden changes in trade policies in the past. In 2008, speculators were holding stocks in anticipation of the expected seasonal price increase, when a ban on imports was suddenly lifted, imports flooded the market, and prices plummeted.

Further analysis of the transport share of maize marketing costs warrants further analysis. A study of maize marketing costs in East Africa found that on average 78 percent of marketing costs (all costs after the farmgate) were transport related.¹⁶ Such a detailed assessment was not possible within this study. While improving the efficiency of the transport component of grain marketing may not result in a large increase in farmgate prices from a percentage perspective, it can greatly increase the competitiveness of locally produced maize for large domestic consumers and for regional consumption.

RICE

MARKET DEMAND

Estimates of imports and domestic production, and therefore domestic consumption, vary widely. This is discussed in further detail in the section below on market supply, and an in-depth market analysis is warranted to understand fully these figures. However, precise quantities aside, it can be definitively stated that Ghana imports the majority of the rice consumed each year, and total consumption is on the rise. In order to understand this market, and therefore the import substitution opportunities, it is essential to disaggregate demand by variety and quality. Consumers buy aromatic and indica rice at a wide range of price points and across a broad spectrum of qualities.

The rice market in Ghana, as in all countries, is highly segmented by variety, degree of processing, grain quality, and sources. There is very little substitution by consumers, though some preferences are price sensitive. Preferences and trade-offs are quite structured and predictable. In addition to rice that is free from debris and stones, Ghanaian consumers prioritize the following characteristics:

¹⁶ World Bank, East Africa: A Study of the Regional Maize Market and Marketing Costs (December 2009).

1. straight mill before parboil;
2. import before local; and
3. aromatic before non-aromatic.

Market trends show that the order of these preferences is quite predictable. In other words, given the same price point, the preference for imported rice means that the vast majority of Ghanaian consumers would purchase imported non-aromatic rice over local aromatic. However, a more important preference is for straight-milled rice, so most consumers would select straight-milled local rice over imported parboiled rice, again given the same price point. The actual price sensitivity threshold for these preferences is unknown, but would be an important point for further analysis.

Only a small segment of the market can afford all three: straight-milled, imported, aromatic rice. This upper end of the market is the least price sensitive, and is willing to pay a significant premium for all three of these quality, source, and variety preferences. This premium is generally a 20 percent higher retail price for imported rice over local rice.¹⁷ In effect, there is an inelastic demand for high-quality Thai jasmine rice, though the size of this market is limited since prices are far beyond the reach of most Ghanaians.

When origin is indicated on the packaging, imported rice commands a slight premium relative to local rice even for similar quality and variety, in the same location, at the same time. This is due to a perception that imports are higher quality. Market and industry experts, including importers and distributors, do not believe that this bias is justified, and that in certain market segments (particularly low quality, high-percentage broken non-aromatics), consumers cannot tell the difference between local production and imports if origin is not indicated on packaging.

Marketing and Distribution Networks

Locally produced rice and imported rice are distributed throughout the country via completely independent marketing and distribution networks.

Local rice is sold on the domestic market, with only occasional informal exports in small quantities. Some straight-milled local rice is gaining ground within limited segments of the urban and rural markets, especially the aromatic varieties. Itinerant traders who usually handle less than 5 MT milled rice per month supply such markets. They buy from wholesalers across the South and Volta regions, who buy paddy from farmers and mill at local rice mills. Most of this local rice falls in the range of 10 to 25 percent broken, but grading in local markets is poor and therefore consumers and vendors do not attach a premium to the percentage broken.

Parboiled rice represents about 20 percent of total Ghanaian rice consumption. It is mainly produced in the three northern regions (Northern, Upper East, and Upper West regions) and sold in local markets and large towns in Northern Ghana. Itinerant traders aggregate parboiled rice, predominantly at the Tamale market, and there are traders who buy the rice from other rural and urban markets and send them to Tamale. Parboiled rice is then distributed to Kintampo, Atebubu, Ejura, and Techiman markets. Ghana's annual parboiled rice consumption is estimated as 175,000 MT with nearly 20 percent of that as aromatic and the rest as non-aromatic rice. It is estimated that less than 5 percent of parboiled rice is traded outside Northern Ghana.

There are about six major rice importers who have maintained robust distribution networks throughout the country, especially in the major cities. They have key distributors strategically and predominantly located in Accra, Kumasi, and Takoradi, who also have wholesalers in some of the major urban centers in the respective regions. There is increased interest by distributors in opening locations in Tamale, as this northern hub grows and takes on more urban consumption patterns. Distributors did not view local production as competition but rather as an opportunity requiring reliable and consistent volumes along with strong, loyal market relationships on the part of local producers and traders.

Table 4 shows the average prices, as of the second week in October 2011, in the Tamale and Kumasi markets.

¹⁷ A French Agency for Development (AFD) report found that, due to consumer preferences for rice quality and other key criteria, local and imported rice are different products that reach different market targets. MoFA/AFD, Study and training on the Ghanaian rice commodity chain (2008).

TABLE 4: CURRENT MARKET FOR RICE IN GHANA (Extrapolated From Official Statistics And Interviews)

	TOTAL MARKET (MT)	% OF MARKET CONSUMP.	EST. IMPORT MARKET SHARE (%)	% OF TOTAL IMPORTS ¹⁸	TOTAL IMPORT VOLUME (MT)	TOTAL DOMESTIC PROD. (MT)	MARKET PRICE (cedi/bag) ¹⁹	WHOLE-SALE PRICE (\$/MT)
Aromatic (e.g., jasmine) Straight-milled, Low % broken (<5%)	94,500	11	100	15	94,500	0	67	\$1,786.67
Aromatic (e.g., jasmine) Straight-milled, Medium % broken (5–15%)	35,000	4	0	N/A	0	35,000	46	\$1,226.67
Aromatic (e.g., jasmine) Straight-milled, High % broken (75–100%)	51,400	6	98	8	50,500	900	78	\$1,040.00
Indica (non-perfumed) Straight-milled, moderate quality (5% broken)	454,000	53	100	72	454,000	0	73	\$ 973.33
Indica (non-perfumed) Straight-milled, lower quality (25% broken)	52,000	6	60	5	31,500	20,500	63	\$ 840.00
Aromatic (e.g., jasmine), Parboiled	30,000	3	0	N/A	0	30,000	40	\$ 533.33
Parboiled local rice	100,000	12	0	N/A	0	100,000	40	\$ 533.33
Home consumption (not marketed)	45,000	5	0	N/A	0	45,000	N/A	N/A
TOTAL CONSUMPTION	861,875	<p>Quantitative data about the Ghanaian rice sector—average yields, production, import volumes, and market disaggregation—are extremely unreliable, as figures cited by official and unofficial sources and vary widely. Points of particular contention include:</p> <ul style="list-style-type: none"> • Total import market share (estimates range from 60 to 95 percent) • The total size of the high quality aromatic rice market (estimates range from 10 to 40 percent, and may be distorted by the prestige associated with trading and consuming unbroken jasmine rice). • Volumes of parboiled rice marketed informally, and/or consumed by producer households. <p>The numbers presented in this chart are therefore considered, yet still subjective, judgments based on conflicting sources of input. A proper market analysis aimed at clearly sizing and segmenting the rice market is warranted.</p>						
TOTAL MARKETED	816,875							
TOTAL IMPORTS	630,557²⁰							
TOTAL DOMESTIC PRODUCTION	231,318							
IMPORTS AS % OF RICE CONSUMED	73%							
IMPORTS AS % OF RICE MARKETED	77%							

¹⁸ EAT estimate based on interviews.¹⁹ Observed.²⁰ Based on EAT interviews, the five top importers alone expect to log a total estimated import volume of 488,804 MT in 2011. General consensus among interviewees, supported by recent analysis in a 2009 Global Food Security Response: Ghana Rice Study, suggests that the top five importers account for 77 percent of total rice imports. The EAT estimate of the total import volume was calculated by multiplying 1.29 to the total imports by the five largest importers.

MARKET SUPPLY

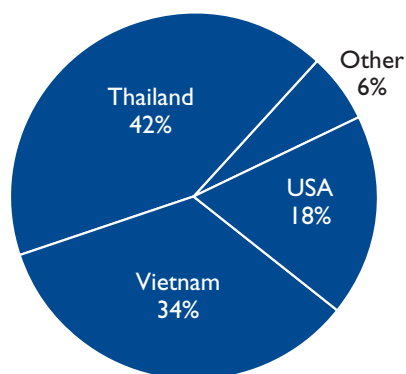
Imports

The vast majority of rice consumed in Ghana is imported, and most of these imports originate in Southeast Asia (see Figure 2). As mentioned in the section above on market demand, the ratio of imported to domestic rice is extremely difficult to confirm. Official statistics state that imports account for 70 percent of all rice consumed in Ghana, and the donor and NGO community concurs.²¹ However, in interviews, multiple industry players put this number at 95 percent or even higher. This is due to a perfect storm of discrepancies. First, there are major disagreements about the total volume of rice imports. Official MoFA statistics cite rice imports of 320,000 MT in 2010, but there is substantial evidence that actual imports were much higher. For instance, the United Nations' Food and Agriculture Organization (FAO) statistical database lists rice imports of 442,000 MT in 2009. A 2010 report jointly produced by MoFA and the Alliance for a Green Revolution in Africa similarly found that rice imports exceeded 500,000 MT in 2008.²² Aside from official claims, there is no reason to assume that rice imports have declined over the past three years, and no importers admit to reduced volumes. Based on EAT interviews, the five top importers alone expect to log a total estimated import volume of 488,804 MT in 2011. Recent analysis²³ suggests that the top five rice Ghanaian rice importers tend to account for 77 percent of total rice imports. Applying this multiplier to the figures cited in in-person interviews, the EAT assessment team estimates that total imports could reasonably be as high as 630,000 MT in 2011.

Informal trade could account for some of the difference in imports cited by official and industry sources. This assessment team was told that shipments arriving in Ghana's major ports are not always tracked, with larger importers successfully avoiding duties and value-added taxes (VAT) on some shipments despite using formal routes. Informal cross-border trade with Cote d'Ivoire easily brings product from the port of Abidjan into Ghana. Several sources stated that in their own business strategies they consistently add 25 to 30 percent to official import figures for rice. Finally, because imported rice is marketed through separate distribution channels, importers are not as familiar with the size of the locally produced parboiled rice market.

In addition to tracking imports, calculating total consumption is a challenge, since both the marketing and household consumption of local rice are estimated per capita without any real baseline. Estimates of domestic production are not precise, because land is not properly surveyed, reported yields are unconfirmed, and total cultivated area fluctuates.

FIGURE 2: ORIGIN OF RICE IMPORTS, BASED ON EAT INTERVIEWS



However, more important than estimating import market share for rice in general is the difficulty in breaking down market segmentation, a critical factor in understanding opportunities and targeting investments. Reported volumes of aromatic and non-aromatic rice imports do not match firsthand estimations of what percentage of imports each quality/variety represents. For instance, total volumes of imported high-quality aromatic rice are often said to be as high as 150,000 MT. Using this range, if total imports are indeed around 600,000 MT, high-quality aromatic rice represents about 25 percent of imports. In comparison, the Millennium Development Authority found that aromatic long-grain, white rice comprised 20 percent of the import market, and this team was frequently told that this type of rice represents as little as 10 to 12 percent of imports.²⁴

²¹ According to the Global Food Security Response: Ghana Rice Study (ACDI/VOCA, 2009), "It is generally agreed that current domestic production accounts for between 30 to 40 percent of domestic consumption (approximately 600,000 MT of milled rice)."

²² MoFA/AGRA, Breadbasket transformation of Ghana Northern Region (2010).

²³ ACDI/VOCA, Global Food Security Response: Ghana Rice Study (2009).

²⁴ MIDA, Investment Opportunity in Ghana: Maize, Soya and Rice Production and Processing (2010).

Domestic Production

MoFA reports that, given little changes in productivity in recent years, domestic production depends on the total area cultivated (see Table 5 and Appendix E). Official estimates have increased from 118,000 to 181,000 hectares cultivated between 2007 and 2010.²⁵ Of this total, 16 percent is irrigated production, 78 percent lowland, and 6 percent upland.²⁶ This field assessment team heard reports of average yields for last season of two to three MT/ha for irrigated/lowland and one to two MT/ha for upland production (see Table 6). Therefore, combining these two statistics it is possible to gain a rough estimate of 2010 domestic production at 385,500 MT paddy (or 231,000 MT of milled rice). In contrast, MoFA estimated 2010 domestic production of 492,000 MT paddy (or 380,000 MT of milled rice). The team did not gain any firsthand evidence of differences in average yields between Northern Ghana and other parts of the country, but this would be an interesting area for further study.

Northern Ghana has 67 percent of the total area planted, including 3,321 hectares irrigated area at 19 sites, and 9000 hectares of lowland rice fields. If average yields are indeed similar throughout the country (disaggregating for lowland/irrigated and upland), then it could be concluded that the north produces about two-thirds of all rice in Ghana.

TABLE 5: AREA UNDER RICE CULTIVATION

REGION	MOFA-REPORTED AREA PLANTED 2010 (HA)
Brong Ahafo (select districts)	2,040
Northern	62,930
Upper West	4,570
Upper East	47,361
Volta (select districts)	4,650
TOTAL SADA	121,551
GHANA TOTAL/Average NATIONALLY	181,228

Source: SRID/MoFA (2011)

TABLE 6: ESTIMATED RICE PRODUCTION, 2010

	AREA PLANTED (HA)	EAT STUDY OBSERVATIONS OF YIELDS PER HECTARE (paddy)*	TOTAL PADDY YIELD (MT)	TOTAL PRODUCTION (MT) MILLED RICE (assumes 60% yield from paddy)
Irrigated (16%)	28,960	3 MT/ha	86,880	52,128
Lowlands (78%)	141,180	2 MT/ha	282,360	169,416
Upland (6%)	10,860	1.5 MT/ha	16,290	9,774

* Note that estimates and observations varied widely.

²⁵ MoFA, Agriculture in Ghana: Facts and Figures, 2010 (2011).

²⁶ ACIDI/VOCA, Global Food Security Response: Ghana Rice Study (2009).

Yields in Ghana are low, and estimates range from 1 to 1.5 MT/ha for rain-fed upland systems, 2 to 2.5 MT/ha for lowland, and 3 to 4 MT/ha for irrigated systems.²⁷This is largely attributable to inadequate water control measures and non-intensive cropping practices as well as the fact that rice production is dominated by smallholder farmers. There is a wide spectrum of rice varieties grown in Northern Ghana, such as Tox 3107, Tox 3108, Digang, and Nericas, as well as two aromatic varieties, Jasmine 85, Togo marshall. The aromatic rice varieties, which are estimated to account for 20 percent of all rice produced in the area, are being strongly promoted by GoG and other projects, especially in the lowlands and irrigated areas where these varieties have done well in trials.

Cost of production analysis indicates a farmer nets US\$583 after investing US\$750 in producing rice on a hectare of irrigated/lowland rice field. Similarly, a farmer would net US\$240 on an investment of US\$400 in cultivating rice on a hectare of upland rice field. Major cost elements in rice production include agrochemicals (fertilizers, pre- and post-emergent herbicides) (28 percent), land preparation (17 percent), and seed (11 percent).

Arguably the most important contributor to reduced losses and therefore increased yields is proper, timely harvesting. There is a limited window of opportunity to harvest rice (four weeks, from late November to Christmas), when the grain is mature and dry, but not too dry. Depending on the size of a plot and access to affordable labor, it is difficult to achieve timely manual harvesting. Late harvesting results in excessively dry grains that are cracked and brittle and are more prone to breakage during milling. Northern Ghana's rice producers therefore resort to parboiling, which repairs the cracks in the grain and reduces the percentage broken during the milling process. About 95 percent of rice produced in Northern Ghana is parboiled (130,000 MT milled rice). The parboiling process also increases the nutritional content of the grain, as more fiber from the bran is absorbed. Thousands of women in Northern Ghana participate in the paddy parboiling process as an important income source. Despite these benefits, parboiling does alter the taste, and most Ghanaian consumers prefer rice that has not been parboiled. Even though the parboiling process is an additional cost to processors, it does not add marketed value, since it does not earn a premium vis-à-vis straight-milled rice. Therefore, in the context of the Ghanaian market for rice, late harvesting and parboiling are inefficiencies that could be reduced. By some accounts, and confirmed through EAT analysis, the cost of this inefficiency is estimated to be over US\$20 million, a cost that is avoidable through improved harvesting.

Augur-worm engelberg rice mills are very prevalent in Northern Ghana. They are owned by individuals and located within rice-growing communities to offer toll-processing services to other rice processors as well as itinerant traders who buy paddy from farmers for local and urban markets in Northern Ghana. There are also rubber-roll single-pass rice mills in some of the communities. These mills have better output in terms of percentage broken than the former type of rice mills. Yield from paddy to milled rice is approximately 55 percent with the augur-worm engelberg mill and 65 percent with the rubber-roll mill.²⁸

²⁷ Ranges based on a variety of primary and secondary sources, but MoFA/AFD, Study and training on the Ghanaian rice commodity chain is a good source at the middle of this range (2008).

²⁸ MoFA/AFD, Study and training on the Ghanaian rice commodity chain (2008).

NAFCO

The National Food Buffer Stock Company (NAFCO) was set up in 2009 by GoG/MoFA to purchase, store, and market grains (rice, maize, and soy beans) to facilitate food security in Ghana.

It has, since 2010, been buying paddy from farmers in Northern Ghana through independent purchasing agents. These agents go to rice-producing communities to buy paddy during the harvesting period, when supply virtually outstrips demand. The goal is to provide a market window to these rice farmers. NAFCO then gives the paddy to seven lead processors for contract parboiling. These lead processors also engage 5,000 women to parboil it for NAFCO. Parboiling is done at different locations within the communities where these women are located. The parboiled paddy is milled at NAFCO's rice-processing mill, located in Tamale. It has an installed milling capacity of 28,800 MT per year. NAFCO produced 5,100 and 10,200 MT (projected) of milled rice in 2010 and 2011, respectively. NAFCO therefore, respectively, purchased \$227,000 and \$453,000 worth of paddy from farmers as well as invested \$600,000 and \$1.2 million in subcontracting parboiling activities.

The main target "market" for NAFCO is a school feeding program, Prison Service, and NADMO for disaster victims. It is government policy to procure staple grains locally for these programs.

These institutional "customers" are a blessing and a curse for NAFCO and northern Ghana's rice farmers. While demand for local rice is increased through this procurement, the orders are usually for large quantities and are placed with little warning and sporadically throughout the year. This overwhelms the capacity of the parboiling and milling system, and in many cases the Nasia facility (which is underutilized most of the year) must outsource to less efficient local mills. Smoothing demand and improving facility management would result in more efficient utilization of the processing infrastructure.

Efforts to Improve Production and Processing²⁹

GoG and partners have supported numerous efforts to improve per-hectare yields of rain-fed rice, which forms nearly 90 percent (152,040 hectares) of total area under rice cultivation (181,000 hectares).³⁰ The focus has been on supporting the use of improved pure seed and application of improved rice production technology. In demonstrations and trials, improved seed increases yields by 25 percent, and improved production technology increases yields by 40 percent. Therefore, the goal is to increase the average yield of upland rice from 2.0 MT/ha to the achievable yield of about 3.5 MT/ha, and from 3.5 MT/ha to 6 MT/ha for irrigated and lowland rice fields.

Another government effort to increase yields is through fertilizer subsidy. GoG covers 33 percent of the cost, allowing farmers to buy fertilizer at US\$20/50 kg instead of the non-subsidized price of US\$30/50 kg. In 2010, GoG subsidized 100,000 MT of fertilizers to farmers, out of which the Northern Region consumed 39 percent. In 2011, this amount will be raised to 150,000 MT, with an increased emphasis on the Northern Region where demand for fertilizer is on the rise.³¹

²⁹ This EAT team's study focused on conversations with the private sector in order to define market opportunities. The diagnostic did not include an in-depth evaluation of ongoing studies and trials being conducted by public and private researchers, the GoG, donors, and implementing partners. However, the EAT team has summarized these efforts without critique in order to support how to tackle identified market opportunities.

³⁰ MoFA, Agriculture in Ghana: Facts and Figures, 2010 (May 2011).

³¹ MoFA, Government Delivers 110 Harvesters To Northern Region September 26, 2011 (2011), available at <http://mofa.gov.gh/site/?p=5390>.

GoG also aims to increase irrigated areas in Northern Ghana by 2,000 ha per year (5,000 throughout Ghana), resulting in 33 percent greater yields than upland production and raising the possibility of again doubling yields with a second season of rice. By applying improved rice production technology in addition, farmers on irrigated land could yield 4.5 MT/ha. If the government's irrigation development plans are implemented, this would mean an 18,000 MT increase in paddy production every year from this initiative alone.³²

As previously mentioned, some of the most important investments to increase production are actually those that reduce losses. On larger commercial and block farms, sufficient numbers of combine harvesters can mean the difference in being able to harvest a field at all or risk losing the entire crop. Of course, this equipment is equally valuable to smallholders, if they are organized in such a way so as to properly utilize the asset. Timely harvesting is also the only way to cut out the inefficiency of parboiling and effectively compete with straight-milled imports.

Similarly, improved milling technology such as rubber roll mills can reduce breakage, which is a form of loss (though there is also a market for 100 percent broken rice). One of the most important and least expensive investments is the installation of proper graders on existing mills, which would allow a processor to properly target the various quality-defined segments of the market.

MARKET OPPORTUNITIES

It is easy to look at the large quantities of rice pouring out of the port at Tema or Takoradi (even if it is difficult to pin down what those precise import quantities are), see productive lowland and irrigated demonstration rice fields, and get excited about the prospects for import substitution. In the long run, there is no reason why Ghana cannot produce rice at the volumes and various qualities the segmented domestic market demands. Agronomists, donors, producers, and even some traders have all joined the effort to increase production of Ghanaian rice. However, there is an enormous gap between current production and processing and the kind of production systems that will be necessary to compete with imports and meet growing demand. In the near term, it is important to focus on specific opportunities that can be seized now, opportunities that are not contingent on large-scale investment or major shifts in consumer behavior. Achieving these short-term opportunities will also set the industry up to shift to the longer-term challenges described below, but it must be done in phases.

Short-Term Opportunities

Only one segment of the rice market is already met through a significant proportion of both domestic production and imports: 25 percent broken indica rice, which is approximately a 50,000 MT market. Currently, one-third of this market is already successfully met through domestic production, and there is an immediate opportunity to increase this and substitute for the remaining 30,000 MT of imports, a US\$25 million opportunity at current prices. This is an opportunity for which Northern Ghana's rice farmers are perfectly well suited.

Meeting this particular goal will take effort and focus but little cash investment in new infrastructure. Local varieties and overall milling capacity are sufficient. However, the top priority will be to achieve timely harvest in order to avoid parboiling, which would knock the product into a different market segment. Additionally, there is a need for improved storage facilities on site at mills to ensure that paddy is properly stored and dried prior to milling. Management of large rice-processing facilities in the area must be improved to smooth utilization of the milling infrastructure. All these efforts require minimal financial investment when compared to large-scale upgrading of processing infrastructure.

³² These efforts are supported by the Rice Sector Support Project (RSSP) jointly funded by the government and the Agence Francaise de Development (AFD) and the Agricultural Value Chain Mentorship Project, funded jointly by the Alliance for a Green Revolution in Africa (AGRA) and the Danish International Development Agency (DANIDA).

Distributors of imported rice say that they would be interested in local procurement for this particular market segment, as they do envision improved margins and do not see major differences in quality that would deter consumers. However, their interest is conditional on a few key factors. First, local rice is insufficiently dry, and must be stored for six months prior to sale in order to reach the same moisture content as Southeast Asian imports. Second, distributors stated that supply chains are difficult, and the product is not as easily available as imports. Although two-thirds of domestic production is from Northern Ghana, there are poor market linkages to the large population centers in southern Ghana, where there is the largest consumption. Therefore, once proper marketing networks are in place, private distributors would be open to local procurement in discrete trials with specific product lines of low quality, indica rice. Rectifying this “disconnect” may involve government or donor facilitation to integrate distribution networks, perhaps finding ways to capitalize on some of the one-way flow of transport and goods to the north.

In addition to these interventions to support the short-term import substitution goal, as production and marketing scales up, installation of graders at local mills would allow Northern Ghana’s rice industry to start to tackle the medium-term opportunity described below, sorting some milled rice into a 5 percent broken product line.

Medium-Term Opportunities

In the medium term, there is an opportunity to substitute for the 5 percent broken, non-aromatic, straight-milled rice currently being imported. Current import volumes are around 450,000 MT, but this market can be expected to increase to at least 650,000 MT by 2015, given current market segmentation. In general, as Table 7 demonstrates, per-capita consumption will drive Ghanaian consumption growth in the next five years. Total consumption will depend on the level of per-capita consumption in 2015, but can be expected to range between 1.2 and 1.6 million MT and represents a viable opportunity to substitute for imports.

Competing with imports will require significant yield increases, improvements in harvesting practices, and improved mills and grading in addition to the marketing and warehouse management initiatives described above. Large commercial farms or commercial outgrower schemes with on-site milling capacity are the most efficient way to increase production to target this demand. Expanding irrigation schemes will be expensive but will open the possibility of quadrupling yields even with no other productivity improvements.

TABLE 7: PROJECTED RICE CONSUMPTION IN GHANA, 2015

CURRENT CONSUMPTION ('000 MT)	2% ANNUAL POPULATION GROWTH ('000 MT)	PER-CAPITA CONSUMPTION (KG/PERSON/YEAR)					
		IN 2015	ADDITIONAL DEMAND ('000 MT)	2015 RICE MARKET ('000 MT)			
861	+	90	{	50	300	1,251	Low
				55	425	1,376	
				60	550	1,501	
				64	650	1,601	High

Current milling capacity in Northern Ghana (919,100 MT milled/year) is theoretically sufficient for these volumes. However, the quality of the mills is poor and could not achieve parity with the 5 percent broken imported rice. There are over 250 out-of-date augur-worm engelberg rice mills (0.15 MT milled rice/hour capacity), which cause significant breakage during milling, even when the kernel has first been parboiled in order to protect it. Most of the existing mills do not have de-stoners or graders. Modern mills operate at over three times the capacity (0.5 MT milled rice/hour), and result in far fewer broken grains. The total investment for replacing and improving milling capacity in Northern Ghana would be 250 new single-pass rubber roll mills (US\$1.42m), as well as fitting the 150 existing single-pass rubber-roll mills with de-stoners (US\$1.6m) and graders (US\$1.47m). These interventions would increase milling capacity in the north to approximately 1.58 million MT.

With additional investment of about US\$15,000 (rice mill, de-stoner, and grader) at an interest rate of 22 percent, the net incremental income for replacing an engelberg rice mill with single-pass rubber-roll rice mill is approximately US\$16,000 and would be able to pay back the loan during the first year after investment. Moreover, the improved quality of rice would increase demand for milled rice from such rice mills and also increase its offer price by up to 15 percent. Thus, this could be a win-win for both toll processors and farmers/traders.

In addition to the need for improved production and milling, there are significant quality issues that must be resolved if consumers are expected to substitute local for imports. Processors must work to completely eliminate debris, stones, and fragrance from the milled rice. "Buy local" marketing campaigns will be necessary, since consumers currently present a strong bias toward imports, though this bias is less pronounced for non-aromatics than aromatics.

There are risks involved with these investments for northern farmers. Other parts of the country are also scaling up production of local varieties and focusing on straight-mill processing, and they will share the import substitution market. To the extent that they maintain better market linkages than those in the north, they may be better poised to meet demand. Moreover, investments in irrigation cannot be guaranteed to result in increased rice production, since farmers may choose to use irrigated sites and other lowland farmlands meant for high-value vegetables, which yield greater profit margins.

Long-Term Opportunities

With current population growth at about 2 percent, an expected growth in annual per-capita consumption of rice from 38kg to more than 50kg by 2015, domestic demand may increase to 1.2 to 1.5m MT for rice.³³ Although some forecasts project per-capita consumption to rise to as high as 63kg (compared to a world average of 86kg), this study remains on the conservative side for per-capita consumption growth. Overall this study projects similar domestic demand for rice in 2015 due to a higher baseline (current market size), as evidenced in Table 7 above.

As incomes and urbanization are on the rise, the average Ghanaian's tastes will follow the lead of the current upper class. Therefore, it seems that this growing market for rice in Ghana will increasingly be dominated by high-quality straight-milled aromatic rice. This is not displacing demand for high-quality straight-milled non-aromatic (the medium-term opportunity described above), a market that is also growing, albeit at a slower rate.

Ghana's rice industry is already looking ahead and seeking ways to produce aromatic rice at a range of qualities and to keep production costs low to capture this attractive and profitable market segment. Estimates range, but EAT concludes that capturing this market entirely would require investment to increase area planted for aromatic rice by roughly 225,000 hectares. Investment in large-scale farms with robust outgrower schemes would be required, and smallholder involvement may be limited. Local processing and marketing channels will be insufficient. Milling infrastructure in the country is years away from the capacity and standards necessary to compete with high end, low-percentage broken imports. Pockets of production and processing of jasmine rice in Southern Volta have been around for a decade or more, and are currently achieving 10 to 15 percent broken grade. They are exploring ways to reduce this number while maintaining profitability, and may be successful in coming years. Northern Ghana's chances of catching up and holding production costs low enough to compensate for additional transport are slim.

³³ MoFA/AGRA, Breadbasket transformation of Ghana Northern Region (2010).

Mitigating Factors

National Food Buffer Stock Company (NAFCO): NAFCO purchases nearly 5 percent of local rice production in the SADA area, consequently creating a small market window for rice farmers in the area. However, this institutional demand is patchy and contributes to the ineffective management of the rice mill. Consequently, it outsources part of the milling process for rice production even though its current output of 10,000 MT forms about 35 percent of the installed capacity (28,800 MT/year) of the mill.

The continuous operations of NAFCO could serve as a guaranteed market for the prospective increase in rice production as a result of potential investment in the rice industry in Northern Ghana. Even though the current estimated purchase of 5 percent of total rice produced in Northern Ghana might not have an impact on pricing of produce, it has the potential to distort prices in the future if purchasing agents are allowed to speculate on volumes and price offers by NAFCO. Effective communication and transparency on activities of NAFCO would address and minimize the impact on the market drivers in Northern Ghana.

Transport: Some of the roads leading to rice producing areas have deteriorated. Consequently, transport costs to these areas are high; therefore, prices of paddy are between 5 percent and 10 percent cheaper where roads are not good. Farmers in areas with bad roads do not have good bargaining power and therefore have to sell their paddy at give-away prices to itinerant traders. Transport makes up 6 percent of the total cost of production to traders (or 26.4 percent of other costs). Improving the road network would improve access to market, which could consequently trigger an increase in rice production as well as significant investment along the value chain, thus enhancing its competitiveness. United Nations estimates have underlined that for developing countries a 10 percent reduction in transportation costs could be accompanied by a growth of about 20 percent in international and domestic trade.³⁴ Therefore, road infrastructure improvement could reduce transport cost and consequently facilitate trade, which has the potential to improve on the livelihood of smallholder farmers as well as enhance food security.

Demographics: Rice production is dominated by men; 65 percent of farmers are male. Youths comprise 30 percent of those involved in rice production. Indications are that most of the youths in the rice-producing areas either are not interested in rice farming or are now attending school. While these trends have positive social impacts, they pose a threat to the industry as they forecast fewer skilled and knowledgeable producers.

Gender roles in the industry are strictly defined. In Northern Ghana, parboiling is a woman's occupation that has been passed on from generation to generation. An estimated 100,000 women are engaged in the parboiling activity that is a crucial unit operation in rice processing in Northern Ghana. It is estimated that 100 percent of rice mill operators are men. Women dominate rice trading and will likely continue to do so. Moreover, women dominate on-farm rice labor, and as with lead farmers, this labor force is aging and not being replaced by young women.

³⁴ J-P Rodrigue, Transportation, Globalization and International Trade, in Geography of Transport Systems (2011), available at <http://people.hofstra.edu/geotrans/eng/ch5en/conc5en/ch5c2en.html>

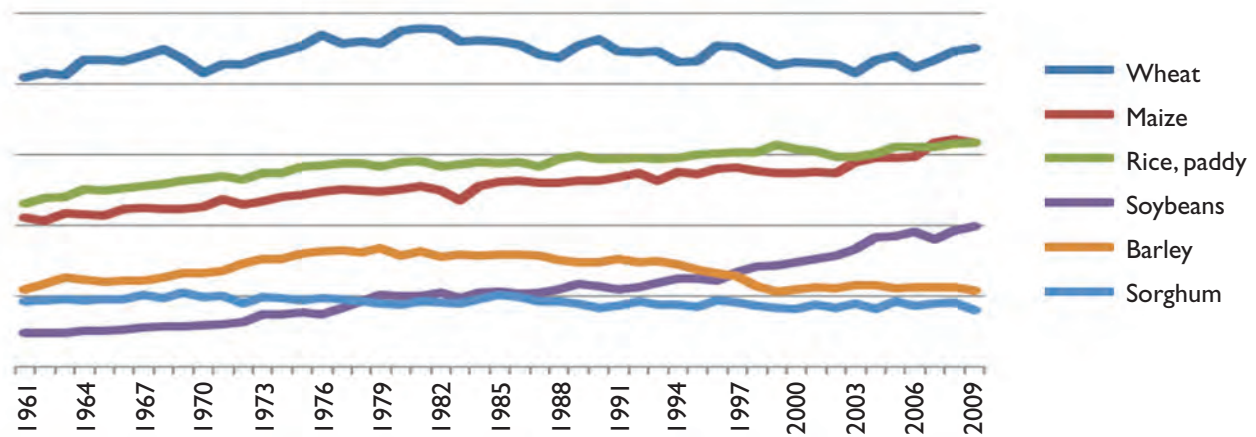
SOY

MARKET DEMAND

Global Context

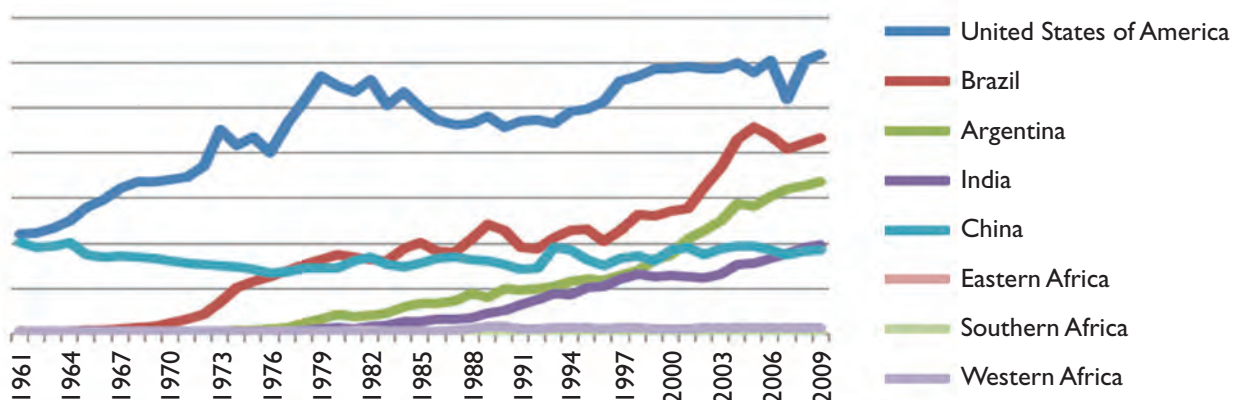
The importance of soy within global agriculture is relatively recent. In the early 1960s, global hectares planted for soy were only 21 percent and 23 percent of those planted for rice and maize, respectively, and only 12 percent of hectares planted for wheat. By 2009, global hectares planted for soy had grown 318 percent, while maize production area had grown by about 50 percent and wheat only 10 percent (see Figures 3 and 4).

FIGURE 3: GLOBAL AREA UNDER PRODUCTION FOR DOMINANT AGRICULTURAL CROPS, FAOSTAT



Until the late 1980s, the United States dominated production (approximately 75 percent) with China a distant second (about 15 percent). Combined South American production overtook U.S. production around 2002 to 2003, driven both by growth in domestic demand (for animal feed and vegetable oil) and significant infrastructure investments for cost competitive export of soybean products (meal, oil, and animal protein).

FIGURE 4: CHANGE IN GLOBAL AREA UNDER SOY PRODUCTION, FAOSTAT



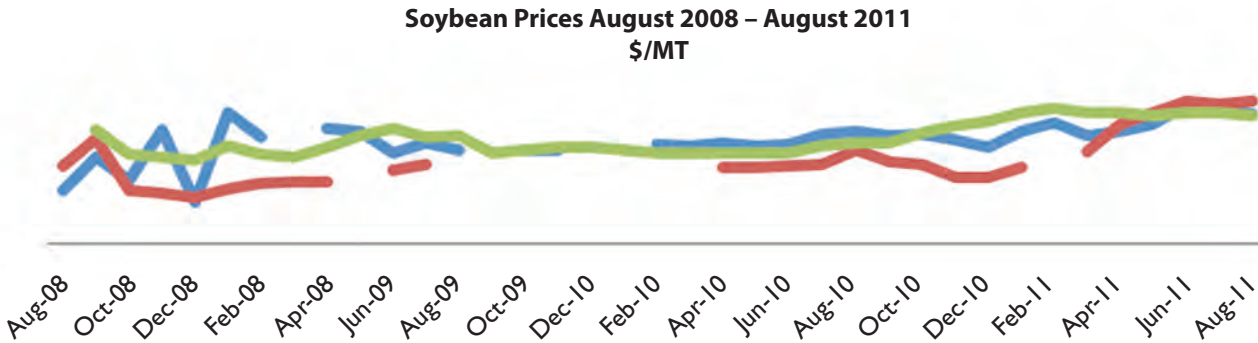
Soy production is characterized by large-scale commercial rain-fed production in temperate or sub-tropical climates, often rotated with a cereal crop (such as maize or wheat).³⁵ Of the top global producers, only India's expanding area under production is predominantly grown by smallholders. The largest soy producers, the United States, Brazil, and Argentina, will see growth in area under production constrained going forward as highest and medium potential production areas become mature and saturated.³⁶

Domestic markets drove the development of the soy industries of Brazil and the United States. The majority of soybeans are processed and consumed in the countries of production. In 2009 and 2010, approximately 35 percent of global soybean production was traded in bean form. Of the soybean meal crushed globally, 34 percent was exported, and only 24 percent of the soybean oil produced traded outside of the country of processing.³⁷

The growth in soy demand in the last decade is mainly due to the prioritization of biodiesel production, specifically in the United States and the EU, and rapid economic growth in Asia where rising incomes are resulting in expanded consumption of animal protein (fed by soybean meal) and vegetable oils. While African markets remain very small in the global soy trade (Sub-Saharan Africa accounts for <0.5 percent of total soy consumption), an interesting opportunity exists for Africa to expand production to meet its own growing regional demand. Rising incomes in African urban markets are driving increased consumption of animal protein and higher-quality vegetable oils, where Brazil's soybean industry started not long ago and which China is experiencing.

The soy market is global and all local and regional soy markets are subject to the volatility of international commodity prices.³⁸ Global soy prices rose dramatically in 2008 and 2009 along with other staple grains, but this past season (2011) has seen prices reach new highs. Prices are not expected to remain this strong, but they offer an opportunity for new production areas to open in response to continued global market expansion, and reach more competitive production efficiencies in the near-term (see Figure 5).³⁹

FIGURE 5: SOYBEAN PRICE TRENDS: GHANA AND U.S. FOB GULF⁴⁰



³⁵ Use of irrigated sites, where the use of soy in a crop rotation makes sense from an overall soil fertility perspective, may be best for soybean seed production.
³⁶ There are research initiatives to develop varieties more adapted to a broader agronomic profile, including more tropical ecologies, which could expand production potential in traditional production countries, particularly Brazil.
³⁷ USDA, World Agricultural Supply and Demand Estimates (September 2011).
³⁸ Any variances in local market volatility from global prices typically result from location, size, and utilization of installed crush capacity, as well as specific local production, market, or trade policy interventions.
³⁹ Appendix C presents actual historical prices and forecasts through 2020.
⁴⁰ Esoko Prices from Esoko data as of on September 30, 2011; U.S. FOB Gulf Soybean prices from IFPRI Food Security Portal website; blue line—Navrongo Market, red line—Yendi, green line—U.S. FOB Gulf.

Soy Market

Ghana's rapidly growing soybean market is driven by the local table egg industry's use of soybean meal in layer feed rations. Of the 150,000 MT of soy demanded annually in Ghana, approximately 75 percent goes into poultry feed. The bulk of soy processing (both in Ghana and globally) goes into producing soybean meal and soybean oil. Imports most often arrive in a processed state, as meal or oil. Local soybean production does have a slight advantage over imported beans, as smaller processors are practically unable to import beans to run through their facilities. The smaller quantities required by these processors must come as container trade, which comes at a higher logistical price than bulk shipments. Only Ghana Nuts, the largest processor, can utilize a larger bulk shipment. Moving processing capacity to larger solvent plants would shift these economics and decrease the logistical costs of importing beans for processing within Ghana.

Table 8 below summarizes the main soy markets within Ghana, with contribution from imports highlighted (roughly half).

TABLE 8: 2010 GHANA SOY MARKET SUMMARY

PRODUCT	TOTAL MARKET (MT)	IMPORT SUPPLY (% OF MARKET SHARE MET BY IMPORTS)	CURRENT WHOLESAL PRICE (\$/MT) AND RETAIL PRICE (\$/MT)	ELASTICITY AND CHARACTERISTICS OF DEMAND
Soybean Cake	Range between 75–100,000 MT [85–112,000 MT soybean equivalent] ⁴¹	Local production ~43,000 % of market met by meal imports between 48% and 61%	\$1,060–\$1,200/MT at 2011 peak (last Dec.–Jan. @ US\$400/MT)	Substitutes include fishmeal and other oilseed cake; fishmeal still represents significant portion of poultry protein (~30%)
Soybean Oil	20,000 MT (industrial and human) [110,000 MT soybean equivalent]	70%	\$1,733/MT (Local soy oil sold in drums at palm oil price; should command 15%–20% premium if properly processed and packaged)	Paint industry can only use soy oil for resin (used in a particular paint product)
Human Food Processing	<1,000 MT	0%	Very small market; diverse products; largely health NGOs	Mostly weaning mix and specific nutrition supplements
Producer Household Retention (for seed and household consumption)	~20,000 MT	N/A	N/A	Households retain between 10 bowls and 1 bag for personal consumption but sell if prices rise aggressively enough
TOTAL/Average	150,000 MT	~50%		

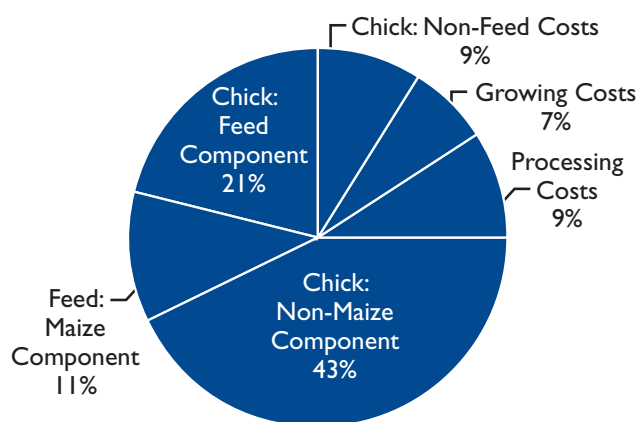
⁴¹ There is a lack of clear consensus on soybean meal imports. The calculations used to derive the soy equivalents for soybean meal required by current Ghanaian poultry industry can be found in Appendix B.

⁴² FAOSTAT reports only 2,700 MTs in 2009. These soybean oil figures are based entirely on interviews with industrial users and critical palm oil producers, importers/traders, and processors.

Poultry

There are many unknowns about the commercial Ghanaian poultry market, the size and dynamics of which have a direct and critical impact on current and potential demand for soy. Sizing Ghanaian commercial poultry production is pivotal to accurately assessing the volumes of imported soybean meal (and feed concentrates). The general consensus is that there are between 15 million and 25 million commercial birds, predominantly (more than 90 percent) layers. This equates to the consumption of 85 to 112,000 MT of soybeans annually, or 75 to 100,000 MT of soybean meal (see Appendix B). Domestic soybean processing is meeting roughly 45,000 MT of the soybean meal demanded with the balance imported as soybean meal or feed concentrate (containing partial protein requirements).

FIGURE 6: COST COMPONENTS OF BROILER, MOZAMBIQUE 2005



Chickens represent a significant opportunity for value addition to grain by transforming feed into meat and eggs. There has been no public in-depth analysis of the cost of production for the Ghanaian chicken industry.

Analysis of the Mozambique industry in 2005 showed that 74 percent of the cost of a broiler is feed (see Figure 6).⁴³ In that same analysis, the soybean meal component represented 50 percent of broiler ration cost. Soybean meal is a high-quality protein, which makes up between 20 percent and 28 percent of a poultry ration. In Ghana, fishmeal and cotton seed cake are traditional proteins used in poultry rations. Significant volumes of fishmeal (as a percentage of required protein) in a poultry ration can lead to a fishy odor and flavor in eggs and the poultry carcass itself. Ghanaian consumers are not sensitive to any fishy odor because of the prevalence of fishmeal use in poultry feed. But soybean meal is a higher-quality protein and in the past five-plus years has grown to represent 70 percent of protein component in feed.

Aquaculture

Ghana's aquaculture is a relatively small component of the feed industry. Production of farmed tilapia represents a market for approximately 5,000 MTs of soy. The aquaculture industry in Ghana is experiencing 5 to 10 percent annual growth, but will probably plateau in a few years. Currently all of the fish feed is imported for Ghanaian tilapia production. As a subsector of feed, the fish feed market represents a smaller, but higher margin investment opportunity than poultry. Several companies are exploring this opportunity, though some are starting with a focus on feed imports and not local processing. Extrusion technology, which does not yet exist in Ghana, is needed to move into fish feed production.

Household Consumption of Beans

Human consumption of soy in Ghana, like most markets, represents a relatively insignificant opportunity. Soy production has been introduced in many rural areas as a women's household nutrition crop, and most producer families have received training in household preparation and consumption of soy. Most of these families are retaining some soybean at home for household consumption. Families reported reserving between 10 bowls (25 kilos) and a full maxi-bag or a bit more of soy for preparation and consumption within the house. At current yields this retention of soybean from the traded market may reach 10 percent, though record high prices in the 2010 to 2011 season may have pulled more from households stores than planned. While many producers and extension agents report that household consumption of soy familiarizes the producer with the crop and provides alternate uses should markets become constrained, thus providing fundamental incentives for producer adoption of the crop, the

⁴³ TechnoServe, Opportunities & Challenges in the Development of the Agricultural Value Chain: Poultry in Mozambique (June 2005).

vast majority of soy is produced as a cash crop and sold into the market. The most common food preparation of soy is the local dish, dawa dawa. Dawa dawa is traditionally produced from the dawa dawa tree, but production-utilizing soy was reported to be a readily accepted and more affordable substitute.

Vegetable Oil

Soybean oil represents a very small piece of the Ghanaian vegetable oil market (20,000 MT of 125,000 MT market dominated by imported palm). With palm production tightening in Asia due to production area constraints, palm production is expanding in West Africa to meet the growing regional demand. The vegetable oil consumer is highly price sensitive. Rising incomes will see the consumer first transition to a blended vegetable oil product with palm oil mixed with sunflower, groundnut, or soybean oil, graduating later to a higher-quality vegetable oil.

The paint industry utilizes crude soybean oil for a particular resin. The current market is roughly 17,000 MT, half of which is demanded by a single paint manufacturer. Only about 6,000 MT of crude soybean oil is produced within Ghana, with the balance imported.

The soybean processing industry in Ghana lacks any meaningful refinery capacity. Even soybean oil sold into the human consumption market is being sold in drums at no premium. According to vegetable oil stakeholders with international experience, but also currently operating in palm oil in Ghana, properly refined and bottled soybean oil for the consumption market should command a premium of about 15 to 20 percent above similarly packaged and marketed palm.

MARKET SUPPLY

While soybeans have been produced in a scattered way in Ghana for decades, only the past five years have seen any significant growth in hectares planted. This has largely been due to a donor focus on soybean promotion and production in response to the recent tight global supply and demand opportunity. Domestic and regional demand for poultry products and higher-quality vegetable oil is growing, and as more Ghanaian producers are exposed to soy production and gain access to soybean seed and extension, additional hectares will come under soy production. Roughly half of the soy used in 2010 was imported as soybean meal or soybean oil as illustrated above in Table 8. MoFA reported 76,000 hectares of soybean production in 2010 with more than half of that in the Northern Region (see Table 9). The industry estimates that up to 50 percent additional hectares may be under production for the 2011 season in response to the strong global prices (see Appendix E).

One source stated that the highest potential soy production area includes a band across Ghana including the northern-most districts of Brong Ahafo and Volta with the southern band of districts of the Northern Region. But neither the soy industry nor research entities can clearly identify and confirm the highest potential soy production areas from an agronomic perspective. It is unlikely though that any soy will be produced outside of the SADA region (unless it is just on or below the 8th parallel in the Guinea Savanna and Forest Savanna Transitional ecological zones).

TABLE 9: 2010 GHANA SOYBEAN PRODUCTION

REGION	AREA PLANTED (HA)
Brong Ahafo (select districts)	0
Northern	49,950
Upper West	14,970
Upper East	6,940
Volta (select districts)	4,360
TOTAL SADA	76,000
GHANA TOTAL	76,000
Average Yield	1.2MT/Ha
TOTAL Production	~90,000

Yield reports range from just 500kg/ha to 2MT/ha, with a generally agreed-upon average of 1.2MT/ha. Yields of 1.2 MT/hectare from largely smallholder producers would be among the highest in Sub-Saharan Africa, but are still low compared to commercial producers. Field trials in Ghana administered by TechnoServe found soy yields as low as 0.8 MT/ha, although there is potential to achieve yields as high as 2.5 MT/ha with proper application of fertilizer, higher density of plants, and use of improved varieties of seed.⁴⁴ For comparison, Table 10 shows the recently completed analysis of the soy industry across southern Africa,⁴⁵ which reported significantly lower smallholder yields. Argentina is included as an additional point of comparison for potential commercial yields.

That same soy industry report from southern Africa stated that only commercial producers consistently yielding over 3MT/ha were profitable soy producers. Most commercial producers in southern Africa produce soy as a key crop in their rotation, and make planting decisions based on maize markets and policy in addition to soy market dynamics. Ghana is not different from southern Africa in that smallholders make money from soy when not fully costing their labor (return above cash costs of production = return on family labor). As smallholders move into more commercial production, they spend cash on labor and their ability to make money dramatically decreases—as well as their yields oftentimes. Emerging farmers in Ghana report that they hire labor to plant many of their crops and pay by the acre. The lack of interest and skill dedicated by this casual day agricultural labor is a major issue in productivity due to inconsistent and inappropriate plant populations, but unfortunately hiring day labor to plant is the only existing option to get a complete field planted in a timely manner.

Reducing labor demands of agricultural production is critical to productivity increases and margin maximization. In soy, the main labor savings practice is the use of pre-emergence herbicides for early weed control. Spreading the use and availability of planters and planting dibblers should also decrease labor requirements and improve return on labor. To date there have not been any significant disease challenges to soybean production, but with increased production and production density, disease resistance and access to agricultural chemicals will rise in importance.

The soy varieties mostly grown in Ghana are two non-shattering varieties released in 2003. Producers prefer these over the previously grown varieties released in the mid-nineties due entirely to issues of pod shattering which occurs in the dry north with any delay in harvesting. Producers with any significant soy experience (and they are relatively few) do believe these non-shattering varieties have overall lower-yield potential. The industry feels that seed research is distracted by the need to chase project funding, lacking a strong consistent core research fund to address its need for day-insensitive, non-shattering, short-season varieties. There is concern among researchers that working with Brazilian seed genetics (where there are similar climatic and day-length conditions producing high-yielding soybeans) may result in genetically modified organism (GMO) materials entering Ghanaian production. Seventy-seven percent of all soybean produced globally is GMO.⁴⁶ Burkina Faso is producing GMO cotton and there is a perception that the area may have started some GMO soy production, though this was not substantiated. Soybean is self-pollinating, thus hybrids are not common. This means that producers do regularly save seed from year to year, with some regular genetic refresh.

TABLE 10: 2010 SOUTHERN AFRICA SOY YIELDS (MT/HA)

	COMMERCIAL	SMALLHOLDER
South Africa	1.9	0.8
Zambia	2.6	0.9
Zimbabwe	1.8	0.5
Malawi	1.2	1.0
Mozambique	1.2	0.9
DRC	n/a	0.8
Argentina	3.4	n/a

⁴⁴ IFAD, Fast track initiative on partnership for grains and oilseed development in Ghana (2009).

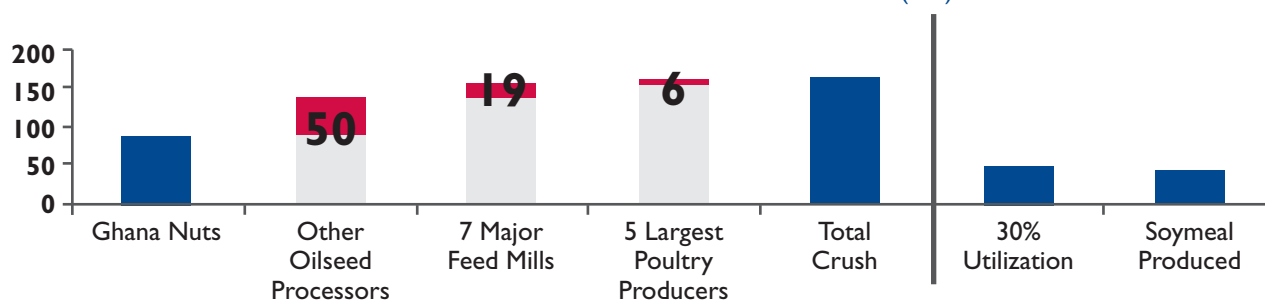
⁴⁵ TechnoServe, Southern Africa Soy Roadmap—Zambia Value Chain Analysis (2010 to 2011).

⁴⁶ http://www.gmo-compass.org/eng/agri_biotechnology/gmo_planting/342.genetically_modified_soybean_global_area_under_cultivation.html.

Processing

The vast majority of soybeans are processed into soybean meal (or cake) and soybean oil. Ghana's soybean processing capacity is largely located in the center of the country, with very limited capacity in the south. The largest processor is the only one to utilize solvent extraction (90,000 MT capacity), which yields 17 to 18 percent oil and high-quality, low-fat, approximately 47 percent protein meal (a higher protein preferred by poultry industry). The rest of the industry utilizes kettle cooking and double expelling (75,000 MT capacity), yielding 10 to 12 percent oil and medium fat, approximately 44 percent protein meal. All imported meal is solvent-extracted soy. Figure 7 presents the capacity and current utilization and production.

FIGURE 7: SOY PROCESSING CAPACITY AND PRODUCTION IN GHANA 2010 (MT)



The two processors located in SADA are currently not operating. One is in bankruptcy after struggling with raw materials, even processing multiple oilseeds in order to diversify. The other processor is attempting to restart operations. The business was initiated with significant donor support, which ended a few years ago.

Processors prefer to purchase as much as they can at harvest in order to offer more stable meal prices to poultry. Cost of capital, timeliness of working capital, and availability of beans limit their ability to buy. As noted above in the Ghana Market section, local soybeans have a cost advantage for the processors, particularly those without a large solvent facility. This year the solvent facility has imported a 15,000 MT ship of soybeans from South America, really a minimum quantity for cost-effective importation. The small and medium processors are not originating sufficient quantities to order bulk beans to run their facilities. This means that when they are unable to originate local soybeans, they are unable to process, causing their customers to purchase imported soybean meal (and soybean oil).

Efforts to Improve Production and Quality

Promotion of soy production has largely been donor initiated in the past few years. There have been some starts with regards to processor-initiated extension and input credit schemes (mostly supported by donors, but not exclusively). No processor interviewed knew of any sustained successes in production promotion, with at least two examples mentioned as failing due to a lack of timely working capital on the part of the processor at harvest, resulting in an inability to honor purchase agreements.⁴⁷ Many producers expressed frustration with soy due to these experiences or trying production in isolation where traders were not actively purchasing in their local markets.

The feed millers and poultry industry are importing a high-quality, consistent, high-protein soybean meal that is logistically easy to get into the greater Accra poultry market. The processors and traders prefer to originate in 500 to 1,000 MT units for cost efficiencies. The struggling poultry industry is not in a position to manage outgrower or contract-growing operations.

The models for extension and input delivery used in soy mirror those of maize, in particular the use of the model farmer as a nucleus delivering mechanized land preparation services, inputs on credit, and aggregating production for sales to traders or aggressive processors.

⁴⁷ The carrying cost of supply for processing purchased at harvest is also significant and out of reach for many of the medium processors. If a 3,000 MT capacity processor purchases 60 percent of its needs at harvest, it requires approximately US\$900,000 (2,000 MT @ \$460/ton) at an annual interest of 18 to 22 percent.

There are a significant number of women producers with about 1 hectare of soy. These women began producing this crop due to some household nutrition project where seeds, land preparation, and extension were provided by a non-governmental organization (NGO). These women report that they struggle in particular to access land preparation services after the projects end due to their smaller production areas. Even when they have money to pay for the land preparation, these women have found that the tractor will prefer to service farming blocks or larger farms, most often involving men. But the women report general satisfaction with the income potential of soy when the NGO also has facilitated marketing. These communities are often not producing large enough quantities to attract the general soy trade.

MARKET OPPORTUNITIES

The most immediate opportunity for Ghana's soybean industry is the direct substitution of imported soybeans, soybean meal, and soybean oil with locally produced and processed products. The medium-term and slightly more complex investment opportunity will be meeting Ghana's increasing demand for chicken meat with locally produced broilers fed with locally produced and processed grains, including soybeans. Finally, longer-term soy industry growth will come from the export of finished soybean products, most likely processed poultry and fish, into West African urban markets.

Short-Term Opportunities

The short-term opportunity for the Ghana soy industry is very straightforward. The industry imports between 35,000 and 63,000 MT of soybean equivalent as processed meal (between 48 percent and 61 percent of the total soybean meal market). The challenge is purely about the availability of raw materials, since the crush capacity to meet these volumes of processed meal exists. While current utilization is about 30 percent, substituting for current imports would increase crush utilization to approximately 70 percent.

With the increased soybean meal production would come additional soybean oil for the local market, about 6,000 MT of additional vegetable oil. Our analysis of the market suggests that this will easily replace 50 percent of the current imports of soybean oil, mostly used in a crude form by the paint industry. Further refinery capacity will be needed in the medium term to replace the refined and consumer-packaged vegetable oil. The production is already expanding in the 2011 season to meet this near-term opportunity. The need though is to concentrate and focus production expansion in high-density geographies where the economies of origination by processors will be most economical.

Medium-Term Opportunities

Ghana currently imports 100,000 MT of ready-to-cook chicken. An equivalent of locally produced broilers (13 million broilers each of 8 cycles/year) would consume an equivalent of 80 to 90,000 MT of additional soy (approximately 75,000 MT of soybean meal). Animal protein production is one of the best added value opportunities for grain. This opportunity would practically double the local soybean meal market.

A coordinated support program for poultry industry expansion will be necessary and would most likely include the development of a poultry industry association to engage policy makers and ready-to-cook chicken importers (without any protection agenda), an "eat local" poultry campaign, and specific technical assistance to improve production and value chain efficiencies.

Additional crush investments are already in the pipeline, but strengthening the poultry industry will be necessary to consume the increased solvent extraction planned by a couple of the key oilseed processors. It is unclear if the planned increased crush is confirmed or just considered. Current capacity would need to roughly double to meet increased demand from local broiler production.

Long-Term Opportunities

Ghana will likely not export soybeans (as beans) into the international market due to the inland location of the production zones and the comparatively high cost of internal transport. The most competitive bean or meal exporters benefit from river and rail access (for relatively cheap international port access) directly at production or processing sites, in significantly higher production volumes than will likely be reached, even over a longer period. And as noted in the Market Demand section above, only about 35 percent of global soybean production is traded internationally as beans, clearly not the most attractive market.

The more interesting opportunity will be to understand demand in the regional urban markets in West Africa for animal protein and to focus on exporting either concentrated feed or animal protein. Companies in Tema are currently exporting intermediate and finished goods by road and ocean into the southern Nigerian urban markets. Crude palm oil is being shipped bulk ocean freight from Tema to Lagos. Capacity on ocean freight on the Nigerian side is the principal barrier to this trade. Southern Nigeria markets are only 300 km from the greater Accra metro area. Poultry and, possibly more interestingly, fish production located around the greater Accra area and east into southern Volta will be well positioned to sell in southern Nigeria. While northern Nigerian markets are very interesting in volume (Kano State has over 10 million people and often runs out of chicken), Ghana is logistically not well positioned to competitively sell into any central or northern market. Nigeria currently imports over 100,000 MT of fish. Both sales of fish feed to a growing Nigerian (and other southern West African urban) aquaculture market(s) and sales of Ghanaian raised fish offer attractive longer-term opportunities with interesting implications for Ghana's soy industry.

These same urban markets are expected to upgrade their vegetable oil consumption, along with animal protein, and soybean oil produced as a result of soybean meal production will fill this growing market. It is unlikely that soybean oil will drive the market, but the urban markets are well positioned to absorb the resulting refined soybean oil produced.⁴⁸

Mitigating Factors

Global prices are at an all-time high (higher than during the food crisis in 2008), but prices must and will come down. Any producer analysis based on prices from this last season is unrealistic in the medium and long term.

Institutional buyers (NAFCO and WFP) of soybeans currently represent relatively small players in the market, but any shifts in policy toward price stabilization could be a risk to the industry.

Soy production in some areas has been introduced as a household nutrition crop. These households are retaining between 10 bowls and 1 bag per household for family consumption. Shifting the focus of soy as a cash crop may isolate female producers. These women have some soy production experience, and specific efforts could be made to help them expand production areas; moving into cash crop production could be an opportunity to increase their income. Men tend to have access to larger plots and dominate cash crop production.

WAREHOUSING

This assessment provides a brief overview of current warehouse infrastructure, commodity-specific handling, and business practices in northern Ghana. It provides important context for this assessment's conclusions about which business models are more likely to be profitable and therefore sustainable, given the existing supply of storage facilities, market demand for postharvest services, and current marketing and storage practices. The assessment is not meant to provide a thorough survey of any of these issues, or an inventory and map of physical structures. Several organizations, such as Ghana Grains Council, IFDC, and AGRA, have been engaged in more in-depth inventories and analysis over a longer period of time.

⁴⁸ This is in contrast to some other markets, such as Mozambique, where soybean processing is developing at a distance from large urban markets and sales of soybean oil present a serious challenge to the profitability for the soybean processors.

Overall, storage capacity in the SADA region is adequate, though there is unmet demand for large-scale and bulk facilities situated near processing and market hubs such as Tamale. Demand for such warehousing comes from processors and large traders or brokers in grains (including maize, rice, soy, groundnuts, cowpeas, and the like). Warehouse management in both community warehouses and large-scale government facilities is extremely poor, resulting in inefficiency, waste, and physical asset deterioration.

A significant portion of storage and postharvest services is offered at subsidized rates, particularly those outside of market centers or government owned,⁴⁹ which do not adequately provide margins to cover operational and maintenance costs. This inhibits an investor's ability to accurately size the market for these services. While the relatively small industrial segment of the grains market demands a high-quality product, the larger grain trade pays very little attention to whether the product is premium quality. Therefore, adding other services to a stand-alone warehouse may not necessarily make it a profitable venture.

Specific to rice, seasonal demand and sporadic government procurement (the large market of domestic milled rice) for institutional consumption mean underutilization of mills' capacity over the course of the year, with an occasional overwhelming of such capacity. As with grain processing more generally, warehousing for raw materials as well as working capital to procure at harvest are critical first steps for increasing processing-capacity utilization and improving operational efficiency.

CURRENT CONTEXT

Overview of Existing Storage and Handling Facilities in SADA

There are over 300 purpose-built warehouses of different shapes and forms across the SADA region. Their general sizes range from below 100 MT to over 1,000 MT and are in varying states of use. Most of these warehouses have been built by the GoG or by NGOs and are predominantly located in farming communities where they were meant to serve as both agricultural input and output storage points.⁵⁰ The majority of community warehouses visited were abandoned or sparingly used, and for other purposes other than originally intended.

The warehouse facilities described can be placed into three categories—large-, medium-, and small-scale—by size and holding capacity.

Large-Scale Storage (More than 1000 MT): These facilities comprise mainly the larger projects established by the GoG and private initiatives in the area. The most prominent government-controlled facility is the NAFCO, which was set up by the GoG in 2009 as a strategic company to stockpile and distribute local food staples to ensure national food security. Since its incorporation, the company has taken over all the defunct Ghana Food Distribution Company (GFDC) facilities dotted across the country. NAFCO has also acquired the Nasia rice project (including milling capacity), which was set up by the government in 1975 but had been abandoned for decades. NAFCO has the largest network of storage capacity in the SADA area.

The Nasia rice-milling plant in Tamale has the capacity to mill 4 MT⁵¹ of rice per hour and has about 2,000 MT of aluminum silos, which remain unutilized. Nasia does not currently mill for the regular market, and operates as a passive recipient of government and institutional orders that are sent from NAFCO headquarters in Accra. The seasonal demand by these programs, such as the school-feeding program and orders for disaster response, means that this facility is occasionally swamped with work but on an annual basis is being underutilized.

⁴⁹ Ownership and management are the key driving factors. The specifics are described more fully in the Current Context section below.

⁵⁰ Out of the warehouses identified, donor projects have built about 135 of them, including the 71 or more built by TechnoServe with USAID funding. Whilst the GoG built the FASCOM units (82 identified) in the late 1970s, most of the donor-led community-level infrastructure development has occurred over the last past 15 years.

⁵¹ This capacity cited by interviewees at the Nasia mill, as well as in the ACDI/VOCA Global Food Security Response: Ghana Rice Study (2009).

NAFCO also has ownership of GFDC silos in Ejura, Ashanti Mampong, and Nkoranza, which currently serve as buffer stock storage points for grains. The Ejura site, the largest, has about 10,000 MT of storage capacity in the form of silos and warehouses and an additional 10,000-ton capacity open barn space for loose grain bulk storage. Last season, NAFCO used about 4,000 MT of the storage capacity and the National Service Secretariat, which is running the maize farms, used about 5,000 MT of the storage area. Storage capacity utilization at Ejura is below 50 percent.

Other neglected government-built agro-processing infrastructure has been taken over by private entrepreneurs. Olam Ghana Limited has appropriated the assets of the defunct Ghana Cotton Company, in Wa and Tumu, Upper West Region. The most notable new construction of warehouse space in northern Ghana is Wienco's new 10,000 MT capacity warehouse in Tamale. Wienco also plans to build a new 18,000 MT facility in Tumu, and has already acquired the land.

In Kintampo, 3G&T Limited has taken over the estate of the British American Tobacco (BAT), including a 3,000 MT warehouse. The Pure Company, a shea butter-processing company also has a 2,000 MT capacity warehouse facility located in Benkrom, North Kintampo, in Brong Ahafo. The privately owned storage facilities are visibly in much better shape than those owned by the government.

There are approximately 8 to 12 such large-scale warehouses dedicated to agricultural produce in the SADA area and are usually found at the agro-processing sites⁵² and major towns and market hubs. Utilization of these facilities is high and in some cases larger buyers like WFP cannot find enough available warehouse space in which to aggregate and store their purchases.

Based on numerous interviews, estimates for new construction of a 2,000 MT warehouse in the SADA area is about US\$150,000.

Medium-Scale Storage (101 to 1,000 MT): There are over 132 medium-scale warehouses and are all built for flat storage only. The majority of them (82) are the former FASCOM warehouses dotted across the northern sector. Many medium-scale structures can be found in the cities and towns. For example, the Ghana Cotton Company warehouse (300 MT) is in Tumu, Upper West, now being operated by OLAM Ghana Limited, and others are found in and around the Tamale and Bolgatanga area. Over 50 percent of these facilities are currently unusable and need major repairs to bring them into operation. The IFDC survey will go into further detail about their condition.⁵³

The highest estimates heard for new construction of a 1,000MT warehouse, which can hold about 10,000 bags of maize, were US\$100,000.

Small-Scale Storage (up to 100 MT): In the SADA area, there are 74 identifiable, purpose-built small-scale warehouses, classified as those with a holding capacity up to 100 MT, including 68 built with the assistance of TechnoServe (USAID-funded.) However, there are many more informal warehouses of all types and shapes found in communities and especially in the major market centers, such as Tamale, Bolgatanga, Wa, Kintampo, and Techiman. These may be multi-purpose rooms and sheds used to store all kinds of wares and produce on demand.

All farmers store some farm produce in their homes and on their farms, either in barns, traditional silos, or makeshift rooms. About 25 percent of all farm produce is stored in farmers' homes for both household consumption and for future sale. This informal "warehousing" could account for over 250,000MT of white maize alone, produced in the SADA area.

It would cost about US\$15,000 to construct a 50 MT warehouse. In comparison with the larger structures, building cost per metric ton of storage is higher as the capacity of the building is reduced.

⁵² Two soybean processing companies, neither currently operating, in Wa and Tamale each have warehouses of between 1,000 and 1,500 MT capacity.

⁵³ IFDC survey of warehouse capacity and condition, shared with EAT team in draft form in October 2011.

Current Storage Practices

Storage patterns and practices vary by commodity, and the market dynamics of the produce determines the handling and length of custody. The three crops—maize, rice, and soy—therefore present varying storage practices.

Maize: All maize harvested is first sun dried on-farm and subsequently stored on-farm or at home in different types of storage facilities available to farmers. These may be traditional silos built with wood or mud or in rooms and sheds.

Farmers sell off about 75 percent of their maize harvest to defray production cost and any debts they may have incurred during the farming of the crop. The remaining 25 percent is usually kept by the farmer as a store of wealth to be sold later and also for feeding their household.⁵⁴

The 75 percent sold may pass through some transient storage at the community where buyers and creditors purchase or retrieve their in-kind (maize) payments. At this level the owners of the maize may store for short periods and then transport the stock out for sale.

Maize is commonly sold to traders and pre-financiers⁵⁵ who may have entered in a form of pre-production arrangement with the farmers. These traders tend to have back-to-back contracts with industrial processors like feed mills and breweries, and institutions such as schools, and may also sell on the open market; these traders practice **spatial arbitrage**.

Small-scale farmers with less than 1 hectare of farmland hardly have enough excess maize to put into speculative storage (they would reserve maize for household consumption) but those who cultivate more than 2 hectares can store about 25 to 30 percent of their harvest to speculate on prices fluctuations. Traders with excess funds may also buy, store, and speculate on price swings; these speculators practice **temporal arbitrage**.

Any maize that is to be stored is usually cleaned, dried well, bagged, fumigated, and packed flat in warehouses. Maize is usually kept in poly woven bags and weighs between 100kg and 150kg; however, a few traders pack in 50kg bags for industrial processors. Generally, poorer farmers may not appropriately treat and store, leading to increased postharvest losses.

Rice: After harvesting, paddy rice is threshed and winnowed to remove dirt and chaff and then bagged in 100 to 120kg sacks for storage, parboiling, and selling to traders. The majority of paddy rice is sold to traders who are procuring to sell in markets outside the production areas, largely ending up in the Kintampo, Atebubu, Ejura, and Techiman markets.

Rice from the northern sector is usually brittle due to high, drying temperatures at harvest coupled with delayed harvesting, and needs to be parboiled to improve moisture content before milling. Parboiling predominantly occurs close to milling sites where most paddy rice is also stored. The tendency is for rice traders to buy and store paddy, and then, on demand, mill required quantities.

Storage of paddy rice is therefore very transient in the production areas and requires little or no fumigation. Due to the high and consistent demand, virtually all the milled rice is bagged and sold immediately after processing.

⁵⁴ Even when producers store some product aggregated in a community warehouse, they may still choose to store some of their grain earmarked for deferred sales (price speculation) at home/on-farm. Producers lose a certain amount of control by handing over grain to someone else prior to a final sale; this could be an additional organizational risk (in the case of a fledgling farmers organization) or operational risk (if grain quality falls as a result of grain handling at storage location).

⁵⁵ Some pre-financiers will bring mechanical maize shellers to their farmers as an additional service. They are more likely to collect on their pre-financing if they appear in the fields quickly at harvest, with additional shelling services to ease postharvest processing.

Soy: Currently, domestic demand for soy far exceeds supply. The swelling appetite for soy is driven by the poultry feed industry. The practice here is that farmers enter into pre-production contracts with soybean processors, oilseed crush and feed mills. The processors are operating significantly undercapacity and even with working capital constraints at harvest, soy is quickly moved out of production areas within a couple of months of harvest. This situation eliminates the need for any significant storage outside of the processors' inventory warehousing and, coupled with the fact that soy is an eyeless bean, which protects it against infections, fumigation is hardly needed.

Standard Business Practices

Warehouse Management: Over half the community warehouses (over 217 in the SADA area) are in a state of disrepair principally due to poor management practices. Many of these structures have been abandoned for lack of funds for maintenance and repair. This is because the facilities have not been run on business lines but as social services to “poor” rural communities.

Many of the defunct but functional warehouses are periodically used by various private and governmental institutions, such as the school feeding programs, NAFCO, private traders, farmers in the communities, and input suppliers. It is doubtful that any of the new users are paying any reasonable fees for the warehouses. Farmers from the communities are, for example, paying GHC1.00 per bag for produce stored for any length of time. The school feeding programs are seen as a largess to the community and therefore do not pay any rent for the use of the facility.

Community-run warehouses lack accountability and clear ownership. Management skills are lacking in the rural communities where many co-op executives monopolize the warehouses as their personal assets (but lacking the straightforward ownership to incentivize real maintenance investments). Similarly, the District Assembly owned market warehouses that are not run on business lines, for example, in Kintampo and Kpassa Nkwanta North. In certain areas, personality conflicts and ethnic differences have caused the collapse of many such rural businesses. A case in point is a perfectly working rice mill at Kwame Donkor, Brong Ahafo, which has been closed down because of personality clashes within the cooperative executives.

The larger government-owned facilities such as NAFCO are confronted with serious operational difficulties brought about by inconsistent demand from institutional contracts and poor payments and incentive structures. NAFCO prices tend to be remarkably low and institutional clients are slow in paying for products purchased, undermining the sustainability of the venture.

In contrast, privately owned and managed warehouses are generally better run and operate on a profit basis. These tend to be larger and found in the major cities such as Tamale, Bolgatanga, and Wa. They are often rented to traders and input providers. In Tamale rental rates for a 1,000MT warehouse range from about GHC600 to GHC1,500 per month. While flat warehouses are more flexible and can be shifted between various commodities or even non-agricultural products as demand requires, even relatively smaller bulk silos (which large-volume individuals can rent for their own identity preserved commodities) can be successfully rented in commercial centers.

Standards and Weights: Product specification and weights are only used when selling to industrial buyers and mills. These organizations typically stipulate, for example, the levels of weight, moisture, and acceptable levels of debris for maize. This practice is virtually non-existent in the informal local markets, which demand very little premium for quality, except in the differentiation between current (new) and previous season (dry) maize where dryness is given a premium

On the local market, an informal but reliable weight system is used where the open market price levels are adjusted by weight of product per bag. For example, in the Techiman area, the current farmgate price for maize is GHC50 to 55 for 170 to 180kg; in the market, wholesale value is GHC55 for 130kg; and retail is GHC55 per 100kg.

Production and Postharvest Services: Stand-alone warehouses may face challenges to profitability such as low utilization rates, low turnover; and high overhead.⁵⁶ It has been postulated that adding other farmer services could diversify revenue and improve the overall profitability of these facilities. These include tractor services (plough, harrow, shell, winnow, cart), parboiling of paddy, milling, input supply, and maize fumigation /pre-treatment. However, individuals and entrepreneurs who specialize in providing each service separately are delivering them efficiently, possibly more so than could be provided by a more diverse warehouse business. Coverage and critical mass of each of these complementary services need more analysis to establish the profitability of each cost center.

For example, a new tractor purchased at about GH¢18,000 and stationed in a farming community in the SADA area will have to plough 10 acres a day (at the going rate of GH¢25/acre), work six days a week during the three months of land preparation, to break even over five years. To make tractor services profitable requires additional utilization of this equipment in the catchment area for services such as planting, weeding, spraying, fertilizer application, harvesting, shelling, and carting. However, in the north there is limited demand by producers to pay for mechanization of some of these farming activities that are currently manual. As a result, tractor services are largely run by independent operators or commercial farmers who seek to maximize utilization of their fixed asset by taking it on the road, traveling many kilometers over the course of each season to find work.

EVALUATING POTENTIAL BUSINESS MODELS

There are multiple models of how a warehouse facility may be utilized, which vary principally by location, size, ownership, and flexibility. Several options for utilization of a flat warehouse of a fairly large size (approximately 1,000MT) are discussed in more detail, including:

- Buying and trading; arbitrage;
- Farmer services center “one stop shop”;
- Nucleus outgrower scheme;
- Agricultural inputs distribution point; and
- Real estate management.

Buying and Trading: Arbitrage

Traders and entrepreneurs are profitably buying and selling commodities using the existing infrastructure available in the SADA area. The market has limited barriers to entry and the opportunity exists for additional competition from new entrants. There are two options available to the trader: purchasing to sell and move to current markets, either into the open market or via a pre-arranged purchase contract with a processor or consumer (spatial arbitrage); and buying produce to hold and sell later into the market (temporal arbitrage).

Spatial Arbitrage: Spatial arbitrage is the opportunity for a trader to move grain from a location of high supply (production areas) into a location of high demand (processing, aggregation markets, or consumers). The most successful trader is in the market on a regular (daily) basis, with established connections and networks for deals and information. Depending on the commodity, the trader may choose to trade in the spot market or secure sales contracts prior to originating the grain, essentially becoming an origination agent or broker for the end buyer. Most maize traders prefer the latter arrangement. The trader secures a contract buyer (usually an industrial processor or an institution) with agreed specifications and price. This trader can either buy from the open market at harvest (or the time of the trade) or may even enter into pre-production contracts with farmers who agree to produce projected quantities of the crop for the trader. When traders enter into pre-production contracts, the standard practice is to offer some input or land preparation pre-finance to the farmers who in turn pay back the production loan in-product and also agree to sell some or the rest of their harvest at the going market prices or at a negotiated price, at the time of harvest.

⁵⁶ MIDA, The Economics of Warehousing Operations in Sub-Saharan Africa (1997).

For this type of spatial arbitrage, warehousing needs center on aggregation and turnover of commodity. The trader may rent small community warehouses, or even empty houses or rooms, as rural collection points (30 to 50 MT) and a central, urban warehouse (as small as a 60 to 100 MT facility, though some rent larger spaces) on a seasonal basis to minimize capital expenditure. Such ventures are successful in production enclaves around Tamale, Kintampo/Techiman, and the Atebubu/Ejura.

When providing origination agent or broker services via back-to-back contracts, the trader's risks are minimized. Even spatial arbitrage without a contract prior to origination of the commodity minimizes the cost of capital by turning over commodities frequently. This option is particularly suitable for rice and soy, which has been enjoying strong demand.

Temporal Arbitrage: Temporal arbitrage is when a trader (or value chain actor, such as a producer) holds grain during a period of high supply (such as at harvest) in the hopes of selling during a period of low supply but higher demand. The trader buys the produce on the open market or at farmgate, assuming ownership and the cost of carrying (capital and grain management), stores, and speculates that the price will rise sufficiently to cover the cost of carrying plus a return for the increased assumed risk. The trader takes this risk based on previous market experience as well as deep market intelligence gained by continued presence in the market. Temporal arbitrage is speculative and does incur risk, particularly in highly volatile markets (though volatility can incentivize some temporal arbitrage) linked with global supply and demand dynamics. This trading also ties up the trader's capital during the period of speculation, capital that may actually be borrowed and accumulating interest.

Table 11 below shows a projection for a speculative buyer of maize in the Tamale area, during the 2011 season. It illustrates that if at harvest (October/November) a trader purchases a 100kg bag of maize at GHC45 and stores the maize to sell seven months later, at the peak period around May, the venture will only make a profit if prices rise above GHC66—more than 47 percent above the harvest value. Prices of maize only rose by 25 percent in 2010 when bank interest rates were even higher. This gives an indication of the associated risks and costs. Also, consumers may switch to other staple foods, like yams and rice, if/when maize prices escalate.

TABLE 11: A PROJECTION OF MAIZE TEMPORAL ARBITRAGE – 2011 AUGUST HARVEST

ITEM	DESCRIPTION	VALUE
Maize Price Per Bag at Harvest	100kg	GHC35.00
Short-Term Interest	ADB rates	20%
Length of Storage	Months	6
Warehouse Storage Cost		GHC6.00
Interest Payment	6 months	GHC3.5
Additional Handling & Transportation		GHC8.00
Total Storage Cost		GHC17.50
Break-Even (Harvest Price+Costs)		GHC52.50
Price Hike Needed for Break-Even	GHC17.50	50%

Appendix D includes a table of maize prices from the past nine years with an analysis of the profitability of temporal arbitrage using the above calculation methodology. In five of the last nine years temporal arbitrage would have been profitable or broken even. Volatile maize prices in the past decade may make temporal arbitrage a risky business model. While there are some structural and systemic conditions that make temporal arbitrage less attractive in the current market, this was not—and might not always be—the case. For instance, a 1997 study on warehouse economics estimated real return on equity for inter-season temporal arbitrage in Ghana to be as high as 120 percent annually.⁵⁷

Farmer Services Center “One Stop Shop”

The Farmer Services Center model consists of a warehouse facility that provides other production and post-production agricultural services within a specific geographic rural market. Services may include tractor services, sale of inputs, grain cleaning, storage with fumigation, and marketing services. An example is the MIDA-funded Agribusiness Centers (ABCs), five of which are being established in the SADA region. The structure is a partnership between local entrepreneurs and a farmer-based organization in the area of operation, with a 70 to 30 equity split. It is projected that each ABC will cover a catchment area with about 60,000 MT of the relevant crop and also provide other farm services to farmers in its zone. The project is pre-financed by MIDA, with the fixed base operation (FBO) part of the investment considered a pure grant. The objective is to provide production and post-production (including marketing) services to producers in a for-profit business model, prioritizing some producer ownership.

THE MIDA ABC MODEL

- **70 to 30 Investor and FBO split**
- **Catchment area of 60,000 MT production zone**
- **Service provision for a fee helps diversify risk**
- **Trading an option for the investor with working capital**
- **Branding and marketing is an additional service**

Similar win-win models, such as FASCOM, have been tried in the north but have failed because many assumptions were not met. Success for this model is contingent upon all of the following:

- The ability to compete with entrepreneurs who have specialized in the provision of profitable farmer services such as tractor operators and input supply;
- Farmers' willingness to pay cash for services rendered instead of in-kind transactions;
- A network of well-situated community warehouses (aggregation points) in the catchment area;
- High crop yields that will minimize expanse of coverage area (decrease logistical costs); and
- A grains market that attaches value to brand and associates it with quality.

Unfortunately, none, or certainly not all, of these conditions are currently in place, and therefore the model is not attractive to investors. The services with the greatest margins in this portfolio are tractor-based, and as previously explained, independent operators with the flexibility to travel long distances with the asset are much more efficient and therefore profitable. It was generally understood that no smallholder farmer in Northern Ghana will pay for storage, preferring a ready buyer or storing a limited number of bags for home consumption or barter. If a farmer decides to store before marketing, community warehouses charge rates far below what the ABC business models propose. Drying services for maize are unnecessary in northern Ghana (where maize dries in the field), and shelling is again a tractor-based service for which the ABC must compete with more efficient independent operators.

The ABC recipients of the MIDA funding were enthusiastic about the upcoming launch of the centers and said that the centers would greatly enhance their current operations. However, it was the unambiguous conclusion of this assessment that while the new facilities and equipment are welcome, the upfront costs being covered by MIDA would not have been considered by these individuals and businesses through any private means, such as if a competitive bank loan had been available. Interviewees demonstrated a lack of consideration for the upfront costs of the initial infrastructure and equipment purchase in their business

⁵⁷ MIDA, *The Economics of Warehousing Operations in Sub-Saharan Africa* (1997).

models, and they are unsure and unconcerned about whether they may need to repay MIDA over time. At the time of this assessment, they had not considered what specific services they would offer and how much they would charge, and were unsure if the market would be willing to pay. None could cite a “break even” point for revenues.

These centers stand a high risk of failure in terms of their declared mission and objectives of providing services to farmers for a fee. However, they are likely to evolve quickly into a trading operation, where the business takes ownership of the grain at harvest and utilizes the postharvest handling equipment with their own product for quick onward sale in Kintampo or Techiman. This would still provide a more rurally based market outlet for producers, one of the necessary key development outcomes.

Nucleus Outgrower Scheme

The nucleus outgrower model prioritizes the provision of production pre-financing that ensures the timely delivery of all production and postharvest needs of the farmers (which may include extension), and develops a working relationship that offers a committed supply of farm production to the financier.

The nucleus—the hub and the financier—provides pre-financing for land preparation, fertilizer application, harvesting, threshing, storage with fumigation, and marketing. The nucleus can be a reputable or model farmer as found with Gundaa, Suntaa Nuntaa, and some traditional chiefs, or an organization that acts as a hub for the outgrower, as with Masara N'Arziki, SFMC and Presby Agric Services. The farmers pay back in-commodity, and the nucleus also acts as a market outlet for the farmers.

There are two variations of the model distinguished by the profit motives and business orientation of the nucleus player:

The **Public Private Partnership (PPP)** projects, including NGOs, MIDA, and government projects (e.g., Tono Irrigation), are primarily social businesses designed to benefit and maximize income for rural farmers via production finance, extension delivery, and market assistance. Cost-efficiency in these projects is low.

The **Private Outgrower** alliance has a profit-oriented entrepreneur or organization as the nucleus, and this partnership is primarily designed to maximize profits of the investor. In this arrangement, cost-efficiency is high and continued producer participation is critical for sustained model operation.

Scale, cost-efficiency, maximum utilization of assets, and farm productivity are essential to bring profitability and sustainability for both models. An optimum scale for a model should have the following;

- A catchment area of about 2,000 hectares (calculated for maize);
- Less than 1,000 farmers, preferably in block farms and each cultivating a minimum of two hectares;
- Progressive farmers willing to adopt improved farming methods;
- Access to a 300 to 500 MT warehouse;
- A good network of roads; and
- Ownership of three or four tractors (to be supplemented with rentals when required).

Other success factors include sufficient but targeted training for both farmers and extension staff, and the implementation of an effective monitoring and enforcement system from land preparation to marketing.

The nucleus farmer in the subsidized PPP model may have varied motivations for participating. These may include facilitated access to commercial financing for equipment and/or inputs for the farmer's own operation. The nucleus farmer may also enjoy less tangible benefits from the social status of recognition as a model farmer. This subsidized model farmer can be very useful for extending provision to smallholder farmers, and the impact of this knowledge sharing between the nucleus farmer and associated smallholder farmers may persist after the donor or government support has ceased. However, the schemes themselves are unlikely to be self-sustaining without continued external donor or government support. The private outgrower model is designed to maximize the profits for the nucleus farmer from service provision or trade.

Agricultural Inputs Distribution Point

With the massive campaign and promotion of agrochemicals and fertilizers by public and private organizations such as Wienco, Yara, and AGRA, usage of inputs is on the rise and remarkable improvements have been recorded in grain yields, especially maize. Yield potential is more than double with proper training and adherence to modern farming practices. As more producers are exposed to evidence of these benefits, they will be encouraged to use fertilizers and plant protective chemicals, increasing demand for these inputs.

Simple, direct distribution of agricultural inputs by private dealers is, in some countries,⁵⁸ an excellent way to leverage underutilized community warehouses. It makes convenient use of facilities during the precise point in the year when the rural warehouse is not needed to aggregate harvest. However, this model assumes producers are willing to part with cash payments for inputs, which poses a challenge to entrepreneurs contemplating this business. The input entrepreneur is often then forced to assume risk by extending terms. He faces the risk of side selling as a means of avoiding repayment of the extended credit. He may then decide to provide a ready market for the resulting production from input adoption. It is not difficult to see how quickly an agro-input provider can be compelled into engaging more with farmers and morph into an outgrower in this context. Then the same trader/dealer would require year-round access to the warehouse.

Real Estate Management

Another option available to warehouses located around towns and cities is to open the facility up for other rental purposes. It may be profitable to build and rent such a warehouse to companies and individuals dealing and trading in non-agricultural products, such as hardware, equipment, and electrical wares.

MITIGATING FACTORS

Government Interventions

The government believes in its social obligation to alleviate rising costs of living for the populace and therefore has the tendency to use its institutions such as NAFCO to stabilize prices. The result is price distortion in the marketplace. Investors may not be able to gauge true market indicators to make realistic business decisions. While NAFCO is a market player, its infrastructure and assets are "free," giving it an unfair advantage over competitors in the private sector who have to pay for all assets, and allowing it to charge below-market rates for services (e.g., milling) and pay above-market rates for labor (e.g., loading/offloading). The same applies to subsidized NGOs and grantees that work in the sector. This makes workers and producers reluctant to accept private sector rates, and therefore is a disincentive to private players entering these markets.

⁵⁸ There are examples in other African markets where producers prefer to pay cash for inputs (Zambia, for example), since it frees farmers from selling into strong demand markets without being confined by pre-planting agreements. In the Ghana maize market though, this is unlikely to develop given the market dynamics and the widespread expectation and promotion of production finance.

Improved Farm Yields

An important factor for any fixed agricultural facility that works directly with farms is the productivity of nearby suppliers, since the facility will have a certain critical threshold of throughput (in MT of commodity) required for efficient utilization of the infrastructure and any moveable assets such as tractors. As yields per hectare of rice, soy, and maize increase, the catchment area required to best utilize these assets will shrink and become more accessible. Unpredictable producer adoption of improved production technologies remains a significant risk for an investor.

Increased utilization of storage and temporal arbitrage works to even out supply available to the market. This has an overall price-stabilizing effect as supply spikes during harvest time moderate. While this would negatively impact anyone engaging in temporal arbitrage, this would be a benefit to consumers as well as industrial users who may substitute, for example, maize for another imported grain if prices are stable.

Interest Rates

Interest rates are a critical factor in determining the feasibility of any investment, opening the possibility of profits where there were none or allowing even the most market-responsive venture to break even. High interest rates have the tendency to discourage investment in agricultural projects in general due to the endemic and consistent risks with rain-fed and uninsured traditional farming practices. In the past, maize price fluctuations were very high, from GHC30 to GHC5 in two months (this was not uncommon). Interest rates at the time were high, at more than 22 percent, but this works out to be less than 2 percent per month. It was therefore possible to take a short-term working capital loan and make money from speculation (temporal arbitrage) over a two-month period. Interest rates are even lower now (17.5 percent base), but this market dynamic has shifted, and maize prices are more stable.

CONCLUSIONS

Stand-alone warehouses, especially in rural communities, are not profitable businesses. The idea that adding additional farmer services to their current operations will make them profitable is not based on current market demand for these services. In addition, a certain critical mass of catchment area, farmers' farm size, management, and productivity is required to make them feasible.

Traders, entrepreneurs, and other private individuals can earn profits through renting existing warehouse facilities seasonally. Their chances for success are maximized if their reach extends beyond the farmgate and the open market, through negotiated buyer contracts and pre-production contracts with organized farmers.

In terms of a more fee-based service enterprise, it is unlikely that a win-win storage or services model designed to benefit both farmers and investors equally will yield profits and therefore remain financially sustainable. A model that aims to maximize profits for the investor, though, may deliver meaningful benefits to farmers as a result.

There are over 200 community-warehouses spread out in the SADA area. Over half of them are damaged and in poor repair; but the rest are underutilized. Therefore, the main shortfall of warehouse space is in the major towns and markets.

APPENDIX A: RECOMMENDATIONS FOR FURTHER ANALYSIS

The market opportunities identified by this assessment also uncovered critical gaps in data or market analysis required. The following represent the prioritized recommendations for further analysis:

1. Staple grains do cross regional borders. Quantifying and characterizing this trade along with **understanding regional production competitiveness and markets** are critical for any potential large investments. Further analysis is needed with a regional focus, which would include both the official cross-border trade policy as well as the implementation that may facilitate or inhibit grain flow.

In particular for maize, where the region may offer market scale sufficient to interest larger-scale investments, more work is needed around understanding regional maize production and marketing.
2. Government procurement currently plays a significant role in the marketing of domestic rice, with an impact on rice mills that is not fully understood. Further analysis is needed to understand exactly what is the **size of government procurement for domestically produced rice** (by segment) and at what point (volume, quality, relationships, variety) the domestic rice (produced in the north) becomes more interesting to the distribution and marketing channels currently moving imported rice. This analysis should also identify any ways that government and institutional procurement could be modified to better support efficient mill utilization.
3. While some analysis and documentation exists in the literature, the team did not gain any firsthand evidence of significant **differences in average rice yields between northern Ghana and other parts of the country**, but this is a critical point for further study.
4. The actual **price sensitivity threshold for consumer preferences in rice** is unknown, but would be an important point for further study in the form of consumer surveys or market observation. In other words, what kind of a premium for imported rice are consumers willing to pay? At what price point will they default to local? The same question would then apply to straight-milled vs. parboiled, and aromatic vs. non-aromatic.
5. **West African rice prices are significantly higher than in other countries.** It is often said in Ghana that prices have consistently been 66 percent higher than global prices. The landed cost at Tema for 5 percent broken Vietnamese indica is \$600/CIF/ton (before duties and VAT). A thorough investigation of landed prices in other regions would be important to **understand the source and reliability of this price premium**, which factors into investors' decisions about profitability of domestic production. The cause may be inefficiencies and uncompetitive behavior in the global transport networks. If this were to be eliminated, would prices fall and knock Ghanaian producers out of the market entirely?
6. **It is often suggested that there is a market for Ghana's parboiled rice in Nigeria**, where consumer preferences favor it. There are a wide range of factors to consider when weighing the feasibility of this suggestion, from trade policy to transport logistics to Nigeria's own production and shifting consumption patterns. The EAT study was unable to collect any reliable input on this topic, so further inquiry is required.
7. A high-level, country-by-country value chain mapping of West African poultry was undertaken by the Expanded Agribusiness and Trade Promotion (E-ATP) project. This study though would be augmented by a specific in-depth analysis of regional grain markets as they relate to regional feed competitiveness along with a detailed in-depth analysis of the cost of broiler production within the Ghanaian chicken industry and across the region. The analysis needs to **identify where grain production, feed processing, and animal protein investments should occur** to feed the regional urban markets, along with a quantification of animal protein consumption by geography/market and consumer trends. This analysis will be of particular importance to maize and soybean markets.

APPENDIX B: CALCULATING SOY AND MAIZE EQUIVALENTS FROM POULTRY

Current soy and maize demand from domestic poultry industry—range from reported bird population numbers and total soy demand reported via interviews (about 50 percent currently imported as soybean meal):

15,000,000	20,000,000	total birds in Ghana
0.10	0.10	kg total feed/bird/day
1,500,000	2,000,000	kg total feed/day
1,500	2,000	MT total feed/day
547,500	730,000	MT total feed/year
109,500	146,000	MT total protein/year (approximately 20 percent)
328,500	438,000	MT total maize/year (approximately 60 percent)
76,650	102,200	MT 70 percent of protein component soybean meal (versus 30 percent use of fishmeal)
84,315	112,420	MT soy equivalent (expeller—extracting 10 to 12 percent oil)

Soy and maize equivalents from imported ready to cook chicken

Interviews generally agreed last 12 months imports in the range of 100,000MTs, which is in line with growth seen in FAOSTAT and Ministry of Trade data through 2008/2009 (latest available.) One interviewee very close to the import sector puts the imports at double: 200,000MTs. Both are shown to indicate range. The soy and maize equivalents indicate the potential market should a domestic broiler industry substitute locally produced birds (approximately 13,000,000 birds each of 8 cycles/year for 100,000MTs of ready-to-cook chicken) fed on locally produced and processed soybeans and maize.⁵⁹ The soybean oil number is the amount of soybean oil that would be produced as a result of the soybean meal processing to meet the full ration required.

200,000	100,000	MTs ready-to-cook chicken
440,000,000	220,000,000	Lbs
1	0.73	Convert pounds of meat imports to animal live weight equivalent
606,896,552	303,448,276	Live weight equivalent (lbs)
2	2.12	Meat gain ratio to live weight equivalent
1,286,620,690	643,310,345	Total feed use (lbs)
0	0.25	Total feed use to soy meal (protein) component
321,655,172	160,827,586	Protein component (soybean meal) (lbs)
146,207	73,103	Protein component (soybean meal) (MTS)
1	1.25	MT soybean meal to soybean ratio (low-fat solvent extraction)
182,759	91,379	MT soy equivalent, low-fat solvent extraction
1	1.10	MT soybean meal to soybean ration (expeller)
160,828	80,414	MT soy equivalent, expeller
32,897	16,448	MT soybean oil produced (solvent)
16,083	8,041	MT soybean oil produced (expeller)
0.60	0.60	Maize ratio
350,897	175,448	Maize in feed (MTs)

⁵⁹ The formula used to calculate full feed and soy equivalents is from World Perspectives, Inc., The Value of U.S. Meat and Poultry Exports to U.S. Soybean Producers through 2015 (February 2006).

APPENDIX C: SOY PRICE FORECASTS

UNIT	ACTUAL				
	1970	1980	1990	2000	2010
\$/mt Soybean meal	103	262	200	189	378
\$/mt Soybean oil	286	598	447	338	1,005
\$/mt Soybeans	117	296	247	212	450

UNIT	ACTUAL									
	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
\$/mt Soybean meal	420	350	330	310	308	307	307	306	305	304
\$/mt Soybean oil	1,250	900	865	855	850	840	830	820	810	800
\$/mt Soybeans	530	450	400	395	390	387	384	381	378	375

Note: Projections as of June 2, 2011

Source: World Bank, Economic Policy and Prospects Group

APPENDIX D: MAIZE MONTHLY PRICE TRENDS 2002–2011

NORTHERN REGION	AVERAGE MONTHLY PRICE OF MAIZE GHC Per 100kg Bag												
	Months of Storage		0	1	2	3	4	5	6	7	8	9	Price Swing
YEAR	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	
2002 - 3	9.55	9.20	8.40	9.03	11.67	11.95	11.00	10.67	13.17	12.79	11.73	9.50	52%
2003 - 4	9.96	9.77	10.68	11.65	12.70	13.22	14.75	15.08	16.20	17.58	23.17	22.20	65%
2004 - 5	17.40	15.93	18.70	20.00	19.83	22.68	24.90	28.25	36.25	37.40	41.83	30.67	100%
2005 - 6	24.13	18.95	20.45	21.75	21.22	20.15	18.50	19.70	19.30	19.37	16.60	16.65	-5%
2006 - 7	15.63	14.33	15.59	16.28	16.13	18.74	18.77	19.00	19.00	17.16	21.29	21.13	10%
2007 - 8	18.15	23.62	22.94	26.16	30.33	31.94	36.17	45.20	45.20	53.98	56.67	54.32	135%
2008 - 9	37.18	41.29	35.07	35.31	40.48	48.59	45.08	52.58	52.58	56.02	47.97	42.19	60%
2009 - 10	34.72	37.37	32.82	34.25	34.52	37.59	40.25	38.10	38.10	39.10	36.38	34.78	19%
2010 - 11	33.67	35.03	32.44	42.30	38.40	39.33	37.29	43.67	43.67	44.80	58.44	50.88	38%
9 Year Avg. Price/100kg Bag	22.27	22.83	21.90	24.08	25.03	27.13	27.41	31.50	31.50	33.13	34.90	31.37	53%

Recommendation: Buy in November and sell in June or July – 7 to 8 months storage

KEY

Lowest Prices	
Highest Prices	

Source of Maize Price Data: SRID, MOFA

APPENDIX E: ESTIMATED COSTS OF PRODUCTION

I. Maize

ESTIMATED PRODUCTION COST FOR A ONE ACRE, RAIN-FED MAIZE FARM IN NORTHERN GHANA, 2011

ACTIVITY	COST (US\$)	
	CORRECTLY GROWN	ACTUALLY GROWN
Seed (\$1.20 per 1kg seed)	7.24	7.24
Plowing (range \$15-24, avg \$18)	18.09	18.09
Harrowing	18.09	----
Labor (sowing): range of US\$9–\$18 depending on number of people hired and whether ropes are used for planting in rows (labor costs US\$1.80 per person per day on average); averaging cost of use of dibbler/manual planters	15.08	15.08
Labor (weeding): US\$1.80 per person per day on average	18.09	9.05
Cost of Fertilizer (1 bag sulphate ammonium—US\$15, 2 bags NPK at US\$18)	51.26	18.09
Weedicides: 1 litre per acre, US\$4.25–\$7.25 per acre (avg. US\$6 each) x two applications	12.06	0.60
Services (spraying/advisory/information)	7.24	3.62
Labor (harvesting)	12.06	12.06
Jute Sacks (US\$1.20 per bag)	12.06	12.06
Mechanical Processing (threshing equipment)	15.08	----
Transportation Cost (from farm to house): US\$0.60 per bag	6.03	6.03
TOTAL Cost of Production	192.38	101.92
Expected Yield (kg per acre)	1500	1000

2. Rice

ESTIMATED PRODUCTION COST FOR A ONE ACRE RAIN-FED RICE FARM IN NORTHERN GHANA, 2010

ACTIVITY	COST (US\$)
Seed	22
Single Plough	15
Double Harrowing	15
Fertilizer (NPK, 2 bags)	31
Fertilizer (Urea, 1 bag)	11
Herbicide (2 liters)	18
Labor (planting, fertilizer application)	54
Labor (harvesting)	48
Sacks	18
Transportation to Warehouse	23
TOTAL Cost of Production	255.40
Average Paddy Yield	1,275

Source: USAID – ADVANCE Project, 2010

3. Soy

ESTIMATED PRODUCTION COST FOR A ONE ACRE, RAIN-FED SOY FARM IN NORTHERN GHANA, 2011

ACTIVITY	COST (US\$)	
	CORRECTLY GROWN	ACTUALLY GROWN
Seed (US\$1.20 per 1kg seed)	13.27	13.27
Plowing (range US\$15–\$24, average US\$18)	18.09	18.09
Harrowing	18.09	----
Labor (sowing): range of US\$9–\$18 depending on number of people hired and whether ropes are used for planting in rows (labor costs US\$1.80 per person per day on average); averaging cost of use of dibbler/manual planters	15.08	15.08
Labor (weeding): US\$1.80 per person per day average	9.05	9.05
Cost of Fertilizer (1 bag sulphate ammonium –US\$15, 2 bags NPK at US\$18)	18.09	18.09
Weedicides: 1 litre per acre, US\$4.25–\$7.25 per acre (average US\$6 each) x two applications	21.11	6.03
Inoculants (US\$3 per 100g pack, one pack per 20kg seed per acre)	3.02	3.02
Services (spraying/advisory/information)	7.24	3.62
Labor (harvesting)	12.06	12.06
Jute Sacks (US\$1.20 per bag)	12.06	12.06
Mechanical Processing (threshing equipment)	15.08	----
Transportation Cost (from farm to house): US\$0.60 per bag	7.24	3.02
TOTAL Cost of Production	169.46	113.38
Expected Yield (kg per acre)	1,400	600

Source: USAID – ADVANCE Project, September 2011

ESTIMATED COST OF SOYBEAN PRODUCTION, OUTGROWER VS. NUCLEUS, 2011

	SUBSISTENCE (OUTGROWER)			SEMI-COMMERCIAL (NUCLEUS)		
	1	1	2	1	1	1.2
Farm Size (acres)						
Labor (man days)	47.50	73.75	174.38	123.875	139.625	114.79
Equipment and Tools (US\$)	2.26	11.11	16.84	0.48	5.83	0.75
Fertilizer (US\$)	---	52.77	---	---	13.27	16.58
Inoculants (US\$)				---	---	---
Pesticides and Herbicides (US\$)	---	---	---			---
Services (US\$)	30.15	47.04	81.41	21.11	22.61	18.85
Land and Seed (US\$)	14.47	14.47	18.09	7.54	6.78	5.03
TOTAL (US\$)	75.53	169.87	221.50	103.83	132.70	110.44
Output per ha (kg)	625.00	1,250.00	875.00	1,150.00	1,250.00	833.33
Family Labor Input (man days)	113.00	90.00	13.00	29.00	11.00	10.00

Source: USAID – ADVANCE Project, 2011

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